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Notes on Some Plant Collections from Bachok and Several Forest Reserves in Kelantan

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ABSTRACT A botanical survey of Bachok and various forest reserves at Jeram Linang, Jeram Pasu and Bukit Bakar was part of an expedition from 14–20 June 2008 carried out by the IOES (Institute of Ocean and Earth Sciences) University of Malaya to survey and prepare an inventory of the biodiversity of the coastal region around Bachok, Kelantan. A total of 54 species from 30 families, consisting of seashore and mangrove plants were identified from the coastal area of Bachok and Semerak; while 89 species of flowering plants representing 44 families, a single gymnosperm, *Agathis borneensis* (Araucariaceae); and 15 genera and 23 species of mosses (from 10 families) were recorded in the three forest reserves. Several of the species collected were rarely found outside Kelantan.

ABSTRAK Satu survei tumbuhan di Bachok dan beberapa hutan simpanan termasuk Jeram Linang, Jeram Pasu dan Bukit Bakar, Kelantan adalah sebahagian ekspedisi survei biodiversiti kawasan pantai di sekitar Bachok Kelantan oleh IOES (Institute of Ocean and Earth Sciences) Universiti Malaya pada 14–20 Jun 2008. Sejumlah 54 spesies daripada 30 famili tumbuhan pantai dan bakau dikenalpasti dari kawasan pantai Bachok dan Semerak; sedangkan 89 spesies tumbuhan berbunga (mewakili 44 famili), satu gimnosperma, *Agathis borneensis* (Araucariaceae); serta 15 genera dan 23 spesies daripada 10 famili lumut sejati telah direkodkan di kawasan sekitar Jeram Linang, Jeram Pasu dan Hutan Lipur Bukit Bakar. Beberapa spesies yang dikutip adalah jarang ditemui di luar Kelantan.

(**Keywords:** botanical survey, angiosperms, mosses, Kelantan)

INTRODUCTION

Kelantan (101° 20′ E to 102° 40′ E and 04° 30′N to 06° 15′ N) in northeast Peninsular Malaysia has an area of 1.5 million hectares of which 50% is under forest and wildlife reserves [1]. In Peninsular Malaysia it is the state with the largest area of reserved forest. Its landscape is extremely diverse, ranging from seashores, mangroves and flat plains in the east gradually rising (westwards) towards hilly and mountainous terrain drained by several river systems. Thus the vegetation varies from seashore vegetation and mangrove along the coast, to the extremely species-rich Tropical Evergreen Lowland Rainforest; modified by the influx of monsoon elements from Burma and Siam [2, 3, and 4].

Bachok (25 km east of Kota Bharu) and Semerak (in Pasir Puteh, 50 km southeast of Kota Bharu) are popular recreational destinations owing to their famous scenic sandy beaches. Jeram Linang and Bukit Bakar (Machang district) and Jeram Pasu (Pasir Putih) are the earliest waterfalls in Kelantan to be developed with basic amenities (such as chalets, public toilets, car parks, restaurants, camping sites, jungle treks etc) for recreational activities. These are popular recreation sites for the local people and contribute to increasing public awareness of the importance of forests for people. On the other hand, and as elsewhere, Kelantan's forest reserves also encounter illegal encroachment and taking of forest products. These and forest conversion can lead to rapid depletion of native species. In that context, the present survey is a small study undertaken within a short time; however, various interesting aspects are presented as contribution towards the documentation of Kelantan's flora for conservation purposes.

MATERIALS AND METHODS

This botanical survey was conducted from 14–20 June 2008. Specimens were collected in UM land, Bachok (N 06° 00′ 25″, E 102° 25′ 37″); Semerak (N 05° 52′ 18″, E 102° 30′ 41″); the Forest Reserve areas at Jeram Linang, Machang (N 05° 44′ 27″, E 102° 22′ 36″); Jeram Pasu, Pasir Puteh (N 05° 47′ 63″, E 102° 20′ 21″); and Bukit Bakar Hutan Simpanan Ulu Sat, Machang (N 05° 43′ 1″, E 102° 16′ 38″). Moss specimens growing on soil, rocks, tree branches, trunks and exposed roots, rotten logs and wood were

collected and identified in the laboratory. Angiosperm specimens of flower and fruit were identified in the field or collected, tagged and brought back to the laboratory for further identification. Herbarium specimens were prepared and kept in the University of Malaya Herbarium (KLU).

