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Weed Flora of Arable Peat in Selangor, Malaysia - Quantitative and Spatial Pattern Analyses

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말레이지아 세랑고지역 부식질토양경지 잡초식생의 정량생태분석

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ABSTRACT

Collated data from the 1995-1996 floristic surveys of weeds of arable peat in Selangor district were analysed to assess composition and dominance and spatial distribution pattern based on quantitative and dispersion indices. Forty eight weed species belonging to 19 families of which 31 were broad leaves, 10 grasses and 7 sedges were sampled and these were translated as 77, 8 and 15% of the total cover, respectively. The respective important values were 71, 11 and 18%. Ten species in the order of dominance were *Fimbristylis acuminata, Murdannia nudiflora, Hedyotis corymbosa, Ageratum conyzoides, Asystasia gangetica, Cleome rutidosperma, Cyperus sphacelatus, Lindernia crustacea, Ludwigia hyssopifolia* and *Ludwigia perennis*. Thirty seven species displayed different degree of aggregated pattern of spatial distribution based on variance-to-mean ratios, Lloyds mean crowding or Lloyds patchiness indices. Other species were either random or regular in their spatial distribution. Differences in species-dominance and spatial distribution pattern may be attributed to inherent variations in patchiness and fecundity schedules of each weed species, crops, cropping patterns and agronomic practices prevailing in the area.

Key words : dominance, spatial pattern, dispersion indices, peat soil.

INTRODUCTION

In Malaysia, peat soils cover an area of *ca.* 2.46 millions ha, of which 40% have been cultivated for agriculture and related activities. Cultivation of peat for agriculture requires proper agronomic practices to ensure sustainability in nutrient status and water management.

One of the perennial problems associated with peat cultivation is weed infestation. No report has been found on the quantitative assessment and spatial pattern analyses of weeds of peat in Malaysia although Lee[11] enlisted weed flora of pineapple plantations on peat in Peninsular Malaysia.

This paper reports the results of exploratory floristic surveys on peat with the principal objec-

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tives of providing quantitative assessment and spatial pattern analyses of weed species prevailing. Analyses and interpretation of the surveyed data were done in 1996 at the Weed Science Lab. of Seoul National University, Korea.

MATERIALS AND METHODS

Floristic field surveys were conducted in 1995-1996 in Kelang, Selangor peat farms (Fig. 1). These farms planted with vegetables, rubber, oil palm or fruit trees were surveyed. These areas have a mean rainfall of *ca.* 2360 mm/year and mean maximum and minimum temperatures of 32 and 26℃, respevtively. Thirty six transects, each measuring 50m were laid in the sampling areas. Two hundred and fifty quadrats, each measuring 0.5m × 0.5m systematically from each other, were placed along with species entity and population counts. Species identification was based on the nomenclatorial systems of Henderson[8] and Soerjani *et al.*[13].

Several quantitative indices of each species were calculated using the method of Kim and Moody[10] and relative abundance using the method of Thomas[14]. The assessment of spatial distribution pattern of population of each species *per se* was made based on several indices of dispersion using the method of Dessaint *et al.*[6]. These indices were variance-to-mean ratio (VMR), Lloyd's mean crowding (m^*) and Lloyd's patchiness (Ip)[12]. Calculations were made using the following formulae:

