

熱帯泥炭湿地の植物社会学的研究: 2. マレーシア・ムア地区の植生区分

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Kunio SUZUKI* : Phytosociological Studies on Tropical Peat Swamps 2. Vegetation at Muar, Malaysia

鈴木邦雄* : 熱帯泥炭湿地の植物社会学的研究
2. マレーシア・ムア地区の植生区分

Abstract

There has not been many research with regards to vegetation in the peat swamp areas of Southeast Asia. In Peninsula Malaysia, natural or original peat swamp area can be found within only limited areas. But the area of the natural swamp is decreasing every year due to burning and draining. The phytosociological investigation on the vegetation of the peat swamp areas at Muar, Malaysia was conducted in accordance with the concepts and methods of Zürich-Montpellier school. As a result, it is possible to establish 12 communities and the relationships between the natural and substitutional vegetation, which are being covered by peat/acid sulfate soils.

Key Words: Peat swamp—Phytosociology—Tropics—Vegetation

In the Southeast Asian coastal areas along Peninsula Malaysia, are vast areas of swamps composed of peat soil. This type of soil has been formed under the influence of sea and brackish waters. Now, the natural peat swamp forest and many types of the secondary vegetation are decreasing every year due to burning and draining.

It is a common practice in Peninsula Malaysia that all good land are allocated for export orientated crops such as rubber and oil palm. However with the increase in domestic demand for food as a result of very rapid population growth, more land are needed for crop cultivation. A multitude of limitations and problems are waterlogging conditions, high water table, low inherent nutrient status including low nutrients, high acidic conditions, poor conditions for mechanization and irreversible shrinkage if excessively drained. The peat soil areas have therefore been earmarked for improvement and agricultural development.

Vegetation of the peat swamps in the southern part of Peninsula Malaysia, had been little studied with phytosociological approach. Details of the plant communities and their dynamics in peat/acid-sulfate soil areas is therefore not very clear.

I had the opportunity to study the vegetation dynamics of the peat swamp area at Muar and the neighborhood, Malaysia on August of 1988 and 1989.

This paper is the second in a series of reports dealing with the vegetation on the tropical peat swamps. The first articles in this series described the tropical swamp vegetation at Narathiwat, Thailand (SUZUKI and NIYOMDHAM, 1992). The purpose of the present paper is to describe and classify the vegetation in the peat swamps in Peninsula Malaysia. The relationships between the community units and the human impact are discussed.

Outline of peat in Malaysia

In Malaysia, there are approximately 2.4 million hectares of peat soil although it is somewhat termed loosely as it includes organic clays and muck (ANDERSON, 1964). Of these, 813, 000 hectares are Peninsula Malaysia comprising approximately 6 per cent of the total land area.

The peat of the tropical zone consists mainly of sediments from an abundance of woody material remains such as roots, branches, and tree trunks; whereas the peat of the temperate and arctic zones are of the herbal type. Moreover, original or natural vegetation of peat swamp of the Asian

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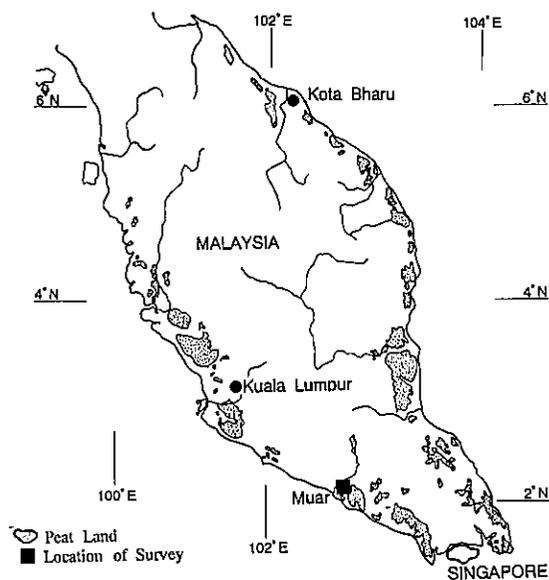


Fig. 1. Map showing the location of the survey area.

tropics is of the forest-type, while that of the temperature zones or arctic zones is of the grassland type. Owing to the adverse chemical and physical properties, tropical peat is a very poor soil materials for crop growth. The high acidity and low nutrient content make it unsuitable for agriculture unless supplements of lime and fertilizers are applied. Peat soils in the tropical, temperature, and arctic zones are all classified into the soil unit, "Histosols (organic soils)", by the Soil Taxonomy of the USDA and FAO/UNESCO (DRIESSEN, 1978; KYUMA *et al.*, 1992).

Outline of the study areas

The study site, Kanjung Kenangan is about 12 km east to Muar town, which is located in the southern part of Peninsula Malaysia. The other study site, Hutan Simpan Air Hitan Utara (North Air Hitan Forest Reserves) is about 24.5 km east to Muar town. The Muar area, facing the Andaman Sea, belongs to the Johor Province. The climate of the area is "Af (climate of tropical rain forest without distinct dry season)" according to Koppen's classification. Peat swampy conditions at Muar can be found behind the sand dunes along the 10-40km NW to SE coastlines of Malacca-Johor. These wetlands have depths of 1-5 meters and characterized by peat soil. The organic materials do not experience decomposition because of long-terms flooding.

Most of vegetation of the peat swamps at Muar, are secondary vegetation such as *Melaleuca*-forest, *Scleria*-grassland, etc. Prior to 1970s, some of the natural peat swamp forest at Muar were remained undeveloped due to permanent water-logging, dense forest and inaccessibility. Now, most of the actual forest at Muar were not natural forests, because they were selectively cutted about 40-50 years ago.

One of the characteristics of land use in the study site is wide spread of agricultural areas including paddy fields, oil palm plantation, rubber-plantation, crop fields, or orchards.

Methods

The field study was carried out according to the BRAUN-BLANQUET approach (BRAUN-BLANQUET, 1964; MIYAWAKI and SUZUKI, 1980). A total of 42 releves were collected from the peat swampy vegetation stands, which appeared floristically and structurally to be homogeneous. All types of vegetation, from natural to substitutional and from herbaceous to forest vegetation, were investigated by the field survey.

It was determined that each and every stand selected for the survey had to have an area extending over the minimum survey space in habitat which showed homogeneous physiognomy, and therefore, could be judged evenly. All the species within the stand were checked to make a complete taxon or species list by layer. Multi-structural communities such as the *Shorea* forest vegetation (tall forest vegetation) were constructed of tree layer-1, tree layer-2, shrub layer, and herb layer.

Each individual taxon or species must be estimated for its appropriate cover degree. Another quantitative estimate per taxon is its sociability rating. Under sociability is meant the grouping or touching of individuals of the same species or taxon, the clumping or clustering of that one species within the confines of the sampled area. The cover degree-abundance scale and the sociability scale follows BRAUN-BLANQUET in 1964 and MIYAWAKI and SUZUKI in 1980. Simultaneously, assessments of habitat conditions, human impact, micro-topography, soil conditions etc. were made.

