Weed survey in different cultural practice in Seberang Perai and Muda Rice Fields in Northern Malaysia

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Abstract. A correlation between weedy species composition and 4 different planting practices in Peninsular Malaysia was being investigated from September 2011 – January 2012. Through this study, the noxious and competitive weed of rice were identified and counted, which should be helpful in developing a more sustainable weed control and management. This study was conducted at 24 different rice field covering four types of planting practices in Seberang Perai and MUDA area, namely wet seeding, water seeding, manual transplanting and mechanical transplanting method, using 0.5 x 0.5 m size quadrat with 20 samples for each field during rice at tillering to heading stage. A total of 27 weed species belonging to 14 families composing of 10 broadleaved, 8 grasses, 7 sedges and 2 submerged weed group were recorded. The dominance weeds species in four planting practices at both areas is *Oryza sativa* complex (weedy rice). Different dominance weed group observed in both areas due to different planting practices, such as in water seeding practice, broadleaved such *Limnochoria flava* and *Monocharia vaginalis* showed the highest I.V. for both areas, for wet seeding practice *Echinochloa crus-galli* and *Leptochloa chinensis* under grasses group have the highest I.V. and for manual and mechanical transplanting practice both have the same weed group which is *Leptochloa chinensis*.
Keywords: *Limnochoria flava, Monocharia vaginalis, Echinochloa crus-galli* and *Leptochloa chinensis*

Introduction

There are about seven granary areas in Peninsular Malaysia and two of them were Seberang Perai which covers approximately 13,000 hectares of rice field and in Muda Irrigation Scheme cover 97,000 hectares rice field. Rice granaries areas are located within north-west region on Peninsular Malaysia. In early 1970, double cropping system has been implemented in Malaysia especially in Muda area after the successful introduction of improved irrigation system. The irrigation within Muda area were controlled by Muda Agricultural Development authority (MADA)(Ho and Zainuddin, 1995) whereas in Seberang Perai the irrigation system were establish in 1984 and it under Integrated Agricultural Development Area (IADA).

Since 1970s, traditional transplanting is the planting practice that has been used by farmer in rice fields in Malaysia (Azmi and Abdullah, 1998). In 2000, 90% area in granary area Peninsular Malaysia has been shifted to direct seeding method (Azmi *et a.,* 2004) due to the limited labour, high of cost and time consuming (Johnkutty *et al*.,2002). In general cultural practice in rice field can be divided into two types; transplanting and direct seeding. Transplanting can be further divided into two methods which is manual and mechanical transplanting. However, direct seeding also had certain conditions which are dry, wet, water seeding (Johnkutty *et al*.,2002; Azmi *et a.,* 2004).

There is a limited number of published weed surveys of rice fields in Malaysia for example by Begum *et al* .2008; Azmi, 1990. Both studies involved weed survey in rice granaries area in Peninsular Malaysia and studies about weed infestation of weed flora in rice fields. Among previous works on weed species composition by Azmi and Mashhor (1995), there are predominant weed shifting due to the changes of cultural practice from transplanting to direct seeding. During season 1989, the agronomic practice in Kemubu area was traditional transplanting and the dominance weed groups were broadleaves while during 1993 season, 79.6% of total area in Kemubu started transform their agronomic practices into direct seeding that lead to the changes of dominant weed group from broadleaved into grasses and followed by sedges, grasses and aquatic weed group.
The objective for this survey was to study the composition and distribution of rice weeds in different agronomic practice in Seberang Perai and Muda area and to compare the weed species in different agronomic practice in both areas. The relationship between weedy species composition and agronomic practice is also to be looked into.

