



UNIVERSITI PUTRA MALAYSIA

**POTENTIAL OF EXSEROHILUM MONOCERAS
(DRECHSLER) LEONARD AND SUGGS ISOLATED
FROM ECHINOCHLOA P. BEAUV. SPECIES AS A
BIOHERBICIDE**

TOSIAH SADI

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SPECIES AS A BIOHERBICIDE**

By

TOSIAH SADI

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POTENTIAL OF *EXSEROHILUM MONOCERAS* (DRECHSLER) LEONARD AND SUGGS ISOLATED FROM *ECHINOCHLOA* P. BEAUV. SPECIES AS A BIOHERBICIDE

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October 2010

Chairperson : Assoc. Prof. Jugah Kadir, PhD

Faculty: Agriculture

Echinochloa spp is widespread in the warm temperate, sub tropical and tropical regions. It is ubiquitous in the Malaysia rice fields and serious weedy pest to the crop, especially after the adoption of double cropping, more rapidly maturing cultivars and a shift from transplanting to direct sowing. The problem worsens by the contamination of farm machineries such as tractors and combined harvester and also through seeds contamination. Chemical herbicides are widely used to control the grass which has a negative implication to the environment and public health.

Several fungal pathogens have been reported to be potential biocontrol agents of this weed. This study was conducted to identify potential indigenous fungal pathogens for the control of *Echinochloa* spp and its requirements to be



developed as bioherbicide. *Exserohilum monoceras* isolate 1125 was identified to be the potential fungus to control *Echinochloa* spp. Studies on the efficacy of the fungus indicated that it was effective at concentration of 10^6 spores/mL, and plant was sensitive at their 4 leaves stage.

The fungus attacked *E. crus-galli* var *crus galli*, *E. crus-galli* var *formosensis*, *E. colona* and *E. orizycola* but with different disease intensity. The fungus was safe to all modern rice varieties, turf grasses and the selected vegetable crops tested, indicated that it was highly selective. Before it developed into a bioherbicide, the fungus need to mass produced.

This study indicated that carbon source enhance, mycelium and production also disease efficacy. Addition of Nitrogen source does not increase the mycelium production however the spore production was significantly increased. The CN ratio found to be good for the mycelium and spore production range from 9:1 to 24:1.

Exserohilum monoceras infection was influence by availability of dew and temperature. The fungus needed a minimum 12 hrs of humidity to caused severe disease on the host. The best temperature for infection is within the range 25°C to 35°C . *Exserohilum monoceras* was also effective in field condition. Spore concentration at the rate of 10^6 spore/mL and 10^7 spore/mL produced 45% and 50% control of *Echinochloa* in the field respectively. At the rate 10^8 spore/mL

the fungus caused toxic effect on rice plants but recovered after sometimes.

Disease severity also increased with spray frequency. The apparent infection rate at 10^7 spore/mL ($r_L = 0.14$ logit/day) was highest followed by 10^8 spore/mL ($r_L = 0.13$ logit/day) and 10^6 spore/mL ($r_L = 0.12$ logit/day). At the end of the trial, tillers production and dry weight of *Echinochloa* was also reduced. The result of this research indicated that *E. monoceras* has potential as a candidate for bioherbicide in the control of *Echinochloa* in rice field but need some improvement in the formulation.

Abstrak thesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Doktor Falsafah

POTENSI *EXSEROHILUM MONOCERAS* (DRECHSLER) LEONARD DAN SUGGS YANG DIPENCILKAN DARI SPESIES *ECHINOCHLOA P.BEAUV.* SEBAGAI BIOHERSID

Oleh

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Echinochloa spp tersebar secara meluas dikawasan beriklim sederhana panas, sub tropika and tropika . Di Malaysia ia tersebar luas di kawasan sawah padi dan menjadi rumpai yang penting terutamanya dengan tanaman dua kali setahun, kultivar yang lebih cepat matang dan kaedah penanaman tabur terus yang diamalkan. Masalah ini menjadi lebih buruk melalui pencemaran biji benih dari jentera perladangan seperti traktor dan jentuai. Racun kimia digunakan secara meluas untuk mengawal rumpai memberikan kesan negatif terhadap persekitaran dan kesihatan umum.