The data of releves which collected in the field,

were put together into raw tables, summary tables, etc. From the integrated summary table, the species recognized as characterizing or differential species were arranged. Finally, the vegetation were classified into communities, considering all the data available.

Result

Plant communities (phytosociological classification)

Forest Vegetation

1. *Tetramerista glabra*-*Gluta renghas*-community (Table 1)

In Peninsula Malaysia, the area of the primitive untouched or natural peat swamp forests are restricted to a few point such as Hutan Simpan Air Hitan Utara and the neighboring. In this research, the primitive untouched or natural peat swamp forests were collected from 2 stations at Hutan Simpan Air Hitan Utara/Muar, and summarized into the *Tetramerista glabra*-*Gluta renghas*-community. The *Tetramerista glabra*-*Gluta renghas*-community is composed of four layers; a) a tree layer-1 having a height of 35-38 meters and a cover of 50-60 per cent, b) a tree layer-2 having a height of 20-22 meters and a cover of 50 per cent, c) a shrub layer having a height of 5-8 meters and a cover of 50 per cent, and d) a herb layer having a height of 0.8 meter and a cover of 20-25 per cent.

Most of the component species are tree species and palms. Some tall tree species have still-roots, buttresses and pneumatophores. Still-roots, buttresses and pneumatophores are very characteristic features of the swamp forest formation. *Calophyllum flavo-ramulum* (Guttiferae), *Canarium pseudodecumanum* (Burseraceae), *Shorea leprosula* (Dipterocarpaceae) and some *Eugenia* species are common tall trees with buttresses and pneumatophores.

The tree layer-1 is dominated by *Gluta renghas* (Anacardiaceae), *Shorea thiseltonii* (Dipterocarpaceae), *Canarium pseudodecumanum*, *Shorea leprosula* and Sapotaceae species. The tree layer-2 is dominated by *Tetramerista glabra* (Tetrameristaceae), *Eugenia kelata* (Myrtaceae), *Eugenia grandis*, *Litsea castanea* (Lauraceae), *Elateriospermum tapos* (Euphorbiaceae), *Calophyllum flavo-ramulum*, *Dacryodes rigosa* (Burseraceae), *Shorea leprosula*, *Polyalthia lateriflora* (Annonaceae) and

Melanochyla species (Anacardiaceae).

On the shrub layer, *Eugenia goniocalyx* (Myrtaceae), *E. claviflora*, *Knema patentinervia* (Sapindaceae), *Carallia brachiata* (Rhizophoraceae), *Stemonurus malaccensis* (Icaciniaceae), *Medinilla crassinervia* (Melastomataceae), *Campnosperma acuminata* (Anacardiaceae), *Alphonsea johereensis* (Anacardiaceae), *Calophyllum* species (Guttiferae), climber; *Freycinetia angustifolia* (Pandanaeae), and Palm (Palmae); *Cytostachys lacca* are abundant. The herb layer is dominated by *Agonema longifolia*, climber; *Piper caninum* (Piperaceae), *Clidemia hirta* (Melastomataceae), *Uncaria elliptica* (Rubiaceae), *Hanguana malayana* (Flagellariaceae), *Freycinetia angustifolia*, fern; *Taenitis blechnoides* (Taenitidaceae), *Piper porphyrophyllum* (Piperaceae), *Memecylon coeruleum* (Melastomataceae) and Melastomataceae species. Component species of the herb layer are comparatively poor except seedlings of tree species.

The structure and physiognomy of the community is similar to that seen in the lowland dipterocarp evergreen rain forest occurring on mineral soils (NIYOMDHAM, 1986). The pH value of the peat swamps at Hutan Simpan Air Hitan Utara, Muar, Malaysia is found to be 3.8-4.2: and depth of the organic peat layer is 3-10 meters.

2. *Shorea thiseltonii*-*Xerospermum intermedium*-community (Table 2)

In this research, the phytosociological data of the tall tree forest was collected at Kanjung Kenangan, Muar and summarized into the *Shorea thiseltonii*-*Xerospermum intermedium*-community. This community is composed of a) a tree layer-1 having heights of 25 meters and maximum height of 28 meters; b) a tree layer-2 having heights of about 18 meters; c) a shrub layer with heights of 2-7 meters; and d) a herb layer of poor biological characteristics. The total number of species in the *Shorea thiseltonii*-*Xerospermum intermedium*-community is 41 based on the surveyed area. The surveyed area is ca. 1,000 square meters. Most of the species are tree species, having still roots, buttresses and pneumatophores. The component species of tree layers are *Xerospermum intermedium* (Sapindaceae), *Palaquim obovatum* (Sapindaceae), *Shorea thiseltonii*, *Fagraea crenulata* (Loganiaceae), *Macaranga*

Table 1. Tetramerista glabra-Gluta renghas-community.

