Heart of Borneo Series

MENTAWAI

The Lush Rainforest of Northern Mulu



AMPENG, A., MEEKIONG, K., SAPUAN, A., JACK, L., HAMDEN, M.,
SANI, B.H., SYAFIANI, O., NAZARI, A., & ISHAK, H.

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Published by

FOREST DEPARTMENT SARAWAK

Wisma Sumber Alam

Jalan Stadium, 93660 Kuching, Sarawak

Tel: +6082 319 190; Fax: +6082 319237

Website: forestry.sarawak.my

and

Universiti Malaysia Sarawak (UNIMAS)

94300 Kota Samarahan, Sarawak

Website: unimas.my

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ISBN

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First published 2017

Citation:

Ampeng, A., Meekiong, K.., Sapuan, A., Jack, L., Hamden, M., Sani, B.H., Syafiani, O., Nazari, A., & Ishak, H. 2017. *Heart of Borneo Series 3: Mentawai - The Lush Rainforests of Northern Mulu.* Forest Department Sarawak & Universiti Malaysia Sarawak, Kuching: 123 pp.

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Phalaenopsis bellina

MESSAGE FROM THE RIGHT HONOURABLE CHIEF MINISTER OF SARAWAK

DATUK PATINGGI TAN SRI (DR.) HAJI ADENAN BIN SATEM

It gives me great pleasure to offer my heartiest congratulations to the Forest Department Sarawak in publishing this book, Mentawai - The Lush Rainforest of Northern Mulu.

Demand for the multiple roles of the forests is experted to be amplified in the future as more people take greater interest in forest-related issues and environment . Management of Forests entails a balancing act - between meeting economic demands and conserving nature. Forest products have been a major contributor to our export earnings thus a great factor in our economic growth. At the same time, nature will have to be protected to ensure adequate water resources, maontain biodiversity and environmental stability.

While the development cannot be stopped, the Forests Department Sarawak has made serious effort to launch and head scientific expeditions involving researchers, environmentalists, foresters and university personals to record all flora and fauna as part of conservation effort.

I am proud to say that Sarawak State Government still manages to retain a substantive amount of its forests in pristine state despite rapid urbanization and development processes.

Hence, the publication of this book, "Heart of Borneo Series 3: Mentawai - The Lush Rainforest of Northern Mulu", is indeed timely and opportune.

Finally, I would like to congratulate the Forest Department Sarawak and those who have contributed in one way or another in the preparation and publication of this book. The forest and this fine depiction of our treasure by the Forest Department shall be our legacy to those who come after us.

DATUK PATINGGI TAN SRI (DR.) HAJI ADENAN BIN SATEM

(Chief Minister of Sarawak)



Nepenthes faizaliana

FOREWORD By
DIRECTOR OF FOREST
FOREST DEPARTMENT OF SARAWAK

Mentawai Scientific Expedition: The Lush Rainforest of Northern Mulu, was held from 5 to 17 September 2012 with participation of over 80 researchers and scientists from various government institutions, universities and local NGOs. The expedition was organized by the Forest Department Sarawak which funded and supported by the Ministry of Natural Resources and Environment Malaysia and State Government of Sarawak as a continuation project under the Heart of Borneo (HoB) Initiative. Mentawai Scientific Expedition, in fact is a third scientific expedition conducted in the project that revealed the diverseness of floras and faunas in the State.

The Book entitled "The Heart of Borneo Series: Mentawai - The Lush Rainforest of Northen Mulu" is focus on the flora component, is mainly a collection of results and observations by the first author during the expedition and as well as from the previous data collections of various researchers. As part of the editorial member, I am privileged and honored to write the foreword for this book of very important scientific observations and discoveries on the Mentawai forest which is among the beautiful and uniques area in Sarawak.

The organizing committee deserves much credit for the time and effort put in for the success of the expedition. Special appreciations goes to all the esteemed participants who have been gracious to provide the data and photos which culminated into wonderful publication.

Thank you

HAJI SAPUAN BIN AHMAD

Director of Forests

Sarawak Forest Department



Beautiful river flowing through the pristine Mentawai forest

PREFACE

This book gives us a glimpse on the findings of the Scientific Expedition to Mentawai, Mulu made in 2012 which was organized by the Forest Department of Sarawak.

This book is the fourth in a Heart of Borneo Series publication under the Heart of Borneo Project Initiative for Sarawak. It highlights the results of the 2012 expedition with colourful of photographs and information on activities, the physical environments and the flora studies.

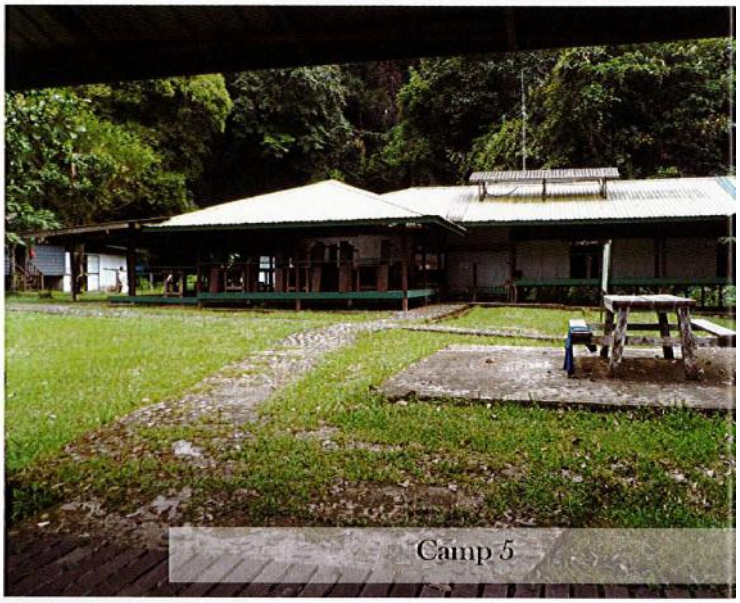
From the 12-day expedition, a tremendous amount of data was collected by researchers and scientists from various government departments, research institutions, universities and NGOs from Malaysia. The area covered in the expedition is relatively small, which is focus on the northern part of the Mulu National Park with only about 10 percent of the Park. The biodiversity recorded is exceptionally, many species of flora and fauna have been recorded and compiled. This book, however only highlighted on the flora component. The herbaceous plants component is the most diverse with many gingers, gesneriads, aroids and sedges are dominated the understorey layer of the forests. The orchids, ferns, bryophytes and fungi are also found abundantly in the area. One of the most significance finding for the expedition is the discovery of large population of the Ramin Telor trees (Gonystylus bancanus) which is rarely seen in the present day throughout Sarawak. The site has being proposed to be a pemanent study plot and as gene bank for that endanger Ramin species.