RESULTS AND DISCUSSION

Angiosperm and moss species collected are given in Tables 1–3. The coastal areas of Bachok and Semerak recorded 54 species from 30 families, comprising typical seashore vegetation (Table 1) such as *Canavalia rosea, Casuarina equisetifolia, Ipomoea pes-caprae, Pandanus odoratissimus, Vitex odorata, Hibiscus tiliaceus* and *Spinifex littoreus* which are common in the sandy beaches of Kelantan. Further inland, *Catunaregam tomentosa* is one of the most common shrub species observed. Besides seashore vegetation, the Semerak area also has pockets of mangrove along the Semerak river. The mangrove identified included species such as *Rhizophora apiculata, R. mucronata, Avicennia alba, Ceriops tagal, Sonneratia alba, Brugurira cylindrica, Lumnitzera racemosa,* as well as the less common *Cayratia trifolia* and *Derris heptaphyla.*

A total of 44 families of angiosperms comprising 89 species were recorded (Table 2) and 10 families of mosses made up of 15 genera and 23 species were collected from areas around the three forest reserves. These study sites are well irrigated by swift-flowing streams, often cascading down boulders as waterfalls, creating a range of niches for plants. On large shaded, damp boulders and tree branches and trunks are found 15 genera of mosses from 10 families (Table 3). The most common genus is *Calymperes* (family Calymperaceae) collected from both Jeram Linang and Bukit Bakar. Of the 23 species collected, an epiphyllous moss, *Aerobropsis subleptostigmata* (family Meteoriaceae) is a new record for Kelantan since this species has only been collected before from two locations, i.e. Taman Negara (Yong, unpublished data) and Cameron Highlands [5, 6].

At Jeram Linang and Jeram Pasu (below 300 m elevation) and Bukit Bakar (400–500 m), the natural vegetation is Mixed Dipterocarp Forest with a good representation of the Dipterocarpaceae, Rubiaceae, Euphorbiaceae, Fabaceae, Melastomataceae and Arecaceae (see Table 2) among 'standard' lowland forest angiosperm families of Peninsular Malaysia [7]. Although this quick survey was to document genera that could be identified by flowers and fruits, not many species of such genera were reproductive at the same time, thus the number of species listed in Table 2 does not reflect the actual richness of a particular genus such as in the Dipterocarpaceae (*Shorea* and *Dipterocarpus)*, Moraceae (*Artocarpus* and *Ficus)* and Rubiaceae (*Psychotria* and *Chasalia*).

In the many forest gaps are found the pioneer and secondary forest species such as macarangas, melastoma, bamboos, grasses and ferns. *Clidemia hirta*, a highly invasive plant in tropical forests [8] has also been collected. Nevertheless, this present study reveals that these forest reserves still harbour some very unique and potentially valuable species including *Molineria latifolia* and *Eurycoma,* both threatened species useful in therapeutics; *Zanthoxylum rhetsa*, practically endemic to Kelantan, *Psychotria* a few species of this genus are very much sought after by herbalists as a pain killer and anti-cancer plant and many other medicinal species such as *Ficus, Chasalia, Alstonia, Calophyllum* and others. *Agathis borneensis* very commonly observed in Bukit Bakar probably owing to its sandy soil and slightly higher elevation, is not seen in Jeram Linang and Jeram Pasu.