No. of releve:	1	2
Field no.:	P1	Q1
Area of releve (qm):	8000	4800
Height of tree layer-1 (m):	35	38
Cover of tree layer-1 (%):	60	60
Height of tree layer-2 (m):	20	18
Cover of tree layer-2 (%):	20	30
Height of shrub layer (m):	6	6
Cover of shrub layer (%):	50	40
Height of herb layer (m):	0.8	1.2
Cover of herb layer (%):	15	20
Total no. of species:	102	113
<i>Eugenia gonicalyx</i> (Myrtaceae)	S	2.2 +
<i>Dacryodes rostrata</i> (Burseraceae)	S	1.2 1.2
Anacardiaceae sp. 1	S	+ +
<i>Piper caminum</i> Bl. (Piperaceae)	S	+ +
	H	+2 1.2
<i>Clidemia hirta</i> Don. (Melastomataceae)	H	+ +
<i>Uncaria elliptica</i> Hook. f. Th. (Rubiaceae)	H	+2 +
<i>Carallia brachiata</i> (Rhizophoraceae)	S	1.2 +2
	H	. +
<i>Hanguana malayana</i> (Jack.) Marr. (Flagellariaceae)	H	2.3 2.2
<i>Pandanus</i> sp. (Pandanaceae)-MENG-KUANG	T2	1.2 .
	S	2.2 2.2
	H	+2 +
<i>Stemonurus malaccensis</i> Sleumer (Icacinaeae)	T2	1.1 .
	S	+ +
<i>Ardisia</i> sp. (Myrsinaceae)	S	2.2 1.2
	H	1.2 .
<i>Eugenia claviflora</i> Roxb. (Myrtaceae)	S	+ 1.2
	H	+ +
<i>Macaranga</i> sp. 1 (Euphorbiaceae)	S	+ +
<i>Porterandia anisophylla</i> Ridl. (Rubiaceae)	S	1.2 1.2
<i>Calophyllum</i> sp. (Guttiferae)	S	+ +
<i>Freycinetia angustifolia</i> Bl. (Pandanaceae)	T2	. 1.2
	S	1.2 +2
	H	1.2 +2
<i>Calophyllum flavo-ramulum</i> Hend. (Guttiferae)	T2	. 1.2
	S	+ +
<i>Taenitis blechnoides</i> (Willd.) Sw. (Taenitidaceae)	H	1.2 1.2
<i>Liana</i> specimen PO13	T2	+ .
	S	+ +
<i>Memecylon coeruleum</i> Jack. (Melastomataceae)	S	+ +
<i>Nepenthes</i> sp. (Nepenthaceae)	S	+ +
	H	+2 .
<i>Timonius flavescens</i> Baker (Rubiaceae)	T2	1.1 .
	S	1.2 +
<i>Calophyllum rubiginosum</i> (Guttiferae)	S	2.3 +
<i>Piper porphyrophyllum</i> (Piperaceae)	H	+ +
<i>Cnestis palala</i> Merr (Connaraceae)	T2	+ .
	S	+ +
<i>Amischotolype griffithii</i> (Larke) Hassk. (Commelinaceae)	H	2.2 1.2
	S	+ +2
<i>Melastomataceae</i> sp.	S	2.2 1.1
<i>Zalacca</i> sp. (Palmae)	H	. +
<i>Tetramerista glabra</i> Miq. (Tetrameritaceae)	T2	1.1 1.1
<i>Tetrastigma lanceolarium</i> Planch. (Vitaceae)	H	+ +
<i>Camposperma acuminata</i> (Anacardiaceae)	S	+ +
<i>Alphonsea johorensis</i> (Annonaceae)	S	+ +
<i>Eugenia linoceroidea</i> (Myrtaceae)	S	+ +
<i>Cytostachys lacca</i> Becc. (Palmae)	T2	1.1 .
	S	1.2 1.2
<i>Knema patentinervia</i> (Sapindaceae)	T2	1.1 .
	S	+ +
<i>Medinilla crassinervia</i> (Melastomataceae)	S	+ +
<i>Indigofera griffithiana</i> (Papilionaceae)	S	2.2 2.2
<i>Aglaonema longifolia</i> (Araceae)	H	1.2 1.2
<i>Eugenia rugosa</i> (Myrtaceae)	S	2.2 .
<i>Gluta renghas</i> L. (Anacardiaceae) -RENGAS	T1	2.2 2.2
	T2	. 1.1
<i>Eugenia</i> sp. 1 (Myrtaceae)	T2	2.2 1.1
<i>Polyalthia lateriflora</i> King (Annonaceae)	T2	+ .
	S	+ +

Sapotaceae sp. -NYTHOH	T1	1.2	1.1
	T2	1.1	1.1
<i>Canarium pseudodecumanum</i> (Burseraceae)	T1	1.1 .	
	T2	. 2.2	
	S	+2 .	
<i>Shorea leprosula</i> (Dipterocarpaceae)	T1	2.2 .	
	T2	1.1 .	
	S	+ +	
<i>Diospyros siamensis</i> Hochr. (Ebenaceae)	T1	1.1 .	
	S	+ +	
Specimen WO11 -NATOH	T2	1.1 1.1	
Specimen -PEREIKAN 1	T2	1.1 1.1	
Specimen -PEREIKAN 2	T1	1.2 2.2	
Specimen -PEREIKAN 2	T1	1.2 2.2	
	T2	1.1 2.3	
<i>Tristania whitiana</i> Griff. (Myrtaceae)	T2	+ .	
	S	+ +	
<i>Dacryodes rogosa</i> Bl. (Gurseraceae)	T2	. 2.2	
	H	+ .	

Species with presence 1 P1: Specimen WO23-TARENTANG T2-+2, Elateriospermum tapos Bl. (Euphorbiaceae) T2-1.1, Specimen-KELA T3 T1-1.1, Eugenia sp. 2 (Myrtaceae) T2-1.2, Specimen W001-MEMPENING T1-1.1, Tree specimen W021 T2-1.2, Tree specimen W022 T1-1.1, Tree specimen P041 T2-1.1, S-+, Scindapsus hederaceus Schott (Araceae) S-+, H-+2, Specimen-PENAREHN T2-+, Evodia roxborghiana Benth. (Rutaceae) S-+2, Gluta sp. (Anacardiaceae) T2-+, Elaecarpus sp. (Elaeocarpaceae) T2-+, Specimen)JANG KANG PAYA T2-+, Specimen W024-BITIS T2-+, Ppecimun W009 T2-+, Guttiferae sp. T2-+, Canarium sp. 1 (Burseraceae) S-+, Tree specimen P001 S-+, Planchonellasp. 1 (Sapotaceae) S-+, Urophyllum sp. (Rubiaceae) S-+, Eugenia sp. 3 (Myrtaceae) S-+, Eugenia milsi (Myrtaceae) S-+, Eugenia spicata Lam. (Myrtaceae) S-+, Mangifera sp. (Anacardiaceae) S-+, Planchonella sp. 2 (Sapotaceae) T2-+, S-+, Cyperus sp. (Cyperaceae) H-+, Knema intermedia Warb. (Sapindaceae) T2-+, Pomelia pinnata Forst. (Sapinaeae) S-+, Nephelium lappaceum (Sapindaceae) S-+, Vitis vinifera L. (Vitaceae) H-+, Schefflera sp. 1 (Araliaceae) H-+, Antidesma cuspidatum (Stilaginaceae) H-+, Cissus trifolia (Vitaceae) H-+, Ficus sp. (Moraceae) S-+, Eugenia sp. 4 (Myrtaceae) S-+, Sindora echinocalyx (Leguminosae) S-+, Antidesma tomentosa Prierra (Stilaginaceae) S-+, Garcinia hombronia (Guttiferae), S-+, Euodis sp. (Rutaceae). S-+, Kopsia singapurensis (Apocynaceae) S-+, Eugenia chlorantha (Myrtaceae) S-+, Alstonia macrophylla Wall. (Apocynaceae) S-+, Diospyros venosa (Ebenaceae) S-+, Calophyllum costatum (Guttiferae), S-+, Zizyphus sp. (Rhamnaceae) S-+, Shorea rugosa Heim (Dipterocarpaceae) S-+, Tree specimen P049 S-+, Dacryodes rubiginosa (Burseraceae) S-+, Stenochlaena palustris Bedd. (Pteridaceae) H-+, Q1: Eugenia kelata Hook. f. Thoms. (Myrtaceae) T2-1.2, Xanthophyllum sp. (Polygalaceae) T2-1.1, Melanochyla sp. (Anacardiaceae)-LENGAS T2-1.1, Specimen W015 -PENAREHN T2-1.1, Shorea thiseltonii (Dipterocarpaceae) T1-2.2, T2-1.1, Specimen-KELAT T2-2.2, Specimen P066-KASEI DAUNKECIL T2-1.2, Specimen W025 T1-2.2, Specimen-KAYU ARABG T1-1.2, T2-2.2, Terminalia cebula (Combretaceae) T2-1.1, Blumeodendron kurzii T1-1.1, Palaquium obovatum T2-1.1, Specimen -RANGAS T1-1.2, Specimen-NATOH T1-1.1, Specimen -PENARAHN T1-1.1, S-+, Specimen -KELAT4 T2-1.1, Eugenia grandis Wight (Myrtaceae) T2-1.1, S-+, Gymnacrahera farquhariana (Myrtaceae) S-+, 2, Litsea castanea Hook. f. (Lauraceae) T2-1.1, S-+, H-+, Cayratia mollissime (Vitaceae) T-+2, Polyalthia hypoleuca (Annonaceae) T2-1.1, S-+, Macaranga polyneura (Euphorbiaceae) S-+, Macaranga sp. 2 (Euphorbiaceae) S-+, Macaranga sp. 3 (Euphorbiaceae) S-+, Melastoma malabathricum L. (Melastomataceae) S-+, Lygodium microphyllum R. Br. (Schizaeaceae) H-+, Santiria rubiginosa Bl. (Burseraceae) S-+, Lindsaea oblanceolata v. A. V. R. (Lindsaeaceae) H-+, Cibotium barometz (L.) J. Sm. (Cyatheaceae) S-+, Dillenia albiflos (Dilleniaceae) S-+, Litsea sp. 1 (Lauraceae) S-+, Ardisia pumila (Bl.) Mez. (Myrsinaceae) H-+, Brackenridge hookeri Gray (Ochnaceae) S-+, Piper hancei (Piperaceae) S-+, Liana specimen Q005 S-+, Rubiaceae sp. H-+, Hoya sp. (Asclepiadaceae) H-+, Artocarpus maingayi Hook. f. (Moraceae) S-+, Camposperma squamata Rydl. (Anacardiaceae) S-+, Canarium patentinervium (Burseraceae) S-+, Asplenium nidus L. (Aspleneaceae) S-+, Elaecarpus floribundus Bl. (Elaeocarpaceae) S-+, Eugenia sp. 5 (Myrtaceae) S-+, Eugenia scortechinii King (Myrtaceae) S-+, Desmos sp. (Annonaceae) S-+, Litsea sp. 2 (Lauraceae) S-+, Hoya diversifolia Bl. (Asclepiadaceae) S-+, Palmae sp. S-+, Xylophia ferruginea Hk. f. & Th. (Annonaceae) S-+, Decaspermum fruticosum Forst (Myrtaceae) S-+, Anacardiaceae sp. 2 S-+, Cissus rostrata (Vitaceae) S-+, Nephrolepis acutifolia (Desv.) Christ (Nephrolepidaceae) H-+, Vitis sp. 2 H-+, Tetracera scandens Merr. (Dilleniaceae) S-+, Schefflera sp. 2 (Araliaceae) S-+, Liana specimen Q016 S-+, Tree specimen Q017 S-+, Eugenia attenuata (Miq.) Koord. & Val. (Myrtaceae) S-+, Lauraceae sp. S-+, Hedytotis sp. (Rubiaceae) S-+, Ardisia colorata Roxb. (Myrsinaceae) S-+.