$$VMR = ms/m$$

$$m^* = \sum_{i=1}^{Q} X_i (X_i - 1)$$

$$Ip = m^*/m$$

where Q = No. of quadrats

X_i = No. of individual species in the ith quadrat

m = mean no. of species

ms = mean square (variance) of each species

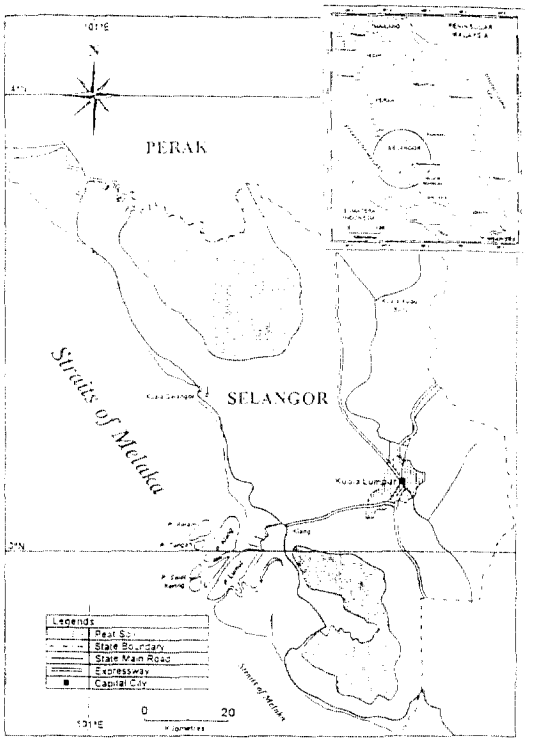


Fig. 1. Location of field survey areas in arable peat of Selangor.

Comparisons on the differences in the degree of aggregation of individual species based on Ip values using Morans autocorrelation test[5] were undertaken.

RESULTS AND DISCUSSION

Species composition and quantitative assessment

Forty eight weed species comprising 19 perennials and 27 annuals belonging to 19 families were recorded in immature ruber, oil palm, fruit and vegetable farms on peat in Selangor. Of these 31 were broad leaves, 10 grasses and 7 sedges (Table 1) and these were translated into *ca.* 76.7, 7.6 and 15.7%, respectively of the population counts. Based on importance value (IV), the broadleaves dominated the weed community on peat accounting for *ca.* 71.0% followed by

Table 1. Family, species and code*, life habit and propagation of weeds of arable peat in Selangor, Malaysia.

Family	No.	Species	Code*	Life habit	Propagation
Broadleaves	1	*Asystasia intrusa* Blume	ASYIN	A	K,S
Acanthaceae	2	*Amaranthus gracilis* Desf	AMAVI	A	S
Amaranthaceae	3	*Stenochlaena palustris* (Burm.) Bedd	STKPA	P	K,S
Blechnaceae	4	*Cleome rutidosperma* DC.	CLERT	A	K,S
Capparaceae	5	*Drymaria villosa* Cham & Schlechtend	-	A	S
Caryophyllaceae	6	*Murdannia nudiflora* (L.) Brenan	MUDNU	P	K,S
Commelinaceae	7	*Ageratum conyzoides* L.	AGECO	A	S
Compositae	8	*Eclipta prostrata* L.	ECLAL	A	S
	9	*Emilia Sonchifolia* (L.) DC. ex Weight	EMISO	A	S
	10	*Vernonia cinerea* (L.) Less	VENCI	A	K,S
	11	*Mikania micrantha* H.B.K.	-	P	K,S
Convolvulaceae	12	*Ipomoea triloba* L.	IPOTR	P	S
Euphorbiaceae	13	*Croton hirtus* L'Herit	CVNHI	P	S
	14	*Euphorbia hirta* L.	EPHHI	A	S
	15	*Phyllanthus debilis* Klein ex. Wild.	-	A	S
	16	*Phyllanthus urinaria* L.	PYLUR	A	S
Luguminosae	17	*Uraria lagopodiodes* (L.) Desv. ex DC.	-	P	S
Melastomataceae	18	*Melastoma affine* D.Don	-	A	S
Oleandraceae	19	*Nephrolepis biserrata* (Sw.) Schott	HEHBI	P	K,S
Onagraceae	20	*Ludwigia perennis* L.	LUDPN	A	S
	21	*Ludwigia hyssopifolia* (G. Don.) Exell	LUDLI	A	S
Papilionaceae	22	*Mimosa pudica* L.	MIMPU	P	K,S
Rubiaceae	23	*Borreria laevis* (Lam.) Griseb	BOILA	A	S
	24	*Borreria latifolia* Schum	BOILF	A	S
	25	*Borreria repens* DC.	-	A	S
	26	*Mitracarpus villosus* (Sw.) DC.	MTCVI	A	S
	27	*Hedyotis corymbosa* (L.) Lam	OLDCO	A	S
Scrophulariaceae	28	*Lindernia crustacea* (L.) F. Muell	LIDCR	P	K,S
Solanaceae	29	*Physalis angulata* L.	PHYAN	A	S
	30	*Passiflora foetida* L.	-	A	K,S
	31	*Solanum nigrum* L.	SOLNI	A	S
Grasses					
Gramineae	32	*Digitaria adscendens* (H.B.K.) Henr.	DIGAD	A	K,S
	33	*Digitaria violascens* L.	DIGVI	A	K,S
	34	*Echinochloa colonum* (L.) Link	ECHCO	A	K,S
	35	*Eleusine indica* (L.) Gaertn.	ELEIN	A	K,S
	36	*Eragrostis tenella* (L.) P. Beauv. ex R.& S.	ERAAM	A	K,S
	37	*Imperata cylindrica* (L.) Beauv.	IMPCY	P	K,S
	38	*Ischaemum muticum* L.	ISCMU	A	K,S
	39	*Panicum repens* L.	PANRE	P	K,S
	40	*Paspalum commersonii* Lamk.	PASSC	P	K,S
	41	*Paspalum conjugatum* Berg./Swartz	PASCO	P	K,S
Sedges					
Cyperaceae	42	*Cyperus sphacelatus* Roth.	-	A	K,S
	43	*Cyperus flavidus* Retz.	CYPGL	P	K,S
	44	*Cyperus rotundus* L.	CYPRO	P	K,S
	45	*Fimbristylis acuminata* Vahl	FIMAC	P	K,S
	46	*Fimbristylis dichotoma* (L.) Vahl.	FIMDI	A	K,S
	47	*Fimbristylis globulosa* (Retz.) Kunth	FIMGL	P	K,S
	48	*Lipocarpha chinensis* (Osb.) Kern.	LICCH	A	S