It is estimated that 12,000–15,000 seed plant species are found in this region, of which about 20% are endemic [9]. Many of these species are known medicinal plants and are commonly used in the daily life of the local inhabitants for the treatment of various ailments especially for skin complaints and diseases of womenfolk and recuperation after childbirth [10]. Traditionally, the forests yield not only timbers but also a host of other non timber products such as fruits and vegetables, latex, dyes, resins, herbal medicines, ornamentals, etc. [11]. As there is no national list of threatened and endangered plant species [9], the conservation status of our flora is uncertain and many of these plants together with their natural habitats could be lost forever (e.g. *Nepenthes benstonei* endemic to this region [12] was not seen in this study).

Despite the short survey, several interesting elements of the flora were detected (new record of epiphyllous moss, *Aerobropsis subleptostigmata*, detection of invasive *Clidemia hirta,* collection of threatened species such as *Eurycoma* and *Molineria latifolia*) indicating that more concerted efforts at documentation of this region would certainly be very instructive and yield invaluable and interesting information.

Table 1. List of seed plants recorded from UM land (U) in Bachok and Semerak (S).

Family	Genus / Species	Locations
Magnoliophyta (flowering plants)		
Acanthaceae	*Asystasia intrusa* Blume	U
	Avicennia alba Blume	S
Aizoaceae	*Sesuvium portulacastrum* (L.) L.	S
Amaryllidaceae	*Crinum asiaticum* L.	U
Apocynaceae	*Alstonia angustifolia* A. DC.	S
Arecaceae	*Nypa fruticans* Wurmb.	U, S
Asteraceae	*Emilia sonchifolia* (L.) DC. ex Wight	U
	Wedelia biflora (L.) DC.	U,S
Cleomaceae	*Cleome* sp.	S
Casuarinaceae	*Casuarina equisetifolia* Blanco	U, S
Clusiaceae	*Calophyllum inophyllum* L.	U
Combretaceae	*Lumnitzera racemosa* Willd.	S
	Terminalia catappa L.	U, S
Convolvulaceae	*Ipomoea pes-caprae* (L.) R. Br.	U, S
Cyperaceae	*Cyperus* sp.	U
Dilleniaceae	*Tetracera scandens* Merrill	S
	Tetracera indica Merrill	S
Euphorbiaceae	*Excoecaria agallocha* L.	S
Fabaceae	*Canavalia rosea* (Sw.) DC.	U
	Cassia sp.	S
	Derris heptaphylla Merrill	S
	Desmodium laxum DC.	S
	Indigofera hirsuta Harv.	U
Lamiaceae	*Clerodendrum inerme* (L.) Gaertn.	S
	Premna tomentosa Kurz	S
	Vitex ovata C.P. Thunberg ex A. Murray	U, S
	Vitex pinnata L.	S
Lythraceae	*Sonneratia alba* Griff.	S
Malvaceae	*Abutilon* sp.	U
	Hibiscus tiliaceus L.	U, S
	Urena lobata L.	U
Moraceae	*Ficus superba* (Miq.) Miq.	S
Myrtaceae	*Eugenia grandis* Wight	S
Pandanaceae	*Pandanus odoratissimus* Blume	U, S
Phyllanthaceae	*Glochidion* sp.	S
	Phyllanthus pulcher Wall.	U
Poaceae	*Ischaemum muticum* L.	U
	Spinifex littoreus Merrill	U, S
Rhizophoraceae	*Bruguiera cylindrica* (L.) Blume	S
	Ceriops tagal (Perr.) C.B. Rob.	S
	Rhizophora apiculata Blume	S
	Rhizophora mucronata Lam.	S
	Rhizophora stylosa Griff.	S
Rubiaceae	*Borreria hispida* K. Schum.	U
	Catunaregam tomentosa-(Bl. Ex DC.) D.D. Tirvengadum	S
	Guettarda speciosa L.	S
	Hedyotis corymbosa (L.) Lam.	U
	Morinda citrifolia Linn.	S
	Uncaria cordata (Lour.) Merr.	U
Rutaceae	*Melicope* sp.	S
Sapindaceae	*Sapindus* sp.	S
Smilacaceae	*Smilax* sp.	S
Taccaceae	*Tacca integrifolia* Ham.ex Hook.f.	U
Vitaceae	*Cayratia trifolia* (L.) Domin	S

Table 2. List of seed plants recorded from the Forest Reserves of Jeram Linang (L), Jeram Pasu (P) and Hutan Lipur Bukit Bakar (B).