Location & date: Kampung Kenangan/Muar, Malaysia at 13, August 1989.

Table 2. *Shorea thiseltonii*-*Xerospermum intermedium*-community.

No. of releve : MU-13, Area : 800qm, Total no. of species : 41 Height and cover of vegetation : Tree-layer-1 28m/50%, Tree layer-2 18m/30%, Shrub layer 7m/60%, Herb layer 1m/10%			
<i>Palaquium obovatum</i> Engl. (Sapindaceae)	T1	3.3	
-Nyatoh	H	+	
<i>Xerospermum intermedium</i> Radlk. (Sapindaceae)-Rambutan Hutan	T1	3.2	
<i>Macaranga pruinosa</i> (Miq.) M.A. (Euphorbiaceae) -Mahang	T1	2.2	
	S	+	
<i>Cratoxylon arborescens</i> (Vahl.) Bl. (Guttiferae) -Geronggang	T1	2.2	
	T2	+	
	S	+	
Lauraceae sp. -Medang	T1	1.2	
<i>Shorea thiseltonii</i> (Dipterocarpaceae) -Meranti Bakau	T1	1.1	
Anacardiaceae sp. -Terentang Simpoh	T1	1.1	
Dipterocarpaceae sp. 1 -Meranti	T1	1.1	
	S	+	
<i>Camposperma acuminata</i> (Anacardiaceae) -Terentang	T1	+	
<i>Adenanthera sp. 1</i> (Leguminosae)-Saga	T2	2.3	
<i>Eugenia acuminatissima</i> Kurz. (Myrtaceae) -Kelat Jambu	T2	2.3	
	S	2.2	
<i>Fagraea crenulata</i> Maing. ex Clarke (Potaliaceae) -Malabera	T2	2.2	
	S	1.2	
<i>Eugenia sp. 1</i> (Myrtaceae) -Kelat	T2	1.1	
	S	2.2	
<i>Gonystylus bancanus</i> Miq. (Theaceae)-Ramin melawis	T2	1.1	
<i>Tetramerista glabra</i> Miq. (Tetrameristaceae)	T2	1.1	
<i>Eugenia sp. 2</i> (Myrtaceae) -Kelat	T2	+	
<i>Palaquim sp. 2</i> (Sapindaceae) -Nyatoh	T2	+	
Myristicaceae sp. -Penarahan	T2	+	
<i>Shorea rugosa</i> Heim. var. <i>uliginosa</i> Foxw. (Dipterocarpaceae)	T2	+	
Anacardiaceae sp. 2	T2	+	
	S	+	
<i>Piper caninum</i> Bl. (Piperaceae) -Sireh Hutan	S	2.3	
<i>Artocarpus maingayi</i> Hook. f. (Moraceae) -Cempedak air	S	2.2	
Burseraceae sp. -Kedondon	S	2.2	
<i>Cyrtostachys renda</i> Bl. (Palmae)	S	1.2	
<i>Ixonanthes reticulata</i> Jack (Lenaceae)-Inggir burung	S	1.2	
Palmae sp. -Rotan Jelayan	S	1.2	
<i>Pandanus sp.</i> (Pandanaceae) -Pinang Raja, Red Palm	S	1.2	
Lauraceae sp. -Medang	S	1.2	
<i>Daemonoropus sp.</i> (Palmae)-Rotan	S	+2	
<i>Freycinetia angustifolia</i> Bl. (Pandanaceae)	S	+2	
	H	+2	
<i>Gynotroches axillaris</i> Bl. (Rhizophoraceae) -Mata keli	S	+	
<i>Pternandra sp.</i> (Melastomataceae) -Sial Menawan	S	+	
Dilleniaceae sp. -Mempelas	S	+	
Calophyllum sp. (Guttiferae)-Bintangor	S	+	
Bombacaceae sp. -Burian hutan	S	+	
<i>Aglaia griffithii</i> Kurz (Meliaceae)	S	+	
<i>Elaeocarpus nitidus</i> (Elaeocarpaceae) -Medang kelawar	S	+	
<i>Alstonia spatulata</i> Bl. (Apocynaceae)-Pulai Basung	S	+	
<i>Scirpodendron costatum</i> -Selinsing	H	2.3	
<i>Stenochlaena palustris</i> Bedd. (Pteridaceae)	H	+2	
<i>Polyalthia longifolia</i> (Sunrat.) Thw. (Annonaceae)-Mempisang	H	+	