A=Annual P=Perennial K=Clonal propagation S=Sexual propagation

* Bayer code (Bayer, 1992) - Not listed in Bayer (1992).

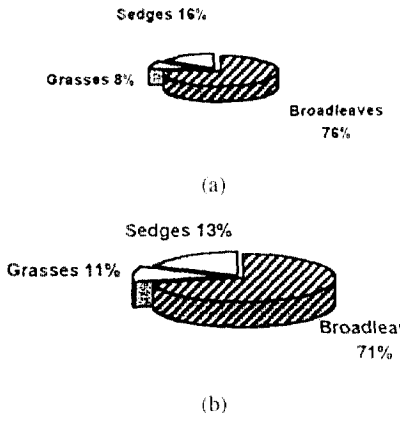
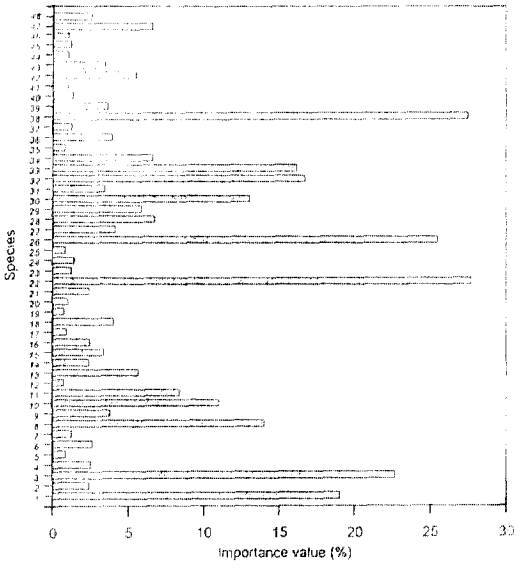


Fig. 2. (a) Percentage occurrence of individual species within each weed group, and (b) summed Importance Values of each weed group of arable peat of Selangor, Malaysia.