Apart from the flora, the atmosphere of Mentawai itself is also unique with beautiful scenery. The Pinnacles is one of the most amazing karst sculptures is located in the Gunung Api formation, indeed not very far from Mentawai which can be connected via the Head Hunter Trail. Many rock stream and caves with high esthetic values for ecotourism spots are also found in the areas.

EDITORS

MENTAWAI

As part of the Mulu National Park, Mentawai or synonymous known as Mentawai Ranger Post located on the uppermost north of the park. The Post is situated at the tributary of two rivers, Sungai Mentawai and Sungai Medalam and this checkpoint only be connected by boat via the Mentawai River. On the west side, about 11 km, is an international boundary of Malaysia and Brunei. The Mentawai area are vastly covered by the riverine or riparian forest, lowland dipterocarp forest and kerangas (opposite map). Few patches of small limestone hills scattered on the south toward the big limestone mountain range of Gunung Benarat and Gunung Api. A small patch of peat swamp forest on the northeast of the Post, just located between sungai Medalam and Sungai Terikan. The Camp 5 (station for a pinnacles view) is located on the south and connected via the Head Hunter Trail from the Kuala Sungai Terikan.

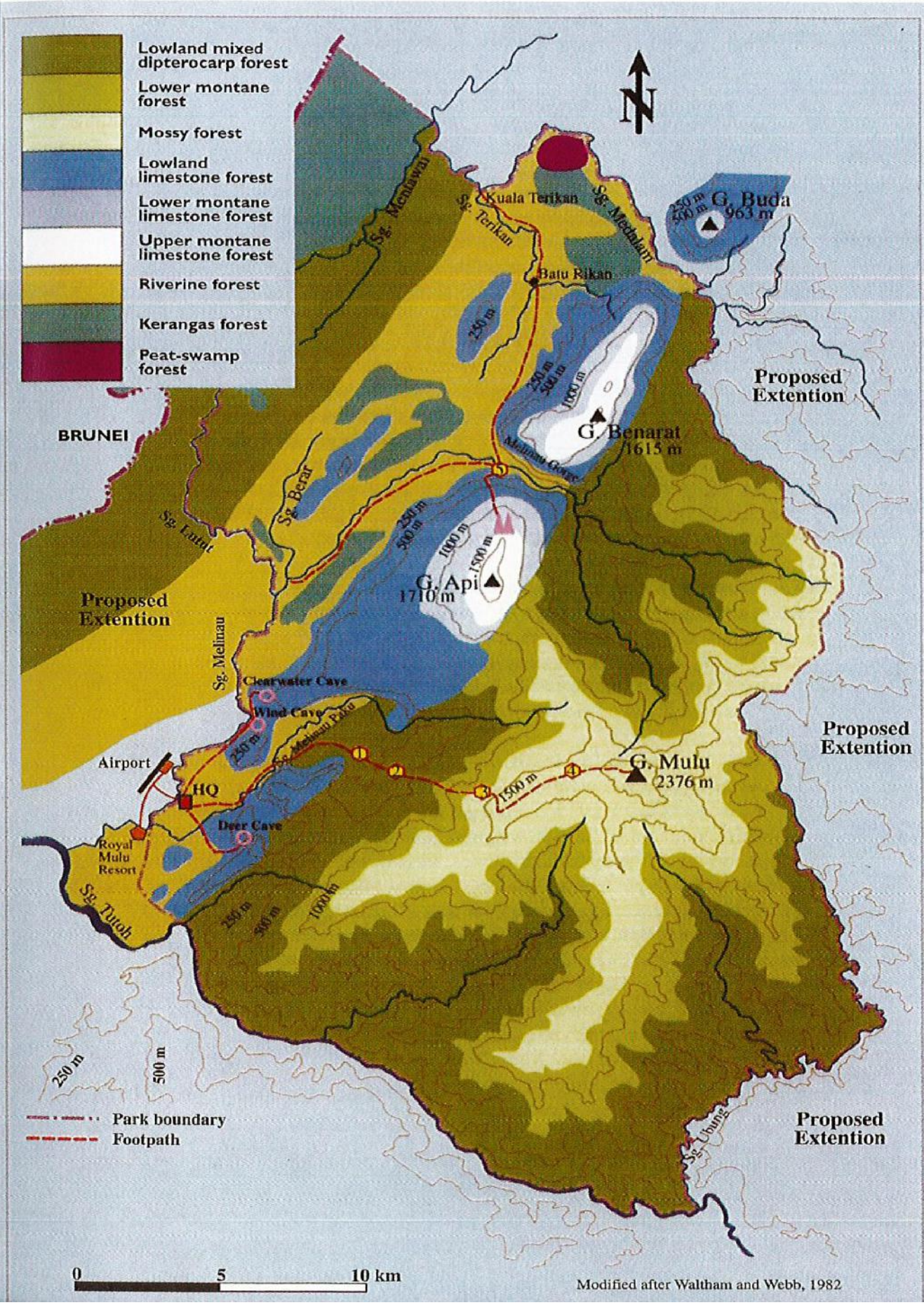


Camp 5

Besides as a checkpoint, the Mentawai Ranger Post is also a Research Post, therefore it equipped with basic accommodations, such as mini laboratory, hostels for researchers and staffs and office building. Other facilities are the green house for orchids and nursery for the Ramin (*Gonystylus bancanus*) propagation.