Location & data : Kampung Kenangan/Muar, Malaysia at 12. August 1988.

pruinosa (Euphorbiaceae), *Eugenia acuminatissima*, etc. In the peat basin, the species variation are low compared to the attuvium Diptercarp natural forest. This actual tall tree forest at Kanjung Kenangan, is not a natural forest in rigid meaning and has been receiving the influence of human activities. The selected cutting of the tall tree forest in the peat swamp area was carried out about 40-50 years ago.

The shrub layers, meanwhile, consist of *Piper*

Table 3. *Macaranga pruinosa*-community.

Releve number :	1	2	3
Field no. :	S	T	U
Area od releve (qm) :	225	150	150
Height of tree layer (m) :	11	12	11
Cover of tree layer (%) :	90	90	90
Height of shrub layer (m) :	4	5	5
Cover of shrub layer (%) :	20	20	10
Height of herb layer (m) :	1.2	1	1
Cover of herb layer (%) :	90	80	90
Total no. of species :	9	11	11
<i>Differential species :</i>			
<i>Macaranga pruinosa</i> (Miq.) M.A. (Euphorbiaceae)	T	5.5	5.5
	S	2.2	2.2
	H	+2	.
<i>Stenochlaena palustris</i> Bedd. (Pteridaceae)	S	1.2	1.2
	H	3.3	3.4
<i>Evodia roxburghiana</i> Benth. (Rutaceae)	S	1.2	+
<i>Melaleuca cajuputi</i> Powell (Myrtaceae)	S	+	1.2
<i>Camposperma species</i> (Anacardiaceae)	S	+	.
<i>Mallotus sp.</i> (Euphorbiaceae)	S	+	.
<i>Mikania micrantha</i> H.B.K. (Compositae)	H	+2	2.2
<i>Scleria sumatrensis</i> Retz. (Cyperaceae)	H	2.3	1.2
<i>Blechnum serratum</i> A. Rich. (Blechnaceae)	H	+2	+
<i>Vitex pinnata</i>	S	.	+
Species S-1 ↓ Hort. (Oleandraceae)	S	.	+
<i>Nephorolepis biserrata</i> Schott var. <i>furcans</i>	H	.	1.2
<i>Cissus repens</i> Lamk. (Vitaceae)	H	.	+
<i>Lygodium microphyllum</i> R.Br. (Schizaeaceae)	H	.	+
Species S-2	S	.	+
<i>Ischaemum tomentosa</i> (Gramineae)	H	.	+2

Loc. & date : Kampung Kenangan/Muar, Malaysia at 15. August 1989.

caninum, *Artocarpus maingayi* (Moraceae), *Shorea rugosa* var. *uliginosa* (Dipterocarpaceae), *Tetramerista globra*, *Gonystylus bancanus* (Theaceae), *Ixonanthes reticulata*, *Pandanus sp.* (Pandanaceae), and palms such as *Cyrtostachys renda* (Sealing wax palm), *Daemonoropus sp.* and Rotan Jelayan. The herb layer is mainly composed of *Scirpodendron costatum*, *Polyalthia longifolia*, the climbing fern; *Stenochlaena palustris* (Pteridaceae).

3. *Macaranga pruinosa*-community (Table 3)

Secondary forests in the coastal wetland (peat/acid-sulfate soils) at Muar are consisted of *Macaranga pruinosa*-forest, *Alstonia angustifolia*-forest and *Melaleuca cajuputi*-forest. The *Macaranga pruinosa*-community is dominated by *Macaranga pruinosa* of about 10-20 meters in height. The phytosociological data of the community were collected from 3 stations at Kanjung Kenangan, Muar. Dominant species of the community are *Macaranga pruinosa*, *Mallotus sp.* (Euphorbiaceae), *Evodia roxburghiana*, *Stenochlaena palustris*, *Scleria sumatrensis*, etc. The habitat of the community, which is the same as that of the

Table 4. *Alstonia angustifolia*-*Melaleuca cajuputi*-community.

No. of releve:	1	2	3	4	5	6	
Field no. (MU-):	27	28	29	30	31	32	
Area of releve (m ²):	150	200	200	150	150	200	
Height of tree layer (m):	11	12	10	12	11	12	
Cover of tree layer (%):	60	40	30	60	80	85	
Height of shrub layer (m):	6	7	5	4	6	5	
Cover of shrub layer (%):	50	30	60	50	40	30	
Height of herb layer (m):	1	1	1	1	1	1	
Cover of herb layer (%):	40	30	30	40	15	5	
Total no. of species:	16	17	17	22	17	12	
<i>Melaleuca cajuputi</i> Powell (Myrtaceae)	T	4.4	3.3	3.3	4.4	3.3	2.3
	S	.	2.2	.	.	.	.
	H	.	+	.	.	.	.
<i>Alstonia angustifolia</i> Wall. (Apocynaceae)	T	1.2	2.2	.	.	3.4	4.3
-Rengas	S	1.2	2.2	+2	1.2	2.2	+
<i>Ixonanthes reticulata</i> Jack. (Linaceae)	S	1.2	+	+	+	2.2	1.2
-Inggir Burung	H	+2	.	.	.	.	+
<i>Scleria sumatrensis</i> Retz. (Cyperaceae)	H	2.2	2.3	2.2	2.2	+	+2
<i>Elaeocarpus friffithii</i> (Elaeocarpaceae)	S	1.2	1.2	+2	+	+2	.
-Kelat							
<i>Stenochlaena palustris</i> Bedd. (Pteridaceae)	H	1.2	1.2	+	3.3	1.2	.
<i>Nepenthes</i> sp. (Nepenthaceae)	T	+2	.	.	+	.	.
	H	+2	2.2	1.2	1.2	.	+
<i>Canthium confertum</i> Korth. (Rubiaceae)	S	.	+	+	2.2	1.2	1.2
-Hampas Tebu	H	.	.	.	.	+	.
<i>Lygodium microphyllum</i> R. Br. (Schizaeaceae)	S	.	+2	+	3.3	+	.
	H	3.3	.	1.2	.	.	.
<i>Elaeocarpus mastersii</i> King. (Elaeocarpaceae) -Merangsi	S	.	.	1.2	1.2	+	+
<i>Eugenia papillosa</i> (Myrtaceae) -Kalat Paya	T	+	1.1	.	1.1	.	.
	S	.	+	.	+	+	.
Rubiaceae sp.	S	+2	+	.	.	.	.
	H	.	+	+2	+	.	.
<i>Gynotroches axillaris</i> Bl. (Rhizophoraceae)	S	1.2	+	.	+	+	.
-Mata Keli	H	.	.	.	+2	.	.
<i>Mussaenda parviflora</i> Miq. (Rubiaceae)	S,H	2.3	.	+	1.2	.	.
<i>Hedyotis congesta</i> Wall. (Rubiaceae)	H	.	.	+	+	+	.
<i>Tetramerista glabra</i> Miq. (Theaceae)	S	2.2	+2	.	.	.	.
-Punah							
<i>Melastoma</i> sp. (Melastomataceae)	S	+2	.	1.2	.	.	.
<i>Palaquium</i> sp. (Sapotaceae)-Nyatoh	S	.	+	+2	.	.	.
	H	.	+	.	.	.	.
<i>Uncaria</i> sp. (Rubiaceae)-Kait-Kait	S,H	.	+	.	+	.	.
<i>Calophyllum</i> sp. (Guttiferae)-Bintangor	S	.	.	1.2	1.2	.	.
<i>Eugenia</i> sp. 2 (Myrtaceae)	S	.	.	+	+	.	.
<i>Prismatomeris subsessillis</i> K. & G. (Rubiaceae)	H	.	.	.	+	+	.
<i>Embelia scortechinii</i> K. & G. (Myrsinaceae)	H	.	.	.	+	+	.