1. A. conyzoides 2. A. gracilis 3. A. intrusa 4. B. latifolia 5. B. latifolia 6. B. repens 7. S. nigrum 8. C. rutidosperma 9. C. hirtus 10. c. sphacelatus 11. C. flavidus 12. C. rotundus 13. D. adscendens 14. D. violascens 15. D. villosa 16. E. prostrata 17. E. colonum 18. E. indica 19. E. sonchifolia 20. E. tenella 21. E. hirta 22. F. acuminata 23. F. dichotoma 24. F. globulosa 25. P. foetida 26. H. corymbosa 27. I. cylindrica 28. I. triloba 29. I. muticum 30. L. crustacea 31. L. chinensis 32. L. hyssopifolia 33. L. perennis 34. M. affine 35. M. micrantha 36. M. pudica 37. M. villosus 38. M. nudiflora 39. N. bisserrata 40. P. repens 41. P. commersonii 42. P. conjugatum 43. P. debilis 44. P. urinaria 45.P. anguiata 46. S. palustris 47. U. lagopodioides 48. V. cinerea

Fig. 3. Importance value (%) of individual weed species of arable peat of Selangor, Malaysia.

sedges and grasses in the respective order of 18.0 and 11.0% (Fig. 2). The ten most dominant species based on the IV index were *Fimbristylis acuminata, Murdannia nudiflora, Hedyotis corymbosa, Ageratum conyzoides, Asystasia gangetica, Cleome rutidosperma, Cyperus sphacelatus, Lindernia crustacea, Ludwigia hyssopifolia* and *Ludwigia perennis* (Table 2). Fig. 3 shows the IV values of individual species sampled, depicting strong species variations. These species are rapid-growing plants producing many seeds and propagules aligned to robust clonal growth. It is intriguing to note that there were only marginal differences in population counts in the five areas surveyed (data not shown). However, wide differences in population counts and species composition were recorded between transects. No concrete reasons can be forwarded to explain the relative dominance (RD) of the ten species listed although it is reasonable to suggest that they possess characteristically efficient and strong clonal growth coupled with the ability to produce mass number of seeds. The herbicides 2,4-D and paraquat, widely used in the areas surveyed for land preparation and clearings were uneffective to annihilate those annuals. Abrahamson[1] has proven that species with wide distribution usually has efficient clonal growth and proliferation.

Table 3 depicts the quantitative indices of individual species of weeds on peat. Invariably, wide differences were registered among species based on these indices signifying their hierarchial or relative importance within the weed community. The order of relative abundance of ten species were *H. corymbosa, M. nudiflora, F. acuminata, A. conyzoides, L. perennis, L. hyssopifolia, A. intrusa, L. crustacea, C. rutidesperma* and *C. sphacelatus* denoting the dominance of broad leaved weeds in the community. Gramineae has more representatives vis-a'-vis Cyperaceae or other families based on species counts and affinity.

Table 2. Quantitative indices of weeds of arable peat in Selangor, Malaysia.