Materials and Methods

Field survey of rice in Seberang Perai and Block IV, Muda area was conducted during September to January 2012. A total of 24 rice fields were surveyed to represent both areas were cover 4 wet seeding, 4 water seeding, 2 manual seeding and 2 mechanical transplanting for each area. The survey was done during when the rice was at the tillering to flowering stages. An inverted "W" shaped pattern was applied during this surveyed (Thomas, 1985). A total of 20 quadrates were used and placed in each of the arm "W" (Fig. 1). Quadrates 0.5m X 0.5m were used in this surveyed place systematically along each arm and the distance of each quadrate is uniform and based on field size and shaped. All weeds in each quadrate were identified, counted and recorded and for the unidentified species will be label and brought to the lab for the later identification by the expertise and after being identified, weed are dried into the oven at 80º for 48hour (Chancelor and William, 1982).

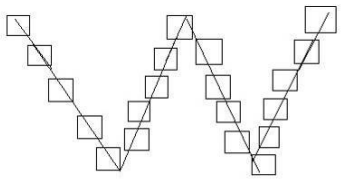

Figure 1. "W" shaped pattern with four transects. Each arm consist 5 quadrates (Q). A total of 20 quadrates represent weed species in each plot. The length of each arms and distance between quadrates was adjusted to cover the whole area if the field was not in square.

The data were expressed as the Important Value (I.V) of each weed species and it was measures as relative frequency (RA), relative density (RD) and relative dry weight (RDW) by the following formula (Lum, 1983):

$$D = \frac{\text{No.of individual in same speciesl}}{\text{Q Area}(m^2) \times \text{no.of Q sampled}}$$

$$RD = \frac{\text{Density of given species}}{\text{Total density for all species}} \times 100$$

$$F = \frac{\text{Number of quadrat have same species}}{\text{Total number of quadrat}}$$

$$RF = \frac{\text{F.of a species}}{\text{Total frequency for all species}} \times 100$$

$$RDW = \frac{\text{Dryweightof species}}{\text{Total dry weight of all species}} \times 100$$

$$(I.V) = RD + RF + RDW$$

Comparison weed species between area and agronomic were calculated using the "Sorenson's Index of similarity"(S) (Goldsmith *et al.*, 1986). S value can be computed by following formulae.

$$S = \frac{2J}{A+B} \times 100$$

Where, S = comparison of association between area, A +B
J = No of species common to both A and B
A= No of species presence at area A
B = No of a species presence at area B

Results and Discussion

According to Azmi (1990) weed are categorizes into broadleaf weeds, grasses, sedges and submerged weeds. Based on this survey, there are 27 species belonging to 24 genera grouped under 14 families recorded in Seberang Perai and Muda areas (Table 1). The 27 weed species are composing of 10 broadleaves, 8 grasses, 7 sedges and 2 submerged (aquatic) weeds. In terms of locality, the composition and distribution of weed species was different in each agronomic practice and areas. A total of 25 weed species were present in Seberang Perai and 21 species in Muda as shown in Table 2 and Table 3.

Table 1. Distribution of weed species in Seberang Perai and Muda area in Main season 2011/2012.

Family	Species	Weed occurrence	
		Seberang Perai	Muda
Aquatic weeds (submerged)			
Lentibularaceae	*Urticularia aurea* Louv.	X	X
Najadaceae	*Najas graminea*(non Del.) Redl.	X	X
Broadleaf weeds			
Alismataceae	*Sagiteria guyanensis* H.B.K.	X	X
Amaranthaceae	*Altenanthera sesillis* (L.) DC	X	X
Araceae	*Pistia stratiotes* L.	X	X
Asteraceae	*Eclipta alba* (L.)	X	X
Butomaceae	*Limnochoria flava (*L) Buchenau	X	X
Onagraceae	*Ludwigia hyssopifolia* (G. Don) Exell	X	X
Pontederiaceae	*Monochoria vaginalis* (Burm.f.) Presl	X	X
Rubiceae	*Hedyotis corymbosa* (L) Lamk.	X	X
Scrophulariaceae	*Lindernia pusila* (Willd.) Bold.	X	X
Sphenocleaceae	*Sphenoclea zeylanica* Gaertn	X	X
Grasses (Graminea)			
	Echinochloa colona (L).	X	X
	Echinochloa crus-galli (L.) Beauv.	X	X
	Hymenache acutigluma (Stend) Gililand	X	X
	Ischaemum rugosom Salisb.	X	X
	Leersia hexandra Sw.	0	X
	Leptochloa chinensis (L.) Nees	X	X
	Oryzae sativa complex	X	X
	Panicum repens L.	0	X
Sedges (Cyperaceae)			
	Cyperus babakensis steud.	0	X
	Cyperus difformis L.	X	X
	Cyperus distans L.f	0	X
	Cyperus haspan L.	X	X
	Cyperus iria L.	X	X
	Fimbristylis miliacea (L.) Vahl	X	X
	Scirpus grossus L. F	X	X