Beberapa patogen kulat telah dilaporkan berpotensi sebagai agen kawalan biologi *Echinochloa*. Kajian telah dijalankan untuk mengenal pasti kulat patogen tempatan yang mampu mengawal *Echinochloa* dan keperluannya untuk dibangunkan sebagai bioherbisid. Pencilan *Exserohilum monoceras* 1125 dikenal

pasti berpotensi mengawal *Echinochloa*. Kajian mendapati ia berkesan pada kepekatan 10^6 spora/mL dan rumpai adalah rentan pada peringkat 4 daun.

Kulat ini menyerang *E. crus-galli* var *crus galli*, *E. crus-galli* var *formosensis*, *E. colona* dan *E. orizycola* dengan kesan yang berbeza. Kulat ini tidak menjangkiti kesemua varieti padi moden, rumput padang, dan tanaman sayur-sayuran yang diuji. Ini membuktikan ia adalah sangat selektif dan sesuai untuk dijadikan agen kawalan biologi.

Kulat ini harus boleh dihasilkan secara pukal jika ia ingin digunakan sebagai bioherbisid. Kajian menunjukkan bahawa sumber karbon mampu meningkatkan penghasilan miselium dan spora juga meningkatkan keberkesanan jangkitan. Sumber nitrogen pula tidak meningkatkan penghasilan miselium tetapi signifikan dalam meningkatkan penghasilan spora. Sementara itu nisbah CN yang bersesuaian untuk meningkatkan penghasilan miselium dan spora adalah diantara 9:1 hingga 24:1.

Jangkitan *E. monoceras* keatas *Echinochloa* juga dipengaruhi oleh kelembapan dan suhu. Kulat ini memerlukan kelembapan minima selama 12 jam untuk menjangkiti secara efektif. Julat suhu yang sesuai untuk jangkitan adalah diantara 25°C hingga 35°C . *Exserohilum monoceras* juga berkesan dilapangan. Kepekatan spora pada kadar 10^6 spora/mL dan 10^7 spora/mL memberi kawalan yang baik iaitu 45% dan 50% masing-masing. Pada kepekatan 10^8 spora/mL kulat

ini memberi kesan toksik pada pokok padi, tetapi pulih kemudiannya.

Jangkitan penyakit juga meningkat dengan meningkatnya jumlah applikasi. Kadar jangkitan ketara penyakit yang paling tinggi adalah pada 10^7 iaitu ($r_L = 0.14$ logit/hari), diikuti oleh 10^8 ($r_L = 0.13$ logit/hari) dan 10^6 ($r_L = 0.12$ logit/hari). Diakhir ujikaji didapati penghasilan anak sisi dan berat kering *Echinochloa* juga menurun. Dari keputusan penyelidikan yang dijalankan, *E.monoceras* didapati mempunyai potensi jika ingin di kembangkan sebagai bioherbisid untuk mengawal *Echinochloa* di sawah padi. Walau bagaimanapun ia masih memerlukan sedikit penambahbaikan dari segi formulasi.

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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.