Family	Genus / Species	Locations
Magnoliophyta (flowering plants)		
Acanthaceae	*Justicia* sp.	B
Agavaceae	*Dracaena* sp.	L
Anacardiaceae	*Pentaspadon velutinus* Hook.f.	L
	Swintonia sp.	L
	Campnosperma macrophylla Hook.f.	P
	Bouea macrophylla Griff.	B
Anisophylleaceae	*Anisophyllea* sp.	L, B
Apocynaceae	*Alstonia angustifolia* A. DC.	L
	Alstonia angustiloba Miq.	L
	Dischidia sp.	P
	Tabernaemontana sp.	P
Araceae	*Amorphophallus* sp.	L
	Pothos sp.	L
Araliaceae	*Arthrophyllum diversifolium* Blume	L, B
Arecaceae	*Areca* sp.	L
	Arenga sp.	L
	Calamus sp.	P
	Caryota mitis Herb.	L, P
Arecaceae	*Eugeisonna tristis* Griff.	L, B
	Licuala sp.	L, P, B
	Pinanga sp.	B
	Salacca sp.	B
Brownlowiaceae	*Pentace* sp.	L
	Pentace macrophylla King	L
Burseraceae	*Canarium* sp.	L
Clusiaceae	*Calophyllum* sp.	L
	Garcinia nervosa Miq.	L
Dilleniaceae	*Tetracera* sp.	P
Dipterocarpaceae	*Cotylelobium* sp.	L
	Dipterocarpus sp.	B
	Hopea odorata Roxb.	L
	Parashorea stellata Kurz	L
	Shorea guiso Blume	L
	Shorea leprosula Miq.	L, B
	Shorea sp.	B
Ebenaceae	*Diospyros buxifolia* Hiern	B
Erythropalaceae	*Strombosia javanica* Blume	L
Euphorbiaceae	*Elateriospermum* sp.	L
	Endospermum sp.	L
	Macaranga gigantean Muell. Arg.	L
	Macaranga javanica Muell. Arg.	L
	Macaranga motleyana Muell. Arg.	L
	Macaranga triloba Muell. Arg.	L
	Sapium baccatum Roxb.	L
Fabaceae	*Intsia palembanica* Miq.	L
	Koompasia malaccensis Maing.	L
	Archidendron jiringa (Jack) I. Nielsen	L
	Uraria crinite (L.)DC.	B
Fagaceae	*Lithocarpus* sp.	L
Gentianaceae	*Fagraea racemosa* Jack *ex* Wallich	P
Hypericaceae	*Cratoxylum cochinchinense* (Lour.) Bl.	L
Hypoxidaceae	*Molineria latifolia* Herb. *ex* Kurz	L, P