Species with presence 1 no. 1: Specimen -P1 T-1.1, *Macaranga pruinosa* (Miq.) M.A. (Euphorbiaceae) H-+, no. 2: *Eugenia* sp. (Myrtaceae)-Kalat Daun Tebal S-+, Specimen -P2 S-+, no. 4: *Indorauchera griffithiana* (Planch) H. Call. (Linaceae), S-+, no. 5: *Melastomataceae* sp. H-+, *Blechnum serratum* A. Rich. (Blechnaceae), H-+, *Hoya* sp. (Asclepiadaceae) H-+2, no. 6: *Sapium baccatum* Roxb. (Euphorbiaceae), -Ludai T-1.1, *Macaranga pruinosa* (Miq.) M.A. (Euphorbiaceae) S-+, *Memecylon* sp. (Memecylaceae) -Nipis Kulit S-+, *Ilex cymosa* Bl. (Aquifoliaceae) S-+.

Location and date: Kanpung Kenangan/Muar, Malaysia at 13. August 1988.

tall tree forests such as the *Tetramerista glabra*-*Gluta renghas* -community, retains rain water all year round and develops "raising bog"

4. *Alstonia angustifolia*-*Melaleuca cajuputi*-community (Table 4).

The organic peat layer is normally thicker than 5 meters. On the other hand, the *Alstonia angustifolia*-*Melaleuca cajuputi*-community in common along the coastal area of tropical Asia where

condition of the soil is poor like after land use for agriculture (shifting cultivation).

The *Alstonia angustifolia*-*Melaleuca cajuputi*-community is dominated by *Melaleuca cajuputi* and *Alstonia angustifolia*. The data of the community were collected from 6 stations at Kanpung Kenangan, Muar. The cover of tree layer ranges 30-85 per cent and the height is about 12 meters. The total number of species ranges from 12 to 22.

The component species of the tree and shrub layers are *Melaleuca cajuputi*, *Ixonanthes reticulata*, *Canthium confertum* (Rubiaceae), *Eugenia papillosa* (Myrtaceae), *Elaeocarpus mastersii* (Elaeocarpaceae), *Gynotroches axillaris* (Rhizophoraceae) and *Nepenthes* species (Ne-

penthaceae). The community can be observed in the peat swampy areas after cutting and burning and also in acid-sulfate soil areas where most of the peat layer have vanished.

Shrub and herb vegetation

5. *Lygodium microphyllum*-*Melastoma malabathricum*-community (Table 5)

The Melastomataceous-shrub, commonly found on the roadside or secondary grasslands of tropical Asia, is also found in the survey area. This shrub which belongs to the *Lygodium microphyllum*-*Melastoma malabathricum*-community is 1.8 meters high and the total number of species is 8. *Melastoma malabathricum* (Melastomataceae), *Lygodium microphyllum* (Schizaeaceae), *Scleria sumatrensis* (Cyperaceae), *Uncaria roxburghiana*, *Ixonanthes reticulata* and *Stenochlaena palustris* are constant. The community grows widely not only on the peat swamps but also on the silica-sandy conditions.

6. *Mazus pumilus*-*Centrosema pubescens*-community (Table 6, releve no. 1-7)

Table 5. *Lygodium microphyllum*-*Melastoma malabathricum*-community.

No. of releve: MU-38, Area: 12 qm, Total no. of species: 8

Shrub layer: heigh 180cm, cover 90%

- 5.5 *Melastoma malabathricum* L. (Melastomataceae)
- 1.2 *Uncaria roxburghiana* Korth. (Rubiaceae)
- 1.2 *Lygodium microphyllum* R.Br. (Schizaeaceae)
- + 2 *Ixonanthes reticulata* (Ixonanthaceae)-Inggir Burung

Herb layer: heigh 80cm, cover 30%

- 3.3 *Scleria sumatrensis* Retz. (Cyperaceae)
- 1.2 *Stenochlaena palustris* Bedd. (Pteridraceae)
- + 2 *Lygodium microphyllum* R.Br. (Schizaeaceae)
- + 2 *Inperata cylindrica* Bea. (Gramineae)
- + Gramineae sp.

Loc. & date: Kanjung Kenangan/Muar, Malaysia at 13. Aug. 1988.

Table 6. Grassland vegetation (1).

1-7: *Mazus pumilus*-*Centrosema pubescens*-community (1-4: Typical sub-comm., 5-7: Sub-comm. of *Cyperus haspan*), 8-10: *Paspalum longifolium*-community, 11: *Imperata cylindrica*-community.