The Mentawai Ranger Post



Modified after Waltham and Webb, 1982

MENTAWAI SCIENTIFIC EXPEDITION 2012

The Scientific Expedition to Mentawai 2012 was organized by the Forest Department Sarawak. The Mentawai Scientific Expedition was the third expedition under the Heart of Borneo Initiative Project and it was held from 5th to 17th Semptember 2012, with the theme, "Exploring the Lush Rainforest of Northern Mulu". More than 60 researchers and supporting staffs from various institutions such as Forest Department Sarawak (FDS), Sarawak Biodiversitiy Centre (SBC), Forest Research Institute Malaysia (FRIM), Forest Department Peninsular Malaysia (JPSM) and local universities Universiti Kebangsaan Malaysia (UKM), Universiti Malaysia Sarawak (UNIMAS) and Swinburne University (Sarawak Campus) as well as NGO's and more than 50 villagers from the nearby Long houses were also involved in this 12 days expedition

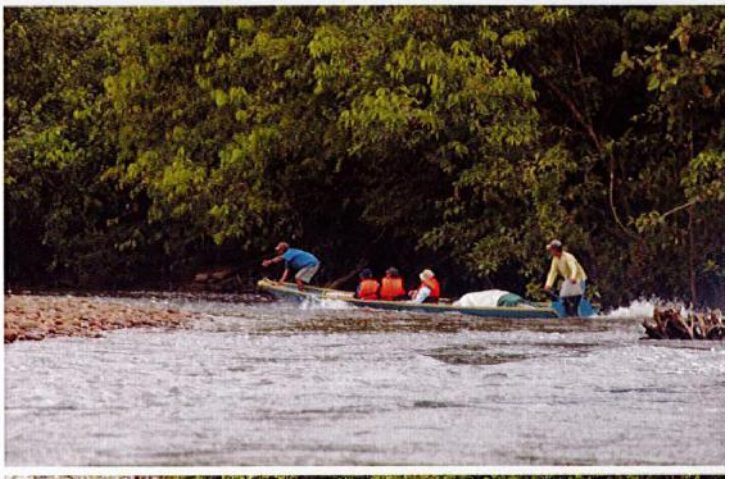




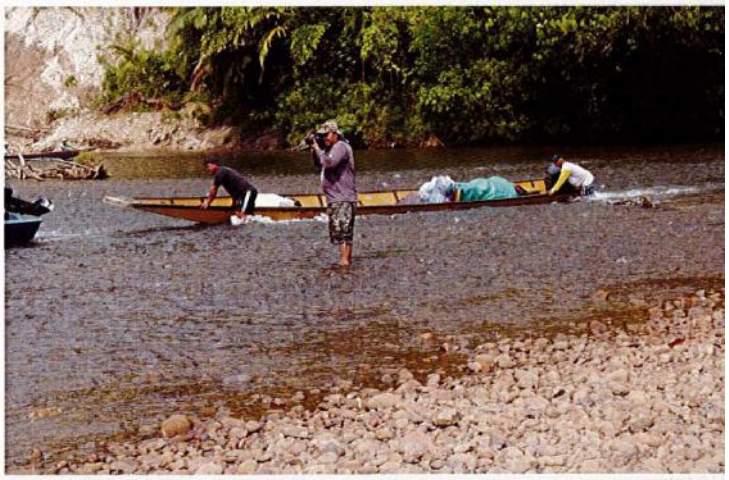

Mentawai
Scientific Expedition


Mentawai
Scientific Expedition







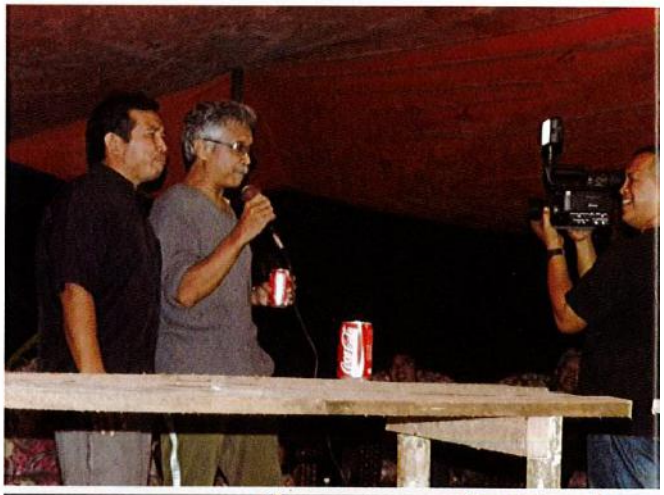



MENTAWAI RANGER STATION



CAMPS

The Mentawai Ranger Post was used as a Base Camp for this expedition and the second camp was located at Ulu Sungai Babi for the groups who studied mammals and avifaunas. The Base Camp was strategically located in the middle of study site, which covered almost every type of vegetations, includes the proposed permanent study site for Ramin Telor.









