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THE DISTRIBUTION OF WEED SEEDBANK EXPERIMENT WITH THREE WATER LEVEL CONDITIONS IN BALIK PULAU RICE FIELDS AGRO-ECOSYSTEM

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ABSTRACT- Weed seedbank experiment was conducted in plant house of School of Biological Sciences USM from 20th of December 2013 until 20th of May 2014. The experiment was started by soil sampling at four different rice field plots (Pokok Kenanga, Tok Kiat, Fasa 3, and Sungai Burung Darat) in Balik Pulau rice fields agro-ecosystem. There were four types of soils that were sampled including sandy soil, mangrove soil, muddy soil, and also clay soil. The soil samples were brought back to USM to be examined. In addition, there were three water level (saturated, partial, and flooded) conditions applied in this experiment. Subsequently, the emergence of weed seedlings was counted and recorded as 'absence' and 'presence'. From the observation, there were 12 weeds species that emerged in this experiment such as *Echinochloa crus-galli* (L.) Beauv, *Echinochloa colona* (L.) Link, *Ischaemum rugosum* Salisb., *Leptochloa chinensis* (L.) Nees., *Oryza sativa* complex (L.), *Cyperus difformis* (L.), *Cyperus iria (L.), Fimbristylis milliacea* (L.) Vahl, *Lemna minor L., Ludwigia hyssopifolia* (G.Don) Exell, *Monochoria vaginalis* (Burm.f.) Presl, and *Sphenoclea zeylanica* Gaertn.. The highest emergence of weeds species in sandy, mangrove, muddy, and clay soils were *Monochoria vaginalis, Leptochloa chinensis, Echinochloa crus-galli, and Sphenoclea zeylanica* respectively. The total number of weeds seedlings present were higher in sandy soil (86 seedlings) followed by clay soil (69 seedlings), mangrove soil (44 seedlings), and muddy soil (26 seedlings). As a conclusion, the grasses and sedges weeds were higher in saturated and partial water level conditions meanwhile broadleaved weeds mostly can be found in flooded water level condition.

Keywords: weeds, seedbank, soils, water level conditions

I. INTRODUCTION

One of the most serious and troublesome issues in rice fields is weed infestation. Reasons that influence the weed emergence and abundance in rice fields are cultivation practice, land preparation, soil moisture content, and management strategy **[1]**. The problem that related with weed start with seeds in the soil (seed bank) and hence, it is very crucial to know about total number and weed species seeds that buried to expect what type of weed species emerge in any rice fields [1]. Until now, there is limited research has been done in Balik Pulau rice fields agro-ecosystem. Therefore, this experiment was conducted to identify weed species that emerge from four different plots with three water level conditions like saturated, partial, and flooded.

II. METHODS AND MATERIALS

Weed seed banks experiment was conducted from 20th December 2013 until 20th May 2014 in plant house of School of Biological Sciences, Universiti Sains Malaysia (USM). Before the experiment was started, soils were sampled in Balik Pulau rice fields agro-ecosystem from four different plots like Pokok Kenanga, Tok Kiat, Fasa Tiga, and Sungai Burung Darat plots. Each plot consists of different soil type which was sandy soil, mangrove soil, muddy soil, and clay soil. After the soil sampling, the soils were brought back to USM. On the experiment day, 2.0 kg of each soil was put into each plastic tray sized (23 cm x 18 cm x 10 cm) **[2]**. Subsequently, each tray was marked with different water level condition either saturated, partial, or flooded for low, medium, and high levels respectively. All treatments were replicated thrice. Then, the soils were watered with tap water everyday based on the water level marked. NPK, Urea, and Compound fertilizers were applied on time. The emergence of weed seedlings were observed, counted, identified, and recorded at the end of the experiment. This experiment was run almost four months.

III. RESULTS

Twelve weeds species were emerged from the soil seed banks such as *Echinochloa crus-galli* (L.) Beauv, *Echinochloa colona* (L.) Link, *Ischaemum rugosum* Salisb. *Leptochloa chinensis* (L.) Nees, *Oryza sativa* complex (L.), *Cyperus difformis* (L.), *Cyperus iria (L.), Fimbristylis milliacea* (L.) Vahl, *Lemna minor L., Ludwigia hyssopifolia* (G.Don) Exell, *Monochoria vaginalis* (Burm.f.) Presl, and *Sphenoclea zeylanica* Gaertn.