Family	No.	Species	RD	RDo	RF	RA	I.V
Broadleaves							
Acanthaceae	1	*Asystasia intrusa* Blume	6.12	10.44	6.16	6.14	22.73
Amaranthaceae	2	*Amaranthus gracilis* Desf	0.66	0.80	0.68	0.67	2.14
Blechnaceae	3	*Stenochlaena palustris* (Burm.) Bedd	0.05	0.20	0.68	0.37	0.93
Capparaceae	4	*Cleome rutidosperma* DC.	4.80	4.86	4.11	4.46	13.78
Caryophyllaceae	5	*Drymaria villosa* Cham & Schlechtend	1.74	0.82	0.68	1.21	3.25
Commelinaceae	6	*Murdannia nudiflora* (L.) Brenan	9.09	13.18	5.48	7.29	27.75
Compositae	7	*Ageratum conyzoides* L.	9.70	5.75	3.42	6.56	18.88
	8	*Eclipta prostrata* L.	0.71	0.28	1.37	1.04	2.36
	9	*Emilia Sonchifolia* (L.) DC. ex Weight	0.05	0.01	0.68	0.37	0.75
	10	*Vernonia cinerea* (L.) Less.	0.75	0.42	1.37	1.06	2.54
	11	*Mikania micrantha* H.B.K.	0.05	0.14	0.68	0.37	0.87
Convolvulaceae	12	*Ipomoea triloba* L.	1.46	2.67	2.74	2.10	6.87
Euphorbiaceae	13	*Croton hirtus* L'Herit	0.94	0.49	2.05	1.50	3.48
	14	*Euphorbia hirta* L.	0.57	0.31	1.37	0.97	2.25
	15	*Phyllanthus debilis* Klein ex. Wild.	0.42	0.26	2.74	1.58	3.42
	16	*Phyllanthus urinaria* L.	0.14	0.12	0.68	0.41	0.95
Luguminosae	17	*Uraria lagopodiodes* (L.) Desv. ex DC.	1.37	3.19	2.05	1.71	6.61
Melastomataceae	18	*Melastoma affine* D.Don	1.60	2.36	2.05	1.83	6.02
Oleandraceae	19	*Nephrolepis biserrata* (Sw.) Schott	0.42	1.13	2.05	1.24	3.61
Onagraceae	20	*Ludwigia perennis* L.	6.59	5.31	4.11	5.35	16.01
	21	*Ludwigia hyssopifolia* (G. Don.) Exell	8.29	4.46	4.11	6.20	16.86
Papilionaceae	22	*Mimosa pudica* L.	0.75	1.32	2.05	1.40	4.13
Rubiaceae	23	*Borreria laevis* (Lam.) Griseb	0.71	0.38	1.37	1.04	2.45
	24	*Borreria latifolia* Schum	0.05	0.03	0.68	0.37	0.76
	25	*Borreria repens* DC.	0.42	0.28	2.05	1.24	2.76
	26	*Mitracarpus villosus* (Sw.) DC.	0.19	0.42	0.68	0.44	1.29
	27	*Hedyotis corymbosa* (L.) Lam	14.88	7.72	2.74	8.81	25.35
Scrophulariaceae	28	*Lindernia crustacea* (L.) F. Muell	4.05	3.69	4.79	4.42	12.53
Solanaceae	29	*Physalis angulata* L.	0.19	0.20	0.68	0.44	1.08
	30	*Passiflora foetida* L.	0.05	0.05	0.68	0.37	0.79
	31	*Solanum nigrum* L.	0.28	0.20	0.68	0.48	1.17
Grasses							
Gramineae	32	*Digitaria adscendens* (H.B.K.) Henr.	1.37	1.30	2.74	2.05	5.40
	33	*Digitaria violascens* L.	0.33	0.42	1.37	0.85	2.12
	34	*Echinochloa colonum* (L.) Link	0.09	0.09	0.68	0.39	0.87
	35	*Eleusine indica* (L.) Gaertn.	1.46	1.35	1.37	1.42	4.18
	36	*Eragrostis tenella* (L.) P. Beauv. ex R.& S.	0.19	0.07	0.68	0.44	0.94
	37	*Imperata cylindrica* (L.) Beauv.	1.22	1.07	2.05	1.64	4.35
	38	*Ischaemum muticum* L.	1.60	2.36	2.05	1.83	6.02
	39	*Panicum repens* L.	0.42	0.28	0.68	0.55	1.39
	40	*Paspalum commersonii* Lamk.	0.05	0.20	0.68	0.37	0.93
	41	*Paspalum conjugatum* Berg./Swartz	0.89	3.00	1.37	1.13	5.26
Sedges							
Cyperaceae	42	*Cyperus sphacelatus* Rottb.	3.44	2.69	4.79	4.12	10.92
	43	*Cyperus flavidus* Retz.	1.37	1.89	4.79	3.08	8.05
	44	*Cyperus rotundus* L.	0.05	0.05	0.68	0.37	0.79
	45	*Fimbristylis acuminata* Vahl	9.66	12.68	5.48	7.57	27.82
	46	*Fimbristylis dichotoma* (L.) Vahl.	0.24	0.20	0.68	0.46	1.12
	47	*Fimbristylis globulosa* (Retz.) Kunth	0.19	0.14	1.37	0.78	1.69
	48	*Lipocarpha chinensis* (Osb.) Kern.	0.71	0.55	2.05	1.38	3.32