TOSIAH SADI

Date: 15 October 2010

LIST OF TABLES

Table	page
2.1: Distribution of weed of Poaceae species based on % of field infested in Muda area from the off-season of 2001 to the off-season of 2005.	9
2.2: <i>Echinochloa</i> species found in Malaysia.	22
2.3: Fungal pathogen of <i>Echinochloa crus-galli</i> .	27
3.1: List of fungi associated with <i>Echinochloa</i> isolated from 5 granary areas surveyed.	42
3.2: Number of fungi isolated from <i>Echinochloa</i> species screened and their reaction to <i>Echinochloa</i> and rice plant.	43
3.3: Percentage of fungi species pathogenic to <i>Echinochloa</i> from different granaries.	44
3.4a: Disease incidence caused by 14 fungi isolates from <i>Echinochloa</i> and MR219 and Area Under Disease Progress Curve (AUDPC) of isolates on <i>Echinochloa</i> in trial 1.	47
3.4b: Disease incidence caused by 14 fungi isolates from <i>Echinochloa</i> and MR219 and area under disease progress curve (AUDPC) of isolates on <i>Echinochloa</i> in trial 2.	48
3.5: Some culture characteristics of isolates, 1125, 1080 and 1100.	53
4.1: Area under disease progress curved (AUDPC) and apparent infection rate (r_L) of <i>E. crus-galli</i> at different spore concentration.	62
4.2: Area under disease progress curved (AUDPC) and apparent infection rate (r_L) of different-aged <i>E. crus-galli</i> infected with <i>E. monoceras</i> .	64
4.3: Apparent infection rate (r_L) and area under disease progress curved (AUDPC), of different <i>Echinochloa</i> species inoculated with <i>E. monoceras</i>	65
5.1: List of tested plants	74

5.2: Evaluation of host range of <i>Exserohilum monoceras</i> 1125.	78
6.1: CN ratio used and sucrose and urea to obtain them	92
6.2a: Effect of different C sources on mycelium and spore production of <i>E. monoceras</i> and the spore infective efficacy on <i>E. crus-galli</i> .	95
6.2b: Effect of added carbon sources on the infective potency of <i>E. monoceras</i> spores on <i>E. crus-galli</i> as measured by the percentage disease severity, area under disease progress curve (AUDPC) and apparent disease rate.	96
6.3a: Effect of different nitrogen sources on the biomass and spore production of <i>E. monoceras</i> .	100
6.3b: Effect of different N sources on the effective potency of <i>E. monoceras</i> spores produced as measured by the, percentage of disease severity, AUDPC and apparent disease rate.	101
6.4: Effect of adding 2% sucrose with 0.1% N source on the spore production by <i>E. monoceras</i> and on the infectivity of the spores on <i>E. crus-galli</i> as measured by the Disease Severity, AUDPC and Apparent Disease rate.	105
7.1: Percentage disease severity and apparent infection rate of <i>E. monoceras</i> on <i>E. crus-galli</i> treated with different initial dew hours. Data are based on six replicates.	120
7.2: Percentage disease severity and apparent infection rate of <i>E. monoceras</i> on <i>E. crus-galli</i> treated with different initial dew period temperature. Data are based on six replicates.	122
8.1: Treatment combinations used (Spore concentration x Spraying frequency).	131
8.2: Disease progress rates on <i>E. crus-galli</i> plants by different concentrations of <i>E. monoceras</i> spores. The rates are the slopes at the linear part of the quadratic equations during the incremental phase of infection.	136
8.3: Linear regressions for the disease progress rate from 0 – 10 DAT in <i>E. crus-galli</i> plants infected with <i>E. monoceras</i> in 1 – 3 sprays.	141

LIST OF FIGURES

Figure	page
3.1: Maps of Peninsular Malaysia showed the collection site.	36
3.2: Various disease symptoms collected from <i>Echinochloa</i> during the survey. A) leave streak, b) leave spots c) leave spots d) leave scotch.	42
3.3: A) Detached leaves method 1- <i>E. crus-galli</i> 2-Rice B) Effect of <i>E. monoceras</i> on Rice (R)and <i>E. crus-galli</i> (E) 1-Control, 2-Treated.	44
3.4: Comparison of Area Under Disease Progress Curve (AUDPC) of all isolates from trial 1 and trial 2.	49
3.5: Comparison of disease severity development (%) caused by isolates, 1125, 1080 and 1100 on <i>Echinochloa</i> .	49
3.6: <i>Exserohilum monoceras</i> a). Culture characteristic b) Spore 400x.	51
3.7: <i>E. longirostratum</i> a) Culture morphology b) Spores 200x.	52
3.8: <i>Curvularia lunata</i> a) Culture morphology b). Conidiophore and spores (400x).	53
3.9: <i>Exserohilum</i> sp (species unidentified).	53
4.1: Severity of leaf blight on <i>E. crus-galli</i> var <i>crus-galli</i> infected by <i>E. monoceras</i> at the 4-leaf stage.	61
4.2: <i>E. crus-galli</i> treated with <i>E. monoceras</i> in different spore concentrations 10 days after inoculation.	62
4.3: Infection of different-aged <i>Echinochloa</i> with different inoculum concentrations,	63
4. 4: Disease progress of leaf blight on <i>E. crus-galli</i> inoculated with <i>E. monoceras</i> at the 4-leaf stage.	66