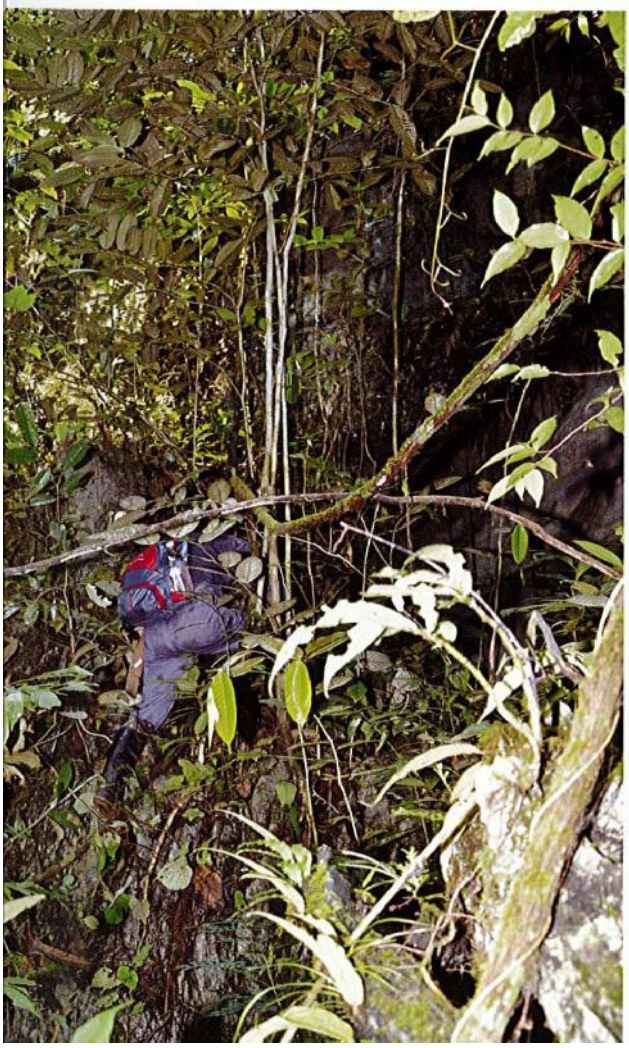


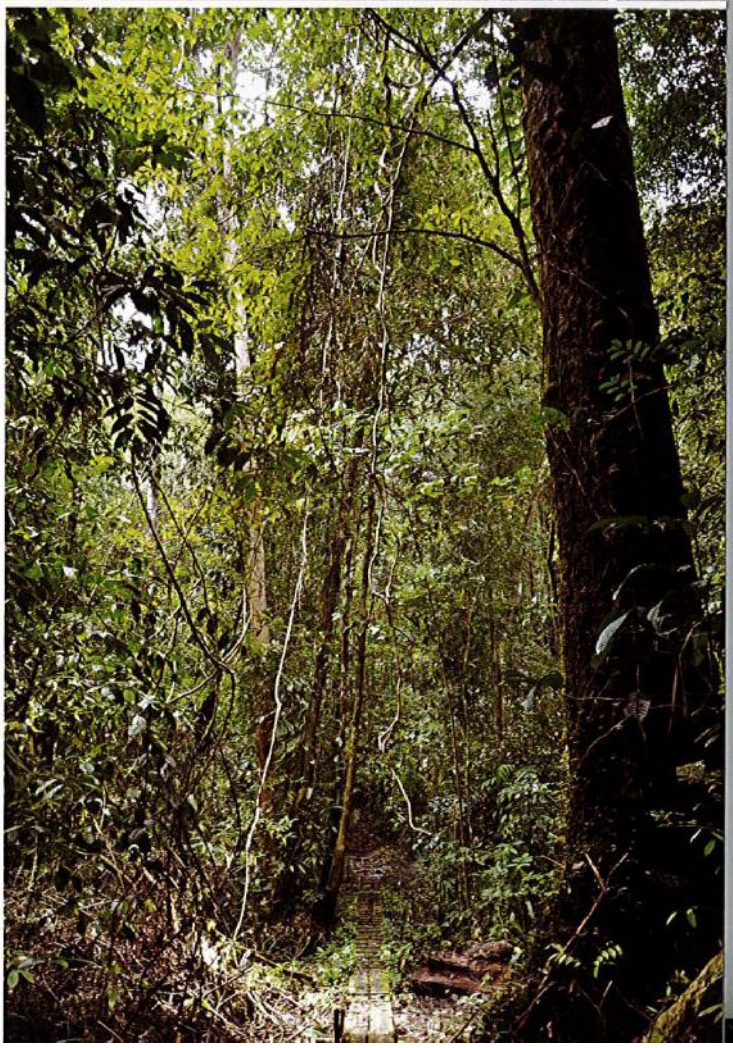


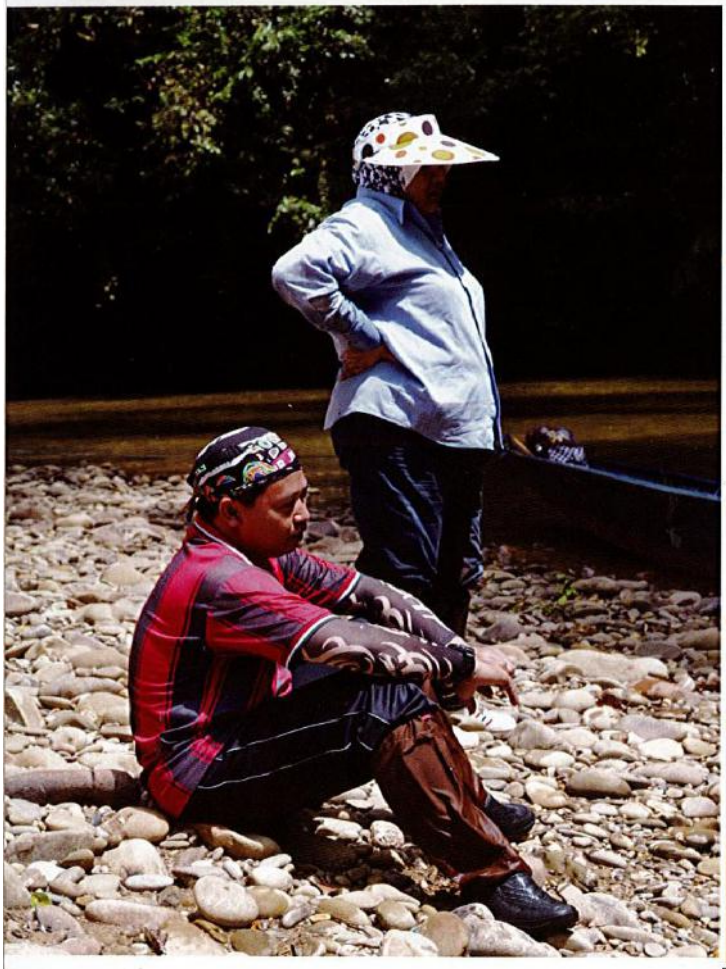
TRAILS

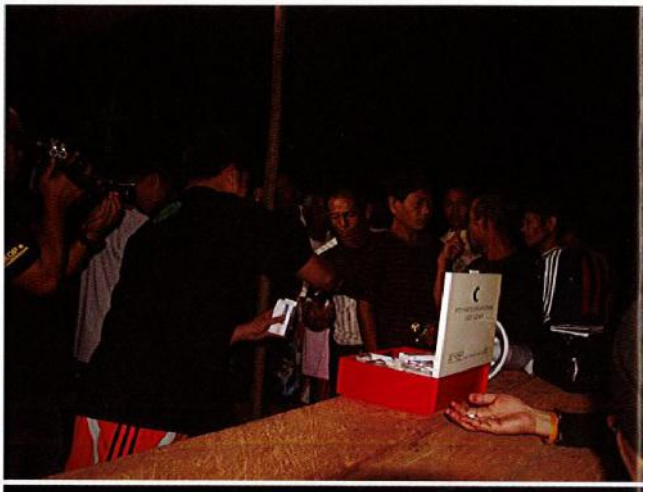
Besides the research trails that been made during the expedition, the surveys also includes