Table 2. Comparison weed species in water seeding field in Seberang Perai and Muda area based on agronomic

Family	Species	Weed occurrence	
		Seberang Perai	Muda
Aquatic weeds (submerged)			
Lentibularaceae	*Urticularia aurea* Louv.	X	0
Najadaceae	*Najas graminea*(non Del.) Redl.	X	0
Broadleaf weeds			
Alismataceae	*Sagiteria guyanensis* H.B.K.	X	0
Amaranthaceae	*Altenanthera sesillis* (L.) DC	0	X
Araceae	*Pistia stratiotes* L.	X	0
Butomaceae	*Limnochoria flava (*L) Buchenau	X	0
Onagraceae	*Ludwigia hyssopifolia* (G. Don) Exell	X	X
Pontederiaceae	*Monochoria vaginalis* (Burm.f.) Presl	X	X
Rubiceae	*Hedyotis corymbosa* (L) Lamk.	X	0
Sphenocleaceae	*Sphenoclea zeylanica* Gaertn	X	X
Grasses (Graminea)			
	Echinochloa colona (L).	X	0
	Echinochloa crus-galli (L.) Beauv.	X	X
	Hymenache acutigluma (Stend) Gililand	X	X
	Ischaemum rugosom Salisb.	X	X
	Leersia hexandra Sw.	0	X
	Leptochloa chinensis (L.) Nees	X	X
	Oryzae sativa complex	X	X
	Panicum repens L.	0	X
Sedges (Cyperaceae)			
	Cyperus babakensis steud.	0	X
	Cyperus difformis L.	X	X
	Cyperus haspan L.	X	0
	Cyperus iria L.	X	X
	Fimbristylis miliacea (L.) Vahl	X	X
	Scirpus grossus L. F	0	X

Table 3. Comparison weed species in wet seeding field in Seberang Perai and Muda area

Family	Species	Weed occurrence	
		Seberang Perai	Muda
Aquatic weeds (submerged)			
Lentibulariaceae	*Urticularia aurea* Louv.	0	0
Najadaceae	*Najas graminea*(non Del.) Redl.	0	X
Broadleaf weeds			
Alismataceae	*Sagiteria guyanensis* H.B.K.	X	X
Butomaceae	*Limnochoria flava (*L) Buchenau	X	0
Onagraceae	*Ludwigia hyssopifolia* (G. Don) Exell	X	X
Scrophulariaceae	*Lindernia pusila*(Willd.) Bold.	X	X
Sphenocleaceae	*Sphenoclea zeylanica* Gaertn	X	0
Grasses (Graminea)			
	Echinochloa colona (L).	X	0
	Echinochloa crus-galli (L.) Beauv.	X	X
	Ischaemum rugosom Salisb.	X	X
	Leersia hexandra Sw.	X	X
	Leptochloa chinensis (L.) Nees	X	X
	Oryzae sativa complex	X	X
Sedges (Cyperaceae)			
	Cyperus babakensis steud.	0	X
	Cyperus difformis L.	X	X
	Cyperus haspan L.	X	0
	Cyperus iria L.	X	X
	Fimbristylis miliacea (L.) Vahl	0	X
	Scirpus grossus L. F	0	X