*RD, Relative density; RDo, Relative dominance; RF, Relative frequency; RA, Relative abundance; I.V., Importance value

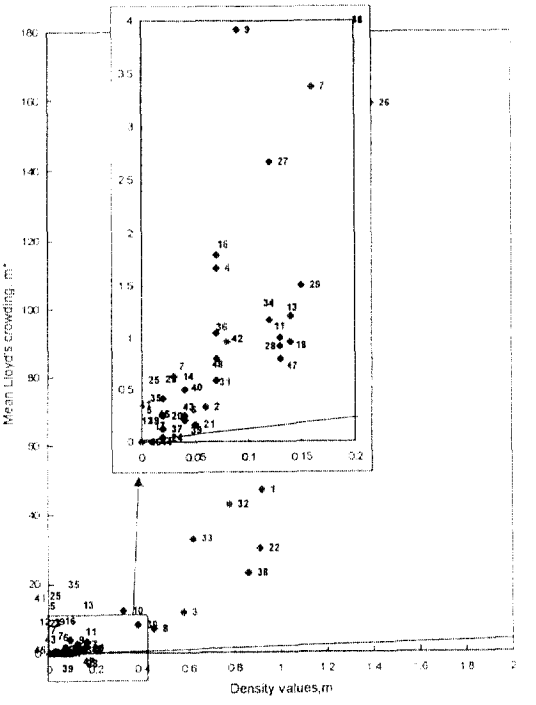
Table 3. Mean density(m), variance(v), variance-to-variance(VMR), Lloyd's mean crowding(m^*) and Lloyd's patchiness index(Ip) of weeds of arable peat in Selangor, Malaysia.