Lauraceae	*Phoebe grandis* (Nees) Merrill	B
	Cinnamomum sp.	L, B
Lecythidaceae	*Barringtonia* sp.	L
Malvaceae	*Durio* sp.	L, P
Melastomataceae	*Clidemia hirta* D. Don	L
	Lijndenia laurina Zoll. & Mor.	B
	Melastoma malabathricum Jack	P
	Memecylon sp.	L
	Pternandra sp.	B
Meliaceae	*Sandoricum koetjape* Merrill	L
Moraceae	*Artocarpus altilis* (Parkinson) Fosberg	L
	Ficus sp.	L
Musaceae	*Musa* sp.	B
Myristicaceae	*Knema*. sp.	L
Myrsinaceae	*Ardisia crenata* Roxb.	L, B
	Labisia sp.	B
Myrtaceae	*Eugenia grandis* Wight	L
	Rhodamnia cinerea Jack	P
Ochnaceae	*Brackenridgea palustris* Bartell.	L
Pandanaceae	*Pandanus* sp.	L, P, B
Pentaphragmataceae	*Pentaphragma* sp.	B
Phyllanthaceae	*Antidesma cuspidatum* Muell. Arg.	L, B
Polygalaceae	*Xanthophyllum* sp.	B
Rubiaceae	*Chassalia* sp.	L
	Ixora sp.	L, P, B
	Psychotria sp.	L, B
	Rennellia paniculata King & Gamble	L
	Rennellia speciosa Benth. & Hook.f.	B
	Tarenna fragrans Koord. & Valet.	L
	Uncaria sp.	L
Rutaceae	*Zanthoxylum rhetsa* DC.	L
Sapindaceae	*Nephelium* sp.	L
Simaroubaceae	*Eurycoma longifolia* Jack	B
Smilacaceae	*Smilax* sp.	L, B
Thymelaeaceae	*Gonystylus bancanus* (Miq.) Kurz	B
Zingiberaceae	*Alpinia* sp.	L
	Etlingera sp.	B
Pinophyta		
Araucariaceae	*Agathis borneensis* Warburg	B

Table 3. List of mosses collected from the Forest Reserves of Jeram Linang (L), Jeram Pasu (P) and Hutan Lipur Bukit Bakar (B).

Family	Genus / Species	Locations
Calymperaceae	*Calymperes erosum* Müll. Hal.	L, B
	Calymperes lonchophyllum Schwägr.	L
	Calymperes moluccense Schwägr.	L
	Calymperes porrectum Mitt.	L
	Calymperes tahitense (Sull.) Mitt.	L, B
	Mitthyridium flavum (Müll. Hal.) H. Rob.	P
	Mitthyridium obtusifolium (Lindb.) H. Rob.	B
	Mitthyridium repens (Harv.) H. Rob.	L
	Syrrhopodon spiculosus Hook. & Grev.	B
Fissidentaceae	*Fissidens crispulus* Brid.	L
Hypnaceae	*Ectropothecium* sp.	L
	Ectropothecium zollingeri (Müll. Hal.) A. Jaeger	P
	Vesicularia dubyana (Müll. Hal.) Broth.	L
Leucobryaceae	*Leucobryum sanctum* (Nees ex Schwägr.) Hampe	L
Meteoriaceae	*Aerobropsis subleptostigmata* Broth. & Paris	P
Neckeraceae	*Pinnatella mucronata* (Bosch & Sande Lac.) M. Fleisch.	L
Phyllodrepaniaceae	*Mniomalia semilimbata* (Mitt) Müll. Hal.	L
Pterobryaceae	*Oedicladium pseudorufescens* (Hampe) B.C. Tan & Mohamed	L
Sematophyllaceae	*Taxithelium nepalense* (Schwägr) Broth.	L, B
	Trichosteleum boschii (Dozy & Molk.) A. Jaeger	B
	Trichosteleum stigmosum Mitt.	B
	Trismegistia lancifolia(Harv.) Broth.	P, L
Thuidiaceae	*Thuidium pristocalyx* (Müll. Hal.) A. Jaeger	L

A. *Tacca integrifolia*

B. *Pandanus odoratissimus*

C. *Cayratia trifolia*

D. *Glochidion* sp.

E. *Catunaregam tomentosa* – fruit

F. *Spinifex littoreus* – fruit

Figure 1. A. *Tacca integrifolia*, B. *Pandanus odoratissimus*, C. *Cayratia trifolia*, D. *Glochidion* sp., E. *Catunaregam tomentosa* – fruit, F. *Spinifex littoreus* – fruit.

A. *Brackenridgea palustris*

B. *Ficus* sp.

C. *Chassalia* sp.

D. *Clidemia hirta*

Figure 2. A. *Brackenridgea palustris*, B. *Ficus* sp., C. *Chasalia* sp., D. *Clidemia hirta*

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