Table 4. Comparison weed species in manual transplanting in Seberang Perai and Muda area

Family	Species	Weed occurrence	
		Seberang Perai	Muda
Broadleaf weeds			
Amaranthaceae	*Altenanthera sesillis* (L.) DC	X	0
Butomaceae	*Limnochoria flava (*L) Buchenau	X	X
Onagraceae	*Ludwigia hyssopifolia* (G. Don) Exell	X	X
Pontederiaceae	*Monochoria vaginalis* (Burm.f.) Presl	X	X
Sphenocleaceae	*Sphenoclea zeylanica* Gaertn	X	X
Grasses (Graminea)			
	Echinochloa crus-galli (L.) Beauv.	X	X
	Hymenache acutigluma (Stend) Gililand	0	X
	Ischaemum rugosom Salisb.	X	X
	Leptochloa chinensis (L.) Nees	X	X
	Oryzae sativa complex	X	X
Sedges (Cyperaceae)			
	Cyperus difformis L.	0	X
	Cyperus iria L.	X	X
	Fimbristylis miliacea (L.) Vahl	X	X
	Scirpus grossus L. F	0	X

Table 5. Comparison weed species in mechanical transplanting field in Seberang Perai and Muda areas.

Family	Species	Weed occurrence	
		Seberang Perai	Muda
Broadleaf weeds			
Amaranthaceae	*Altenanthera sesillis* (L.) DC	0	X
Butomaceae	*Limnochoria flava (*L) Buchenau	X	0
Onagraceae	*Ludwigia hyssopifolia* (G. Don) Exell	X	X
Pontederiaceae	*Monochoria vaginalis* (Burm.f.) Presl	X	X
Sphenocleaceae	*Sphenoclea zeylanica* Gaertn	0	X
Grasses (Graminea)			
	Echinochloa colona (L).	0	X
	Echinochloa crus-galli (L.) Beauv.	X	X
	Ischaemum rugosom Salisb.	0	X
	Leersia hexandra Sw.	0	X
	Leptochloa chinensis (L.) Nees	X	X
	Oryzae sativa complex	X	X
	Panicum repens L.	0	0
Sedges (Cyperaceae)			
	Cyperus difformis L.	0	X
	Cyperus haspan L.	X	0
	Cyperus iria L.	X	X
	Fimbristylis miliacea (L.) Vahl	X	X
	Scirpus grossus L. F	X	0

Table 6. Comparison of importance value of various weed species collected from different agronomic practice in Seberang Perai areas during main season 2011/2012

Species	Wet seeding	Water seeding	Manual transplanting	Mechanical transplanting
Eclipta alba (L)	0.0	0.0	4.0	0.0
Hedyotis corymbosa (L) Lamk.	0.0	2.7	0.0	0.0
Altenanthera sesillis(L.) DC	0.0	0.0	3.9	0.0
Cyperus difformis L.	2.9	1.7	0.0	0.0
Cyperus distans L.	0	0	0	17.9
Cyperus haspan L.	0	2.2	0.0	13.7
Cyperus iria L.	4.3	3.8	5.9	12.4
Echinochloa colona (L).	18.6	11.3	0.0	0.0
Echinochloa crus-galli (L.) Beauv.	60.9	14.2	35.4	45.0
Fimbristylis miliacea (L.) Vahl	0.0	10.5	18.1	20.7
Hymenache acutigluma (Stend) Gililand	0.0	2.2	0.0	0.0
Ischaemum rugosom Salisb.	13.8	4.1	29.2	0.0
Leptochloa chinensis (L.) Nees	28.9	20.3	57.3	13.4
*Limnochoria flava (*L) Buchenau	14.4	52.9	15.6	56.2
Lindernia pusilla (Willd.) Bold.	1.2	0.0	0.0	0.0
Ludwigia hyssopifolia (G. Don) Exell	3.4	19.1	15.1	13.4
Monochoria vaginalis (Burm.f.) Presl	0.0	48.4	0.0	12.2
Najas graminea(non Del.) Redl.	0.0	0.6	0.0	0.0
Oryzae sativa complex	139.1	70.3	110.3	81.8
Panicum repens L.	0.0	0.0	0.0	0.0
Pistia stratiotes L.	0.0	5.0	0.0	0.0
Sagiteria guyanensis H.B.K.	4.6	9.7	0.0	0.0
Scirpus grossus L. F	0.0	0.0	0.0	13.3
Sphenoclea zeylanica Gaertn	13.8	14.0	5.2	0.0
Urticularia aurea Louv.	0.0	5.7	0.0	0.0