the Mulu Park existing trails, such as Head Hunter Trail and Pinnacles View Trail.





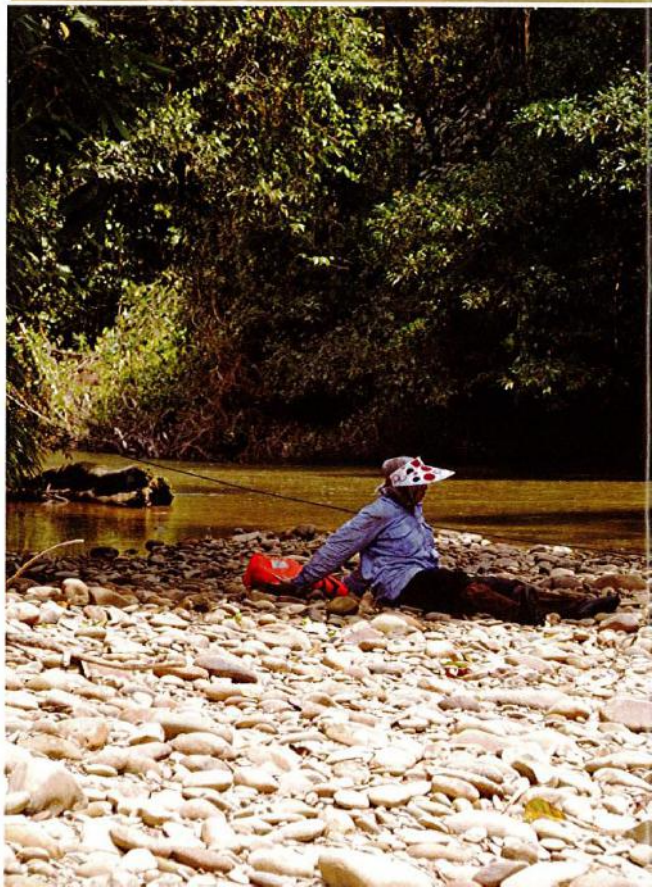








Sampling, collecting, preserving and documenting of the journeys and samples are crucial as they are the evidences of the studies.