In sandy soil from Pokok Kenanga plot, all twelve weeds species emerged except *E. crus-galli* and *L.hyssopifolia*. The emergence of *M. vaginalis* recorded as the highest weed species with (61 seedlings) followed by *L.chinensis* (10 seedlings) and *O.sativa* complex (4 seedlings). *L.minor* recorded in percentage instead of number of seedling which were 90 %, 95 %, and 90% in both partial and flooded water level conditions **(Table 1.1)**. On the other hand, only five out of twelve weeds species emerged in mangrove soil from Tok Kiat plot such as *E.colona, L.chinensis, C.difformis, M. vaginalis*, and *S.zeylanica*. *L.chinensis* has the highest total number of weeds seedling emerged in mangrove soil with (18 seedlings) followed by *M.vaginalis* (14 seedlings), and both *C.difformis* and *S.zeylanica* shared similar number of seedling (5 seedlings) **(Table 1.2)**. Meanwhile, all sedges weeds were absent in muddy soil from Fasa Tiga plot unlike grasses and broadleaved weeds. For grasses weed, *E.crus-galli* showed the highest total number of emerged seedling (7 seedlings), followed by *E.colona* (4 seedlings), and the least was

L.chinensis (3 seedlings). Both *M.vaginalis* and *S.zeylanica* shared similar number of seedling emerged with (6 seedlings) in total for all three water level conditions **(Table 1.3)**. Besides that, only three weeds species present in all three water level conditions in clay soil from Sungai Burung Darat plot including *E.colona, I.rugosum*, and *S.zeylanica*. The emergence of *S.zeylanica* showed the highest number of weeds seedling with (43 seedlings) in total, followed by *E.colona* (11 seedlings) and *I.rugosum* (7 seedlings) **(Table 1.4).**

IV. DISCUSSION

Factors like water depth, temperature, salinity and nutrient level in the soil can affect species composition in the seedbank, seed longevity, germination success, and seedling recruitment from seedbank. For example, the number of viable seeds in the soils such as grasses and sedges decreased, while certain weed species germination in the seedbank suppressed in flooding water condition. This scenario can be seen clearly in Muda rice fields survey when broadleaved weeds, namely *Utricularia aurea* and *Sphenochlea zeylanica* were found as the most dominant weeds in dry and wet seeded rice fields compared to sedges and grasses **[3]**. The emergence of grasses and sedges such as *Echinochloa* species, *L. chinensis*, and *Cyperacea* species were higher in saturated water level condition Previous study has found that sedges and grasses recorded 90 % of the total of dry weight in saturated water level condition **[4]**. In this research, it showed that broadleaved weeds like *M. vaginalis* and *S.zeylanica* were found mostly in flooded water level conditions in Pokok Kenanga plot and Sungai Burung Darat plot respectively.

V. CONCLUSION

In conclusion, weed species were highly infested in Balik Pulau rice fields agro-ecosystem at four different plots like Pokok Kenanga, Tok Kiat, Fasa Tiga, and Sungai Burung Darat plots. The distribution of weeds species was higher in Pokok Kenanga plot (86 seedlings), followed by Sungai Burung Darat (69 seedlings), Tok Kiat (44 seedlings), and the least one was Fasa Tiga plot (26 seedlings). In addition, grasses and sedges weeds mostly emerged in saturated and partial water level conditions as compared to broadleaved weeds which mostly present in flooded water level condition.

VI. ACKNOWLEDGMENT

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Table 1.1 : Number of weed species presence in weed seed bank experiment of sandy soil from Pokok Kenanga plot in Balik Pulau rice field agro-ecosystem.

PLOT		POKOK KENANGA								
WATER LEVEL / DEPTH		SATURATED			PARTIAL			FLOODED		
REPLICATE		R1	R2	R3	R1	R2	R3	R1	R2	R3
TYPE / FAMILY	SPECIES									
A) GRASSESS										
Poaceae	*Echinochloa crus-galli* (L.) Beauv.	-	-	-	-	-	-	-	-	-
(Graminae)	*Echinochloa colona* (L.) Link	-	-	1	-	-	1	-	1	-
	Ischaemum rugosum Salisb.	-	-	1	-	-	-	-	-	-
	Leptochloa chinensis (L.) Nees.	6	-	1	-	-	-	-	3	-
	Oryza sativa complex (L.)	-	2	-	-	-	1	-	1	-
B) SEDGES										
Cyperaceae	*Cyperus difformis* (L.)	-	1	-	-	-	-	-	-	-
	Cyperus iria (L.)	-	-	-	-	2	1	-	-	-
	Fimbristylis milliacea (L.) Vahl	-	2	-	-	-	-	-	-	-
C) BROADLEAVED										
Lemnaceae	*Lemna minor L.*	-	-	-	90%	95%	-	90%	-	-
Onagraceae	*Ludwigia hyssopifolia* (G.Don) Exell	-	-	-	-	-	-	-	-	-
		-	5	2	5	11	14	5	16	3
Pontederiaceae	*Monochoria vaginalis* (Burm.f.) Presl									
Sphenocleacea	*Sphenoclea zeylanica* Gaertn.	-	1	-	-	-	-	-	-	-

Table 1.2 : Number of weed species presence in weed seed bank experiment of mangrove soil from Tok Kiat plot in Balik Pulau rice field agro-ecosystem