Table 7. Comparison of importance value of various weed species collected from Different agronomic practice in Muda areas during main season 2011/2012

Species	Wet seeding	Water seeding	Manual transplanting	Mechanical transplanting
Eclipta alba (L.)	0.0	0.0	0.0	0.0
Hedyotis corymbosa (L) Lamk.	0.0	0.0	0.0	0.0
Altenanthera sesillis(L.) DC	8.2	1.4	0.0	0.0
Cyperus babakensis steud.	0.0	0.0	0.0	0.0
Cyperus difformis L.	1.1	4.3	15.6	3.5
Cyperus distans L.	0.0	0.0	0.0	0.0
Cyperus haspan L.	0.0	0.0	0.0	0.0
Cyperus iria L.	3.3	3.7	38.9	6.8
Echinochloa colona (L).	0.0	0.0	0.0	17.7
Echinochloa crus-galli (L.) Beauv.	75.2	68.0	68.9	52.3
Fimbristylis miliacea (L.) Vahl	10.2	12.8	22.2	16.1
Hymenache acutigluma (Stend) Gililand	0.0	3.8	0.0	0.0
Ischaemum rugosom Salisb.	30.8	3.0	0.0	21.5
Leersia hexandra Sw.	9.7	18.2	0.0	18.8
Leptochloa chinensis (L.) Nees	23.1	15.7	20.5	42.2
*Limnochoria flava (*L) Buchenau	0.0	0.0	19.3	0.0
Lindernia pusila (Willd.) Bold.	0.9	0.0	0.0	0.0
Ludwigia hyssopifolia (G. Don) Exell	19.6	23.6	3.2	2.9
Monochoria vaginalis (Burm.f.) Presl	0.0	7.0	40.9	4.6
Najas graminea(non Del.) Redl.	11.5	0.0	0.0	0.0
Oryzae sativa complex	82.9	102.4	54.1	109.5
Panicum repens L.	0.0	2.0	0.0	0.0
Pistia stratiotes L.	0.0	0.0	0.0	0.0
Sagiteria guyanensis H.B.K.	3.4	0.0	0.0	0.0
Scirpus grossus L. F	19.9	10.0	7.8	0.0
Sphenoclea zeylanica Gaertn	0.0	24.3	10.9	4.8
Urticularia aurea Louv.	0.0	0.0	0.0	0.0

Based on the Table 2 to Table 5, Graminea was the family with the highest number of species (8) and followed by Cyperacea (7) and the remain family was represented by one species. For Seberang Perai there are ranging from 11 to 19 species present in different agronomic practice compare to Muda area whereas ranging from 11 to 15 species. Difference number of species found between difference agronomic practices was likely due to the

existence of minor weed species such *Sagiteria guyanensis* and *Najas graminea* . For instance, *Oryza sativa* complex was the noxious weed species and it has the highest number of important value (I.V) among other species and became the most dominance species in all plots except for manual transplanting plots in Muda area. *Oryza sativa* complex *or Padi Angin* was categorized as weed because they were unwanted plant by farmer in the field and lead to yield loss. However there are no effective control measures that can be used against *Padi Angin* as it is identical to rice crop (Azmi *et al*., 1994) and largely goes undetected. Thus, to prevent further yield losses recent new varieties of rice in Malaysia had been released by MARDI and BASF (known as ClearField rice (CL)) that can be use effectively to overcome *Padi Angin* and other noxious weed species in rice field (Azmi *et al.,* 2008).