4.5: Effect of inoculating <i>E. monoceras</i> at 2.5×10^7 /mL on different species of <i>Echinochloa</i> (<i>E. crus-galli</i> var <i>crus galli</i> , <i>E. crus-galli</i> var <i>formosensis</i> , <i>E. crus-galli</i> var <i>oryzicola</i> and <i>E. colona</i> . A) before inoculation, B) after inoculation 10 days after inoculation.	67
5.1: Modern MARDI rice varieties tested. A) before treatment, B) seven days after treatment.	81
5.2: Effect of <i>E. monoceras</i> inoculation on grasses. A) before inoculation, and B) 10 days after inoculation. I - <i>Rhynchelytrum repens</i> II – <i>Digitaria</i> sp. III- <i>Paspalum</i> sp. IV- <i>Brachiaria</i> sp. V - <i>Imperata cylindrical</i> .	82
5.3: Selected vegetable species after the 7 days of inoculation with <i>E.monoceras</i> A) <i>Lycopersicum esculentum</i> B) <i>Cucurmis sativa</i> C) <i>Brassica</i> .	83
6.1: Effect of added (a) monosaccharide, (b) oligosaccharide, and (c) sugar alcohol on the infective potency of <i>E. monoceras</i> spores on <i>E. crus-galli</i> as measured by the disease severity .	97
6.2: Effect of added (a) inorganic nitrogen, (b) complex nitrogen, and (c) amino acids on the infective potency of <i>E. monoceras</i> spores on <i>E. crus-galli</i> as measured by the disease severity.	102
6.3: Effect of different C-N additions to the culture medium on the infectivity of the <i>E. monoceras</i> spores produced on <i>E. crus-galli</i> . A) sucrose – yeast extract, and B) sucrose – urea	107
6.4: Effect of different sucrose and urea concentrations on mycelium production by <i>E. monoceras</i> .	108
6.5: Effect of C:N ratio of culture medium on mycelium and spore production by <i>E. monoceras</i> .	109
7.1: Area under disease progress curve of different age <i>E. crus-galli</i> infected by <i>E. monoceras</i> with different initial dew treatment.	119
7.2: <i>E. crus-galli</i> plants at 2-leaf stage treated with different dew periods at 10 days after treatment	121
7.3: Area under disease progress curve for different age <i>Echinochloa</i> plants infected with <i>E.monoceras</i> at different dew period temperatures	123

7.4: Eight-leaf <i>E. crus-galli</i> plants infected with <i>E. monoceras</i> at different temperatures. a) non inoculated, b) 25 ^o C, c) 30 ^o C, d) 35 ^o C, and d) 40 ^o C four days after treatment.	124
8.1: Effect of spore concentration of <i>E. monoceras</i> on the disease severity caused to <i>E. crus-galli</i> plants in the field. Three sprays of the spore suspension were applied at -day intervals. The results are from one experiment with three replicates.	133
8.2: Effect of spore concentration of <i>E. monoceras</i> on the disease severity caused to <i>E. crus-galli</i> plants in the field. The lines are drawn using the logistic model.	134
8.3: Apparent infection rate (in logit/day) on <i>E. crus-galli</i> plants for the first 10 DAT with different concentrations of <i>E. monoceras</i> spores. Data presented after linear transformation by the logistic model.	135
8.4: Effects of spore concentration of <i>E. monoceras</i> on the disease severity caused on <i>E. crus-galli</i> plants. The plants were first inoculated at the 2- or 3-leaf stage. Three spray frequencies were used for all the spore concentrations.	136
8.5: Effect of spore concentration on the area under disease progress curve (AUDPC) expressed in unit ² .	137
8.9: Relationship between disease severity on <i>E. crus-galli</i> plants in the field and spray frequency of <i>E. monoceras</i> .	139
8.10: Relationship between disease severity on <i>E. crus-galli</i> plants in the field and spray frequency of <i>E. monoceras</i> expressed by the logistic model.	140
8.11: Apparent infection rate progress (logit/day) in 10 DAT of <i>E. crus-galli</i> infected with <i>E. monoceras</i> in 1 – 3 sprays. Data linearized using the logistic model.	141
8.12: Effect of spray frequency on disease severity in <i>E. crus-galli</i> plants infected with <i>E. monoceras</i> . The plants were first inoculated at the 2-3 leaf stage. The application was a factorial combination of 3 spore concentrations x 3 spraying frequencies.	142
8.13: Effect of spray frequency on the Area Under Disease Progress Curve (AUDPC) (unit ²). The data are from one experiment with three replicates.	143