Family	No.	Species	m	v	VMR	m^*	Ip
Broadleaves	1	*Asystasia intrusa* Blume	0.58	5.28	4.06	11.71	9.01
Acanthaceae	2	*Amaranthus gracilis* Desf	0.06	0.28	2.02	0.33	2.37
Amaranthaceae	3	*Stenochlaena palustris* (Burm.) Bedd	0.00	0.01	1.00	0.00	1.00
Blechnaceae	4	*Cleome rutidosperma* DC.	0.45	3.37	3.31	7.00	6.86
Capparaceae	5	*Drymaria villosa* Cham & Schlechtend	0.03	0.37	5.27	0.63	8.93
Caryophyllaceae	6	*Murdannia nudiflora* (L.) Brenan	0.86	0.10	4.82	22.92	11.87
Commelinaceae	7	*Ageratum conyzoides* L.	0.92	20.28	9.99	47.00	22.82
Compositae	8	*Eclipta prostrata* L.	0.07	1.00	6.65	1.79	11.94
	9	*Emilia Sonchifolia* (L.) DC. ex Weight	0.00	0.01	1.00	0.00	0.00
	10	*Vernonia cinerea* (L.) Less	0.07	0.52	3.25	0.79	4.95
	11	*Mikania micrantha* H.B.K	0.00	0.01	1.00	0.00	0.00
Convolvulaceae	12	*Ipomoea triloba* L.	0.14	0.68	2.20	0.96	3.09
Euphorbiaceae	13	*Croton hirtus* L'Herit	0.09	2.06	10.30	3.92	19.58
	14	*Euphorbia hirta* L.	0.05	0.19	1.56	0.17	1.39
	15	*Phyllanthus debilis* Klein ex. Wild.	0.04	0.20	2.27	0.25	2.78
	16	*Phyllanthus urinaria* L.	0.01	0.03	0.98	0.00	0.00
Luguminosae	17	*Uraria lagopodiodes* (L.) Desv. ex DC.	0.13	0.59	2.04	0.79	2.73
Melastomataceae	18	*Melastoma affine* D.Don	0.12	0.76	2.92	1.17	4.49
Oleandraceae	19	*Nephrolepis biserrata* (Sw.) Schott	0.04	0.18	2.04	0.21	2.31
Onagraceae	20	*Ludwigia perennis* L.	0.62	15.35	10.97	32.83	23.45
	21	*Ludwigia hyssopifolia* (G. Don.) Exell	0.78	19.38	11.01	42.75	24.29
Papilionaceae	22	*Mimosa pudica* L.	0.07	0.64	4.01	1.04	6.51
Rubiaceae	23	*Borreria laevis* (Lam.) Griseb	0.07	0.94	6.25	1.67	11.11
	24	*Borreria latifolia* Schum	0.00	0.01	1.00	0.00	0.00
	25	*Borreria repens* DC.	0.04	0.18	2.04	0.21	2.31
	26	*Mitracarpus villosus* (Sw.) DC.	0.02	0.10	2.48	0.13	3.13
	27	*Hedyotis corymbosa* (L.) Lam	1.40	70.32	22.25	159.25	50.40
Scrophulariaceae	28	*Lindernia crustacea* (L.) F. Muell	0.38	4.06	4.72	8.13	9.45
Solanaceae	29	*Physalis angulata* L.	0.02	0.16	4.00	0.25	6.25
	30	*Passiflora foetida* L.	0.00	0.01	1.00	0.00	0.00
	31	*Solanum nigrum* L.	0.03	0.36	6.06	0.63	10.42
Grasses							
Gramineae	32	*Digitaria adscendens* (H.B.K.) Henr.	0.13	0.69	2.39	1.00	3.45
	33	*Digitaria violascens* L.	0.03	0.37	5.27	0.63	8.93
	34	*Echinochloa colonum* (L.) Link	0.01	0.02	0.99	0.00	0.00
	35	*Eleusine indica* (L.) Gaertn.	0.14	0.80	2.59	1.21	3.90
	36	*Eragrostis tenella* (L.) P. Beauv. ex R.& S.	0.02	0.16	4.00	0.25	6.25
	37	*Imperata cylindrica* (L.) Beauv.	0.12	1.49	5.72	2.67	10.26
	38	*Ischaemum muticum* L.	0.15	0.95	2.81	1.50	4.41
	39	*Panicum repens* L.	0.04	0.33	3.61	0.50	5.56
	40	*Paspalum commersonii* Lamk.	0.00	0.01	1.00	0.00	0.00
	41	*Paspalum conjugatum* Berg./Swartz	0.08	0.62	3.26	0.96	5.04
Sedges							
Cyperaceae	42	*Cyperus sphacelatus* Rottb.	0.32	6.10	8.35	12.17	16.67
	43	*Cyperus flavidus* Retz.	0.13	0.65	2.25	0.92	3.16
	44	*Cyperus rotundus* L.	0.00	0.01	1.00	0.00	0.00
	45	*Fimbristylis acuminata* Vahl	0.91	12.37	6.03	30.00	14.63
	46	*Fimbristylis dichotoma* (L.) Vahl.	0.02	0.25	5.00	0.42	8.33
	47	*Fimbristylis globulosa* (Retz.) Kunth	0.02	0.06	1.47	0.04	1.04
	48	*Lipocarpha chinensis* (Osb.) Kern.	0.07	0.41	2.74	0.58	3.89

Digitaria adscendens and *Ischaemum muticum* were the most abundant and dominant grass species according to RD or IV indices. The near equivalents of sedge species were *F. acuminata* and *C. sphacelatus* while among the broad leaves, these were *M. nudiflora* and *H. corymbosa*.