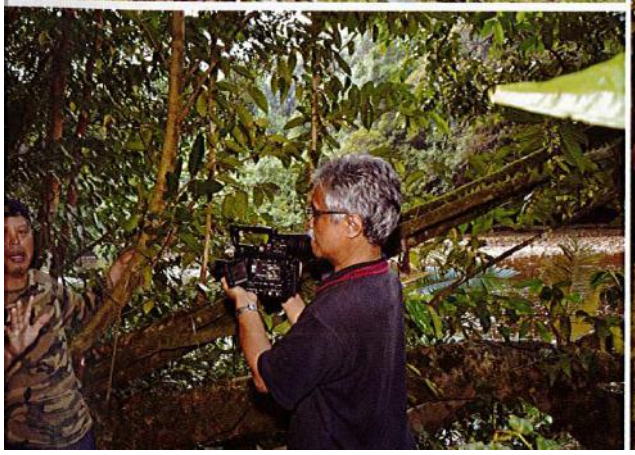






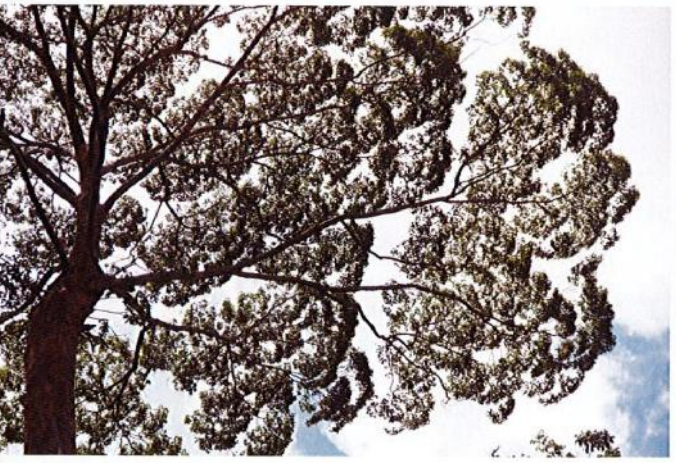


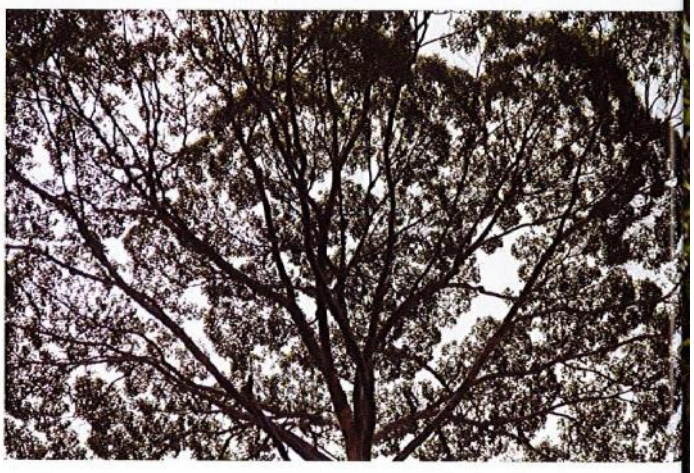












CANOPY

Forest canopy or also refer to the upper layer of habitat zone, that formed by the mature tree crowns and including others such as epiphytes and lianas. The canopy layer provides protection from strong winds and storms, while also intercepting sunlight and precipation, leading to a relative sparsely vegetated understorey layer. The canopy of the rainforest is typically thick, about 10 m and intercepts around 95% of sunlight and homes to unique flora and fauna not found in other layers of forests. Many animals such as the primates, birds and reptiles have evolved to live solely in the canopy, and never touch the ground.



BOLE

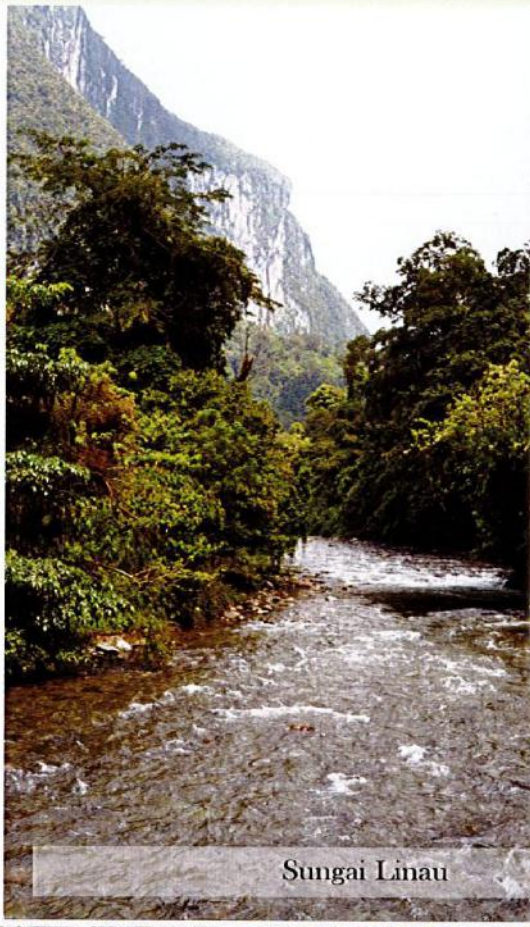
Trunk is a general term used to refers the main wooden axis of a tree which is an important diagnostic feature in tree identification, and which often differs markedly from the bottom of the trunk to the top, depending on the species. Some of the tree genera or species straight away can be identify via the characteristics of the trunk. For example, the genus *Diospyros* can be differentiated from other genera by distinctive thick, dark brown or dark gray bark that is broken into rectangular blocks. The Tualang tree (*Koompasia excelsa*) and Kempas or Menggeris (*Koompasia malaccensis*) are easily recognized because of straight bole and the colour of the bark. The trunk or bole is the most important part of the tree for timber production.





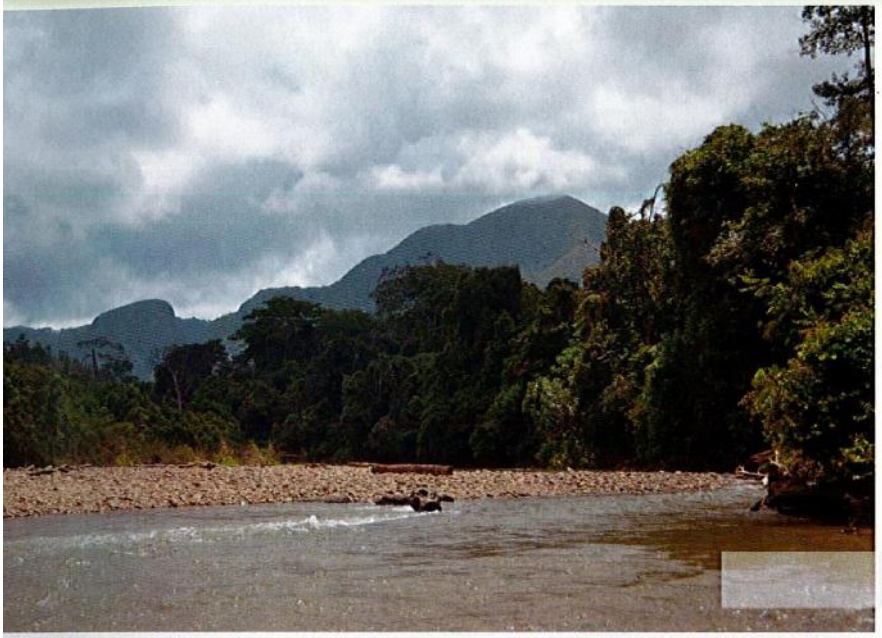
RIPARIAN

A riparian zone of riparian area is the inteface between land and a river or stream. The plants habitat and communities along the river margins and banks and includes the adjacent areas are called riparian forest, characterized by hydrophytes plants; a group of plants that have adapted to the aquatic environment. The riparian forest is important in ecology, particularly in soil conservation and for fauna diversity. For example, the Ensurai (*Dipterocarpus oblongifolius*) and Resak Ai (*Vatica rynchocarpa*) are among the plants that only found growing well on the river banks where they presenceness crucially important to prevent the soil erosions as well as their flowers and fruits are the food source for the aquatic faunas.