8.14: Effect of <i>E. monoceras</i> concentration on the AUDPC and biomass of <i>E. crus-galli</i> and rice. The data are from one experiment with three replicates.	144
8.15: Effect of spray frequency on the AUDPC and biomass of <i>E. crus-galli</i> and rice plants. The data are from one experiment with three replicates.	145
8.16: A) Flooding after heavy downpour, B) Plot sprayed with 10^7 spores/mL at 2x spray frequency, and C) Control plot showing some infection.	146



LIST OF ABBREVIATIONS

AUDPC	Area Under Disease Progress Curve
C	Carbon
DGA	D-gluconic acid
IPM	Integrated Pest Management
IWMS	Integrated weed management system
MARDI	Malaysian Agricultural Research and Development Institute
N	Nitrogen
PDA	Potato Dextrose Agar



TABLE OF CONTENTS

	Page
ABSTRACT	ii
ABSTRAK	v
ACKNOWLEDGEMENTS	viii
APPROVAL	ix
DECLARATION	xi
LIST OF TABLES	xii
LIST OF FIGURES	xiv
LIST OF ABBREVIATIONS	xviii
CHAPTER	
1 GENERAL INTRODUCTION	1
2 LITERATURE REVIEW	5
2.1 Rice	5
2.2 The Malaysia rice industry	6
2.3 Weed problem	6
2.4 Weed control	9
2.4.1 Cultural control	9
2.4.2 Mechanical control	11
2.4.3. Chemical control	11
2.5 Problem associated with chemical herbicides	11
2.6 Integrated weed management systems	14
2.7 Biological control of weed	16
2.7.1 Definitions	16
2.7.2 History and general principles	18
2.7.3 Biological control of weeds with pathogens	19
2.8 The host and its pathogens	21
2.8.1 The weed- <i>Echinochloa</i> spp	21
2.8.2 Fungal pathogens	26
3 SURVEY AND SCREENING OF FUNGAL PATHOGENS FROM <i>Echinochloa</i> SPECIES	33
3.1 Introduction	33
3.2 Material and Methods	35
3.2.1 Survey, isolation and collection of fungal pathogen	35
3.2.2 Plant production	36
3.2.3 Inoculum preparation	37