Releve no:	1	2	3	4	5	6	7	8	9	10	11
Field no. (MU-):	10	6	9	11	8	12	7	36	34	35	37
Area of vegetation (qm):	4	4	5	4	4	5	4	6	6	6	6
Heigh of vegetation (cm):	20	40	40	10	30	30	20	100	80	100	120
Cover of vegetation (%):	60	40	60	30	60	40	30	95	90	95	98
Total no. of species:	3	4	5	4	4	5	7	1	2	3	2
<i>Differential species of communities:</i>											
<i>Centrosema pubescens</i> Benth (Leguminosae)	3.3	+2	+	2.3	2.3	+2	+	.	.	.	.
<i>Mazus pumilus</i> v. Steens (Scrophulariaceae)	2.3	2.3	2.2	2.3	.	+	2.2	.	.	.	.
<i>Cyperus haspan</i> L. (Cyperaceae)	.	.	.	.	2.2	1.2	2.2	.	.	.	.
<i>Blechnum serratum</i> A. Rich. (Blechnaceae)	.	.	.	.	.	+	+2	.	.	.	.
<i>Paspalum longifolium</i> Roxb. (Gramineae)	.	1.2	4.4	1.2	3.3	2.2	.	5.5	5.5	5.5	+2
<i>Inperata cylindrica</i> Beauv. (Gramineae)	.	.	.	.	.	.	.	.	.	.	5.5
<i>Other species:</i>											
<i>Macaranga pruinosa</i> (Miq.) M.A. (Euphorbiaceae)	.	.	+	.	+2	.	+	.	.	.	.
<i>Scleria sumatrensis</i> Retz. (Cyperaceae)	.	.	.	.	.	.	+	.	.	+2	.
<i>Mikania cordata</i> Rob. (Compositae)	.	.	.	.	.	.	.	.	+2	+	.
<i>Alocasia</i> sp. (Araceae)	+	.	.	.	.	.	.	.	.	.	.
<i>Borreria setideus</i> Ridl. (Rubiaceae)	.	+	.	.	.	.	.	.	.	.	.
<i>Melastoma</i> sp. (Melastomataceae)	.	.	+	.	.	.	.	.	.	.	.
<i>Ipomea aquatica</i> Forsk. (Convolvulaceae)	.	.	.	+	.	.	.	.	.	.	.
<i>Crassocephalum crepidioides</i> S. Moore (Compositae)	.	.	.	.	.	.	+	.	.	.	.

Location and date: Kanjung Kenangan/Muar, Malaysia at 13-15. August 1988.

Table 8. Grassland vegetation (3).

1-2: *Lygodium microphyllum*-*Mikania cordata*-community.3-5: *Ischaemum longifolium*-*Asystasia coromandeliana*-community.

Releve no :	1	2	3	4	5
Field no. (V-):	1	3	2	4	5
Area of vegetation (qm):	6	8	6	4	4
Heigh of vegetation (cm):	120	150	60	30	50
Cover of vegetation (%):	100	80	95	100	100
Total no. of species:	5	5	2	4	6
<i>Differential species :</i>					
<i>Mikania cordata</i> Rob. (Compositae)	3.3	3.3	.	.	.
<i>Ischaemum timorensis</i> (Gramineae)	+2	+	.	.	.
<i>Lygodium microphyllum</i> R. Br. (Schizaeaceae)	+2	+	.	.	.
<i>Asystasia coromandeliana</i> Nees. (Acanthaceae)	.	.	5.5	5.5	5.5
<i>Ischaemum longifolium</i> (Gramineae)	.	.	.	+	2.2
<i>Other species :</i>					
<i>Stenochlaena palustris</i> Bedd. (Pteridaceae)	1.2	.	+2	+2	2.2
<i>Scleria sumatrensis</i> Retz. (Cyperaceae)	2.2	3.3	.	.	1.2
<i>Nephrolepis biserrata</i> Schott ver. furcans	.	.	.	.	.
Hort. (Oleandraceae)	.	3.3	.	.	+
<i>Trena orientalis</i> Bl. (Ulmaceae)	.	.	.	1.1	.
<i>Macaranga</i> sp. (Euphorbiaceae)	.	.	.	.	+

Loc. and date : Kanpung Kenangan/Muar, Malaysia at 15. August 1988.

tion where some peat layers have vanished because of burning.

8. *Imperata cylindrica*-community (Table 6, releve no. 11)

The *Imperata cylindrica*-community is characterized by dominated *Imperata cylindrica*, and is distributed in the roadside or in wastelands. The *Imperata*-dominated grassland grows widely on wet habitat in tropical and temperate Asia. The community has a height of 120cm and a cover of 98 per cent. The total number of species is 2. The habitat is wet and the nourishment is poor.

9. *Ischaemum crassipes* f. *aristatum*-community (Table 7, releve no. 1-5)

The *Ischaemum crassipes* f. *aristatum*-community is characterized by dominated *Ischaemum crassipes* f. *aristatum*. The data of the community were collected from 5 stations at Kanpung Kenangan, Muar. The community occurs on the peat swamps where are flooded for a long term of year.

The community is divided into two sub-communities: a) the sub-community of *Asystasia coromandeliana* and b) the sub-community of *Lygodium microphyllum*. The sub-community of *Asystasia coromandeliana*, characterized by *Asystasia coromandeliana*, has a height of 7-10cm and a cover of 100 per cent. The sub-community of *Lygodium microphyllum*, characterized by *Scleria sumatrensis* and *Lygodium microphyllum*, has a

height of 40-80cm and a cover of 89-100 per cent. 10. *Stenochlaena palustris*-*Scleria sumatrensis*-community (Table 7, releve no. 6-13)

The *Stenochlaena palustris*-*Scleria sumatrensis*-community, with dominated *Scleria sumatrensis*, is widely developed on the peat swampy habitat. The community is 80-120cm in height and the differential species are *Scleria sumatrensis*, *Lygodium microphyllum*, *Stenochlaena palustris* and melastomataceous species. The community has a cover of 98-100 per cent and the total number of species is 3-6; it is a common natural or secondary grassland of the peat swamps in tropical Asia.

11. *Lygodium microphyllum*-*Mikania cordata*-community (Table 8, releve no. 1-2)

The *Lygodium microphyllum*-*Mikania cordata*-community is developed on the peat swampy habitat. The differential species are *Mikania cordata*, *Ischaemum timorensis* and *Lygodium microphyllum*. The community has a height of 120-150 cm and a cover of 80-100 per cent. Total number of species is 5. The dominated species is climbing *Mikania cordata* or *Scleria sumatrensis*.

12. *Ischaemum longifolium*-*Asystasia coromandeliana*-community (Table 8, releve no. 3-5)

The *Ischaemum longifolium*-*Asystasia coromandeliana*-community is characterized by dominated *Asystasia coromandeliana* (Acanthaceae) and *Ischaemum longifolium*. The community has a

height of 30-60cm and a cover of 95-100 per cent. Total number of species is 2-6. Other component species are *Stenochlaena palustris*, *Scleria sumatrensis*, *Trena orientalis*, *Nephrolepis biserrata* var. *furcans* and *Macaranga* species. The community is widely developed on roadside and wastelands.

Vegetation dynamics at Muar, Malaysia

Figure 2 shows the relationships between the natural and substitutional vegetation in the coastal wetlands of Muar, Malaysia, which are being covered by peat/acid sulfate soils.