Different dominance weed group were observed in both area depend on the agronomic pratice that has been used. For example in wet seeding plot, grasses such *Leptochloa chinensis* become the dominant group that infested the plot. For water seeding practice broadleaved such *Limnocharis flava* was the dominance group that dominate the plot and for manual and mechanical transplanting grasses was the dominance species. There are an order in weed group in four different agronomic practice in Seberang Perai and Muda area. The dominance weed group in wet seeding in the order of grasses (G)> sedges (S)> broad-leaved (B)>Aquatics (AQ). For water seeding practice weed dominance based on weed group: (B)>(G)>(S)>(AQ) and for both transplanting practice, the order weed group was similiar to wet seeding practice due to lack of water in the field during crop establishment that give advantages to grasses and sedges to emergence and repressed broadleaved and aquatic weed from germinating (Begum *et al.,2008*). Based on Moody and Drost (1981) dry condition encourages grasses such *L. chinensis* to establish. The recommended technique for transplanting practice is after 5 to 7 days of transplanting (DAT),water is require as soon as possible to prevent the germination of weed seed bank of *Padi Angin* and others weeds and to make sure growth of paddy rice are uniform (Azmi *et al.,*1994*b)*. Early 1980s, transplanting has been used widely all over the granary area in Peninsular Malaysia especially in Muda areas and in early 1990s, agronomic practice from transplanting was shifted into direct seeded and give effect to the changes of weed flora from broadleaved and sedges into noxious and competative weed grasses due to the usage of chemical in controlling of weed infestation in field (Azmi and Baki, 1995).

The present study shows instead of *Oryza sativa* complex and *Echinochloa crus-galli* as a dominance weed species, *Leptochloa chinensis, Ischaemum rugosum, Ludwigia hyssopifolia, Limnocharis flava* and *Monochori vaginalis* also other dominance species and equally important weed in Muda area. Based on Sorenson's Index of Similarity, Seberang Perai (54.5-64.5) and Muda area (62.1-78.3), the higher of S value indicated that species composition between block was closely similar and the lower S value indicated species composition in both plot were diverge. Based on Table 5 and Table 6, in Seberang Perai areas, shows the range is lies between 54.5-64.5 which suggest that the weed species in Seberang Perai area is common in all plot with the different agronomic practice and for Muda area, the S value lies into 62.1-78.3 it meant there were repeated weed species occurred in four agronomic practice and some weed species such *Pistia stratiotes* only present in water seeding practice in Seberang Perai area and absent in water seeding plot in Muda area. This was probably due to water source for Seberang Perai and Muda area which originated from different locality as Seberang Perai water came from Sungai Muda (Haque *et al*., 2010) and in Muda from Pedu dam (Weng and Boon, 1994). Klingman *et.* al (1975) stated that weed seed, rhizomes and stolon are easy to be transported by farm machinery during land preparation and during harvesting by using combine harvester from one place to another place. Furthermore water one of factor that play a main role as dispersal agent that can disperse weed seed via surface running off trough stream, irrigation, rivers and drainage canals (Wilson, 1980).However, based on Drost and Moody (1982), the composition of weed flora and dominance patterns of weed group in rice areas affected by soil moisture or condition after harvesting period.

Conclusions

Weed dominance in different agronomic practice shown different species and weed group. *Oryza sativa* complex exist in each of the area and infested that area. Other major weeds also exist differently in different agronomic practice due to technique of practice. *Oryza sativa* complex, *Leptochloa chinensis, Cyperus iria, Fimbristylis miliacea, Ischaemum rugosum* and *Ludwigia hyssopifolia* could be found in each of agronomic practice in Seberang Perai and Muda area. For future study, weed survey in eight rice granary areas should be conducted to know the impact of planting practice on weed succession in all granary areas for the effectiveness of weed management in rice fields.

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