3.2.4	Screening and pathogenicity testing	37
3.2.5	Disease assessment	39
3.2.6	Identification and characterization	40
3.2.7	Data analysis	40
3.3	Results	41
3.3.1	Survey, isolation and collection of fungal pathogens	41
3.3.2	Detached leaves method	42
3.3.3	Whole plant method	45
3.3.4	Identification and characterization	51
3.4	Discussion	54
4	EFFICACY OF <i>Exserohilum monoceras</i> ON <i>Echinochloa</i> SPECIES	56
4.1	Introduction	57
4.2	Materials and methods	57
4.2.1	Inoculums production	57
4.2.2	Plant production	58
4.2.3	Effect of inoculums density	58
4.2.4	Effect of inoculums density on different on plant growth stage	59
4.2.5	Efficacy of <i>E. monoceras</i> on different <i>Echinochloa</i> species	59
4.2.6	Disease assessment	59
4.2.7	Data analysis	60
4.3	Results	60
4.3.1	Effect of inoculums density of <i>E. monoceras</i> on <i>E. crus-galli</i>	60
4.3.2	Effect of conidia concentration on infection caused to <i>E. crus-galli</i> at different plant growthstage	62
4.3.3	Efficacy of <i>E. monoceras</i> on different <i>Echinochloa</i> species	64
4.4	Discussion	68
5	DETERMINATION OE <i>Exserohilum monoceras</i> HOST RANGE	71
5.1	Introduction	71
5.2	Materials and methods	72
5.2.1	Inoculums production	72
5.2.2	Effect on host	72
5.2.3	Host range determination	73
5.2.4	Experimental design and site	76
5.2.5	Disease assessment	76

5.3	Results	77
5.3.1	Effect of <i>E. monoceras</i> on target host	77
5.3.2	Determination of host range	77
5.4	Discussion	86
6	IDENTIFICATION AND EVALUATION OF CARBON, NITROGEN SOURCES AND CN RATIO FOR THE ENHANCING MYCELIAL, SPORE PRODUCTION AND INFECTIVITY OF <i>E. monoceras</i> ON <i>E. crus-galli</i>	86
6.1	Introduction	86
6.2	Materials and methods	87
6.2.1	Fungal culture	87
6.2.2	Basal media	88
6.2.3	Screening of Carbon (C) sources	88
6.2.4	Screening of Nitrogen (N) sources	89
6.2.5	Spore production in solid medium	89
6.2.6	Effect of sucrose and several N source for sporulation of <i>E.monoceras</i>	90
6.2.7	Efficacy testing	91
6.2.8	Evaluation of different C: N ratio	92
6.2.9	Data analysis	93
6.3	Results	93
6.3.1	Carbon Sources	93
6.3.2	Nitrogen Sources	98
6.3.3	Adding of sucrose and selected N	103
6.3.4	CN ratio	105
6.4	Discussion	109
7	EFFECT OF DEW PERIOD AND TEMPERATURE ON DISEASE DEVELOPMENT OF <i>E. crus-galli</i> AT DIFFERENT GROWTH STAGE BY <i>E. monoceras</i>	113
7.1	Introduction	113
7.2	Material and methods	114
7.2.1	Inoculum production	114
7.2.2	Plant production	115
7.2.3	Inoculation procedure	115
7.2.4	Effect of initial dew-period	116
7.2.5	Effect of dew period temperature	116
7.2.6	Assessment of disease development	117
7.2.7	Data analyses	117
7.3	Results	118
7.3.1	Effect of dew period on disease development in <i>E. crus-galli</i> seedlings of different growth stage	119
7.3.2	Effect of dew period and temperature on disease	

	development in <i>E. crus-galli</i> seedlings of different growth stage	121
7.4	Discussion	124
8	EVALUATION OF <i>Exserohilum monoceras</i> IN RICE FIELD	127
8.1	Introduction	127
8.2	Materials and methods	129
8.2.1	Plant preparation	129
8.2.2	Experimental design	129
8.2.3	Sprayer calibration	129
8.2.4	Inoculation	130
8.2.5	Disease Assessment	131
8.2.6	Biomass Assessment	131
8.2.7	Data analysis	132
8.3	Results	132
8.3.1	Effect of spore concentration on disease severity, apparent infection rate and disease progress	132
8.3.2	Effect of different spray frequencies on disease severity, apparent infection rate and disease progress	138
8.3.3	Effect of <i>E. monoceras</i> concentration on <i>E. crus-galli</i> and rice biomass	143
8.3.4	Effect of spray frequencies on <i>E. crus-galli</i> and rice biomass	145
8.4	Discussion	146
9	GENERAL DISCUSSION AND CONCLUSION	149
	REFERENCES	155
	APPENDICES	171
	BIODATA OF STUDENT	186
	LIST OF PUBLICATIONS	187
	LIST OF AWARDS	189