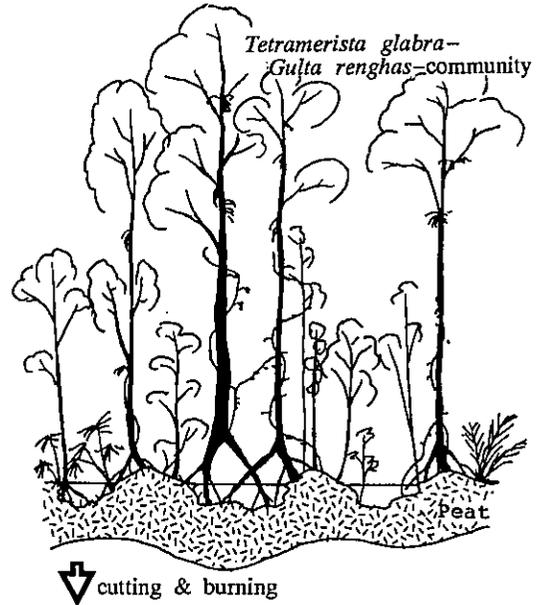
The original vegetation in the peat swamp area of Muar is of a community similar to the *Tetramerista glabra-Gluta reinghas*-community or the *Shorea thiseltonii-Xerospermum intermedium*-community (see Fig. 2, phase 1). However due to forest cutting, cultivation, burning, and pasturage, most of the peat soil disappeared within a short time (see Fig. 2, phase 2). Lowering of the water table leads to oxidation of surface peat which is followed by humification (decomposition) and loss of volume (shrinkage). This can result in severe consequences in the tropics where peatlands are located mainly in lowland coastal areas. While peat layer is still present cultivation of rice and oil palm plantation is possible (see Fig.2, phase 3 ; VIJARNORN and PANICHAPONG, 1987). But after the loss of the peat layer, ground level goes down and the soil changes into a sulfate one, the main recovery or reconstruction of original vegetation is impossible (see Fig.2, phase 4). Potential natural vegetation was alternated by the change of soil condition under the influence of human activities. The actual forest vegetation is a kerangas forest such as the *Alstonia angustifolia-Melaleuca cajuputi*-community.

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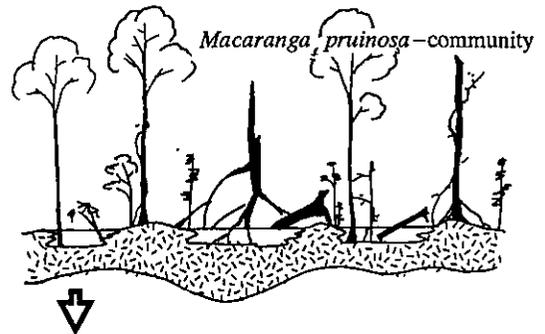
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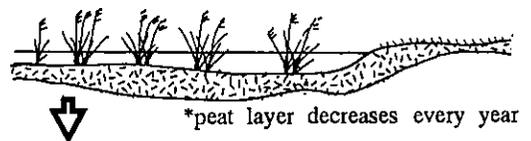
Phase 1. Natural forest



Phase 2. Secondary forest



Phase 3. Paddy field & pasture



Phase 4. Kerangas forest

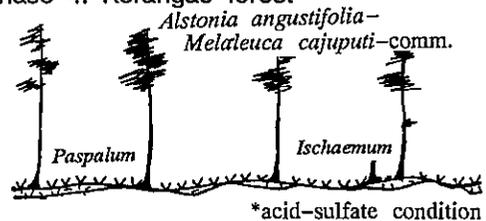


Fig.2. Vegetation dynamics on the peat swamps at Muar, Malaysia.

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摘 要

湿潤熱帯とくに東南アジアの沿岸低地には、面積 240 万 ha といわれる泥炭湿地が広がっている。筆者は、1987 年以来、タイ、マレーシア、インドネシアを中心とする地域の泥炭湿地の植生を対象とした植物社会学的研究を進めてきている。本報告では、その第 2 報として、マレーシア半島部の代表的な泥炭湿地であるムア地区の植生区分を行った。現地踏査による 42 地点の植生調査資料をもとに、森林植生から草本植生まで 12 群落にまとめ、あわせて森林伐採・排水・火入れ等による植生劣化の過程（遷移）について植物社会学的考察を行った。現在進められている火入れや排水を行う土地開発は、泥炭層の消失と酸性硫酸塩土壌の生成を伴うため、自然植生の復元が長期的にも困難となり、農林業的土地利用も短期間に限定されている。

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○ シロミノヤブヘビイチゴ (鳴橋直弘*) Naohiro NARUHASHI*: *Duchesnea indica* f. *albocaput*

シロミノヤブヘビイチゴは、福井県立博物館の若杉孝生氏と、元福井市立郷土自然科学博物館の林幸子氏が、昨年福井市にある足羽三山の一角で発見したものである。

Fig. 2 に示したように、肥大した花托は白色で、小果実はクリーム色である。小果実表面はほとんど平滑である。染色体数は $2n=84$ で、ヤブヘビイチゴと同じであった (Fig. 1)。シロミノヤブヘビイチゴと赤実のヤブヘビイチゴを比べると、果実の色以外、際立った形態上の差は見当たらなかった。

ここの個体群は、主に栄養繁殖で増えているものと思われる。また、この集団と 10 m 離れた所に、普通の赤実のヤブヘビイチゴが生育していた。牧野富太郎は 1931 年に、非常に珍しい植物であるシロミノヘビイチゴを発表しているが、今回のシロミノヤブヘビイチゴも珍しい植物と思われる。

標本作製及び 2 度にわたり筆者を現地に案内して下さった若杉孝生氏と、染色体の観察でお世話になった岩坪美兼氏に、心から感謝する。

***Duchesnea indica* (ANDR.) FOCKE f. *albocaput* NARUHASHI, f. nov. (Fig. 2A & B).**

Carpophora subglobosa alba. Fructi cremei raro aurantiaci.

This form differs from typical *D. indica* in the white fruiting receptacle.

Habit. Japonia, Honshu: Fukui Pref., Fikui City, Asuwa-sanzan, WAKASUGI no. 34420, Jun. 21, 1991 (Fr.); ibidem, WAKASUGI & NARUHASHI no. 91102401, Oct. 24, 1991 (Fr.) & 92061001, Jun. 10, 1991 (Fr.)-Holotypus in KANA; Isotypus in KYO, MAK, TI & TNS.

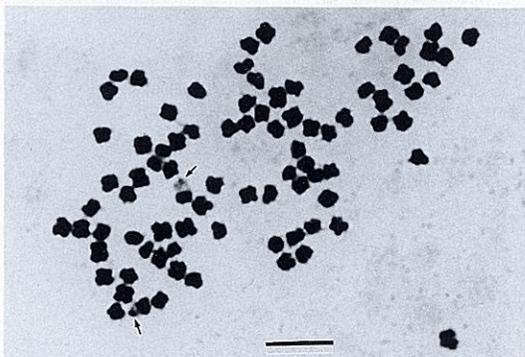


Fig. 1. Somatic metaphase chromosomes of *D. indica* f. *albocaput*. $2n=84$. Bar represents 5 μ m.