Sungai Linau





Sungai Medalam



Sungai Mentawai



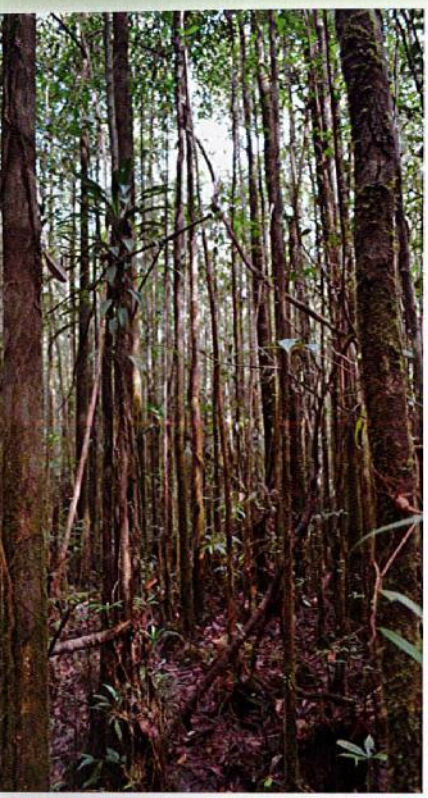
Tributary of Sungai Buda

SWAMPY

Swampy forests or flooded forests are forests which are inundated with freshwater, either permanently or seasonally. They normally occur along the lower reaches of rivers and around the freshwater lake. In Mentawai, the swampy forested area is located on the north west to the Mentawai Ranger Post, where it surrounding by the hill mixed dipterocarp forest and limestone forest. The Alan (*Shorea albida*) and Ramin Telor (*Gonystylus bancanus*) are the two most dominance species here.







KERANGAS

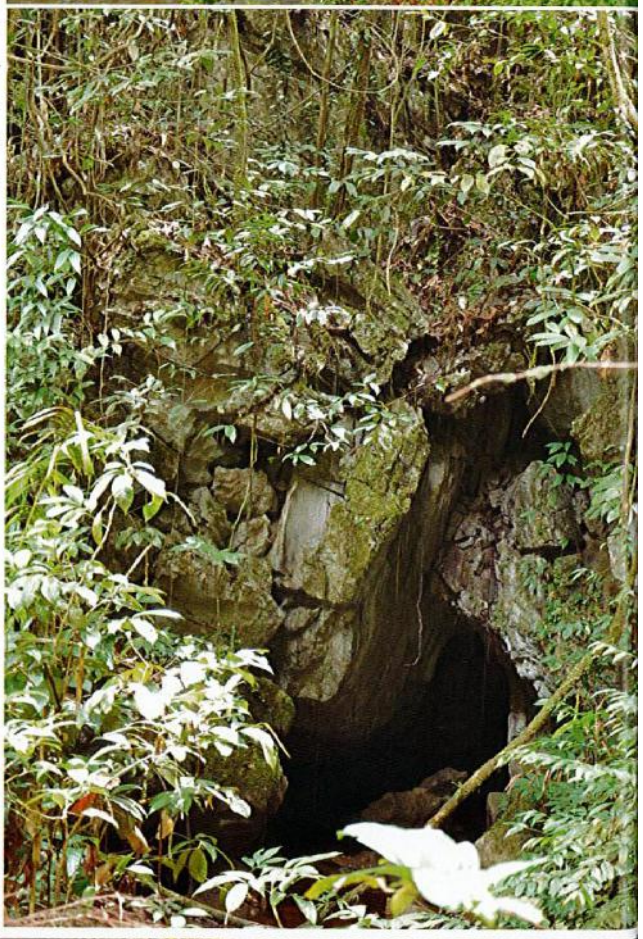
Beccari (1904) was the first to mention scientifically the "Kerangas" forest type, which he described structure, species and soils and recognized the similarity to what he called Campos (now Caatinga) in Brazil. Kerangas is an Iban term for infertile sandy soils on which neither rice nor other crops will flourish. The term is also applied to the natural forest on these and related unfavourable soils. The kerangas vegetation ranges from tall, complex, aerodynamically rough, relatively rich in species and evenly mixed (highly diverse) to low, poor in species and with high degrees of species dominance. Clusiacea, Myrtaceae, Dipterocarpaceae (*Hopea* and *Vatica*) and Sapotaceae are among the dominance tree families in the kerangas forest.



LIMESTONE

Limestone is a sedimentary rock composed largely of the mineral calcite and aragonite, which are different crystal forms of calcium carbonate ($CaCO_3$). Most limestone is composed of skeletal fragments of marine organisms such as coral, forams and molluscs. The limestone vegetations in the Mulu National Park is probably the largest limestone areas in Sarawak, that consists of two highest limestone peaks in State, Gunung Benarat (1,615 m) and Gunung Api with 1,710 m. Comparing with four major limestone areas in Sarawak, the Bau Dered-Krian Range, Padawan-Tebakang Range, the Bukit Sarang and the Niah-Subis Range, the Mulu limestone formation is the youngest in age formulatted around 35 million years ago.