Spatial distribution pattern

Species displaying characteristically random spatial distribution patterns were *B. latifolia*, *C. rotundes*, *E. sonchifolia*, *P. foetida*, *M. micrantha*, *P. commersonii* and *S. palustris* where VMR values were equal to unity(Fig. 4). Conversely, species with regular distribution pattern were *E. colonum and P. urinaria*. Baki[3] and Baki *et al.*[4,5] *inter-alia* employed the relationship between Lloyd's mean crowding and Lloyd's mean density to characterise the spatial distribution pattern of weeds. All species of weeds of rice fields in Samarahan, Sarawak and Tanjung Karang, Selangor were random in their distribution, citing agrotechnical activities and agroclimatic factor and plant growth habits as attributes to explain such spatial pattern. In this study variabilities in the spatial pattern of distribution of different weed species can be attributed to inherent variations in their, growth habits, fecundity schedules, cropping patterns and agronomic practices prevailing in the areas of survey. For example, in the oil palm, rubber and fruit orchards, the inter-rows were covered by leguminous crops, thereby preventing or arresting proliferation of weeds even in the absence of formal weed control programme. Nature abhors vacuum[21]. In oil palm, rubber and fruit orchards, weeds proliferate in inter-rows where leguminous cover crops failed to establish. In vegetable plots, weed control operations are normally done as pre-crop or pre-planting routines eradicating weeds above ground leaving soil seed bank relatively untouched or intact. The short-lived effect of chemical control programme practised on arable



1. *A. conyzoides* 2. *A. gracilis* 3. *A. intrusa* 4. *B. latifolia* 5. *B. latifolia* 6. *B. repens* 7. *S. nigrum* 8. *C. rutidosperma* 9. *C. hirtus* 10. *c. sphacelatus* 11. *C. flavidus* 12. *C. rotundus* 13. *D. adscendens* 14. *D. violascens* 15. *D. villosa* 16. *E. prostrata* 17. *E. colonum* 18. *E. indica* 19. *E. sonchifolia* 20. *E. tenella* 21. *E. hirta* 22. *F. acuminata* 23. *F. dichotoma* 24. *F. globulosa* 25. *P. foetida* 26. *H. corymbosa* 27. *I. cylindrica* 28. *I. triloba* 29. *I. muticum* 30. *L. crustacea* 31. *L. chinensis* 32. *L. hyssopifolia* 33. *L. perennis* 34. *M. affine* 35. *M. micrantha* 36. *M. pudica* 37. *M. villosus* 38. *M. nudiflora* 39. *N. bisserrata* 40. *P. repens* 41. *P. commersonii* 42. *P. conjugatum* 43. *P. debilis* 44. *P. urinaria* 45.*P. anguiata* 46. *S. palustes* 47. *U. lagopodioides* 48. *V. cinerea*

Fig. 4. Lloyd's Mean crowding(m^*) versus density values (m) for each individual species of arable peat of Selangor, Malaysia. X=Iwao lines, (1968).[9]

peat in Selangor, apparently, allows the weeds to emerge, proliferate and establish.

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摘 要

말레이지아 Selangor地域의 부식질 耕地土壤에 分布하고 있는 耕地의 雜草植生을 조사하고 정량적 생태분석을 수행한 결과는 다음과 같이 要約된다.

1. 이 地域 耕地雜草의 種組成은 19科에 속하는 31種의 廣葉雜草, 10種의 禾本科 雜草, 7種의 莎草科 雜草로 이루어졌고, 雜草의 植生被度에서 각각 77, 8, 15%를 점유하였으며, 이들의 重要度는 각각 71, 11, 18%이었다.
2. 이 地域 耕地雜草중 10種의 優點種은 優點度順位에서 *Fimbristylis acuminata*, *Murdannia nudiflora*, *Hedyotis corymbosa*, *Ageratum conyzoides*, *Asystasia gangetica*, *Cleome rutidosperma*, *Cyperus sphacelatus*, *Lindernia crutacea*, *Ludwigia hyssopiflora* 및 *Ludwigia perennis*이었다.
3. 이 地域 耕地雜草들은 分散/平均比, Lloyd의 平均群集度, Lloyd의 集中性 分析을 한 결과 草種別로 매우 다양한 空間分布를 나타내었다.
4. 이상과 같은 草種間 優點度 및 空間分布類型의 差異는 각 草種 本來의 種子生産性 및 繁殖習性과 群集性의 差異와 이 地域 耕地의 作物種類, 作付體系 및 耕種方法과 除草慣行의 差異에 기인하는 것으로 생각한다.

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