PLOT		**TOK KIAT**								
WATER LEVEL / DEPTH		**SATURATED**			**PARTIAL**			**FLOODED**		
REPLICATE		**R1**	**R2**	**R3**	**R1**	**R2**	**R3**	**R1**	**R2**	**R3**
TYPE / FAMILY	**SPECIES**									
A) GRASSESS										
Poaceae	*Echinochloa crus-galli* (L.) Beauv.	-	-	-	-	-	-	-	-	-
(Graminae)	*Echinochloa colona* (L.) Link	-	-	-	-	-	**1**	-	-	**1**
	Ischaemum rugosum Salisb.	-	-	-	-	-	-	-	-	-
	Leptochloa chinensis (L.) Nees.	**16**	-	-	**2**	-	-	-	-	-
	Oryza sativa complex (L.)	-	-	-	-	-	-	-	-	-
B) SEDGES										
Cyperaceae	*Cyperus difformis* (L.)	-	**4**	-	-	**1**	-	-	-	-
	Cyperus iria (L.)	-	-	-	-	-	-	-	-	-
	Fimbristylis milliacea (L.) Vahl	-	-	-	-	-	-	-	-	-
C) BROADLEAVED										
Lemnaceae	*Lemna minor L.*	-	-	-	-	-	-	-	-	-
Onagraceae	*Ludwigia hyssopifolia* (G.Don) Exell	-	-	-	-	-	-	-	-	-
Pontederiaceae	*Monochoria vaginalis* (Burm.f.) Presl	-	**1**	**5**	**1**	**4**	**2**	-	-	**1**
Sphenocleacea	*Sphenoclea zeylanica* Gaertn.	**2**	-	-	**3**	-	-	-	-	-

Table 1.3: Number of weed species presence in weed seed bank experiment of muddy soil from Fasa Tiga plot in Balik Pulau rice field agro-ecosystem

PLOT		**FASA TIGA**								
WATER LEVEL / DEPTH		**SATURATED**			**PARTIAL**			**FLOODED**		
REPLICATE		**R1**	**R2**	**R3**	**R1**	**R2**	**R3**	**R1**	**R2**	**R3**
TYPE / FAMILY	**SPECIES**									
A) GRASSESS										
Poaceae	*Echinochloa crus-galli* (L.) Beauv.	-	**2**	**1**	-	-	**3**	-	**1**	-
(Graminae)	*Echinochloa colona* (L.) Link	-	-	-	-	**1**	**1**	-	**2**	-
	Ischaemum rugosum Salisb.	-	-	-	-	-	-	-	-	-
	Leptochloa chinensis (L.) Nees.	**1**	-	-	**1**	-	-	**1**	-	-
	Oryza sativa complex (L.)	-	-	-	-	-	-	-	-	-
B) SEDGES										
Cyperaceae	*Cyperus difformis* (L.)	-	-	-	-	-	-	-	-	-
	Cyperus iria (L.)	-	-	-	-	-	-	-	-	-
	Fimbristylis milliacea (L.) Vahl	-	-	-	-	-	-	-	-	-
C) BROADLEAVED										
Lemnaceae	*Lemna minor L.*	-	-	-	-	-	-	-	-	-
Onagraceae	*Ludwigia hyssopifolia* (G.Don) Exell	-	-	-	-	-	-	-	-	-
Pontederiaceae	*Monochoria vaginalis* (Burm.f.) Presl	-	-	-	-	**3**	-	-	**1**	**2**

Sphenocleacea	*Sphenoclea zeylanica* Gaertn.	-	3	-	1	2	-	-	-	-

Table 1.4: Number of weed species presence in weed seed bank experiment of clay soil from Sungai Burung Darat plot in Balik Pulau rice field agro-ecosystem

PLOT		**SUNGAI BURUNG DARAT**								
WATER LEVEL / DEPTH		**SATURATED**			**PARTIAL**			**FLOODED**		
REPLICATE		**R1**	**R2**	**R3**	**R1**	**R2**	**R3**	**R1**	**R2**	**R3**
TYPE / FAMILY	**SPECIES**									
A) GRASSESS										
Poaceae	*Echinochloa crus-galli* (L.) Beauv.	-	-	-	-	-	-	-	-	1
(Graminae)	*Echinochloa colona* (L.) Link	-	2	1	-	3	3	-	-	2
	Ischaemum rugosum Salisb.	-	-	1	-	1	2	-	1	2
	Leptochloa chinensis (L.) Nees.	-	-	-	1	-	-	1	-	-
	Oryza sativa complex (L.)	-	-	-	-	-	-	-	1	-
B) SEDGES										
Cyperaceae	*Cyperus difformis* (L.)	-	-	-	-	-	1	-	-	-
	Cyperus iria (L.)	-	-	-	-	-	-	-	-	-
	Fimbristylis milliacea (L.) Vahl	-	-	-	-	-	-	-	-	-
C) BROADLEAVED										
Lemnaceae	*Lemna minor L.*	-	-	-	-	-	-	-	-	-
Onagraceae	*Ludwigia hyssopifolia* (G.Don) Exell	-	-	1	-	-	-	-	-	1
Pontederiaceae	*Monochoria vaginalis* (Burm.f.) Presl	-	-	-	-	1	-	-	-	-
Sphenocleacea	*Sphenoclea zeylanica* Gaertn.	-	17	5	1	5	-	1	14	-