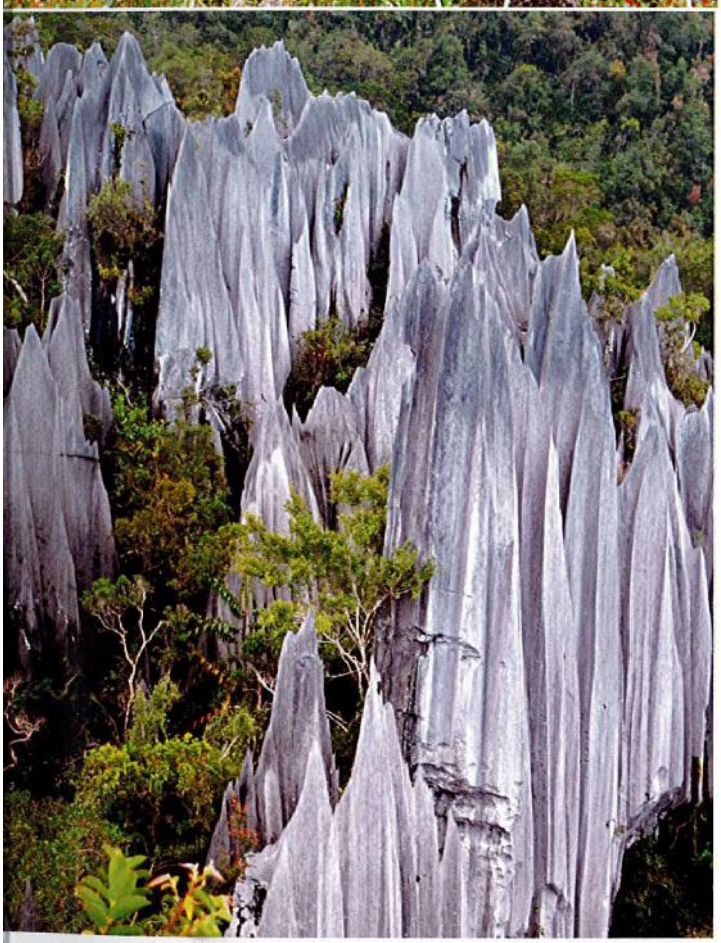












PINNACLES

Pinnacles is one of most spectacular of surface karst features in the Mulu National Park. The pinnacles with about 40 - 50 m in height created by carbon dioxide rich water dissolving the calcium carbonate, the main mineral in limestone. How do pinnacles form in the shape they do?

All limestone is deposited as a sedimentary rock in horizontal layers but movement of the Earth's plate causes these layers to develop vertical cracks. As the limestone is lifted above the sea, soil is formed on top and water soaking pores in the limestone itself making the cracks wider and deeper. Soil collapse into the space left the removal of the limestone (Clarke, 2011)

Over the past five million years or so these mountains have been simultaneously lifted up and worn down by heavy rain. Soils which once covered the limestone have been washed away to expose the pinnacled surface of the limestone mountain (Clarke, 2011).

Located in the Gunung Api limestone formations, the pinnacles can be reach via the Mulu National Park Head Quarters through the Sungai Melinau or from the Mentawai Ranger Post through the Head Hunter Trail.



MIXED DIPTEROCARP FORESTS

Lowland and hill mixed dipterocarp forests are the second largest vegetation type in Mentawai. Most the dipterocarp forests in Mentawai areas of below 400 m elevation, where the terrains are gener flatterened and slightly slopes. Only few places with steeps and dissected by narrow valleys. T vegetation is dominated by large and tall of dipterocarp trees such as *Kapur* (*Dryobalanops* spp.), *Mer* (*Shorea* spp.), *Keruing* (*Dipterocarpus* spp.) and *Resak* (*Vatica* spp.) and as well as other trees from t family Anacardiaceae, Burseraceae, Clusiaceae and Fabaceae. The understorey layer in this vegetatio not as rich as riparian or kerangas forest as it received a very limited amount of light. The plants includes the lianas, climbing palms (rattans), sedges and the ferns.

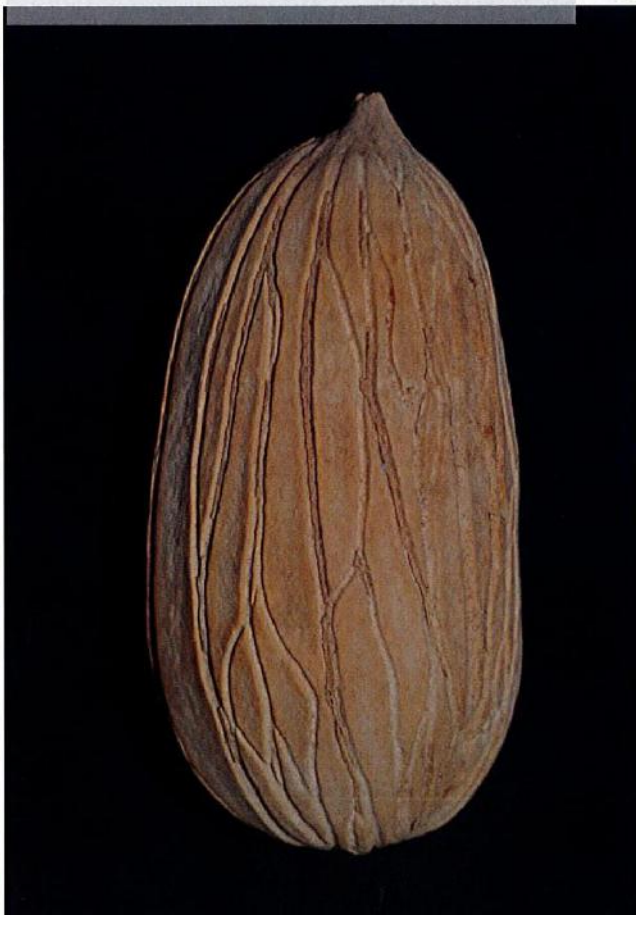


BELIAN

Belian tree or popularly known as "Bornean ironwood" also scientifically known as *Eusideroxylon zwageri* Teijsm. & Binn., member of the Lauraceae family is one of the most durable and heaviest timber in the world. The Belian tree is native to the Borneo, Flores, Java, Sumatra and the southern parts of the Philippines. The Belian trees are normally found grows in lowland primary and secondary forest up to 650 m altitude. The plant prefers well-drained soils, sandy to clay-loam, sometimes limestone and commonly found along the river banks.

Belian stem

Belian fruit

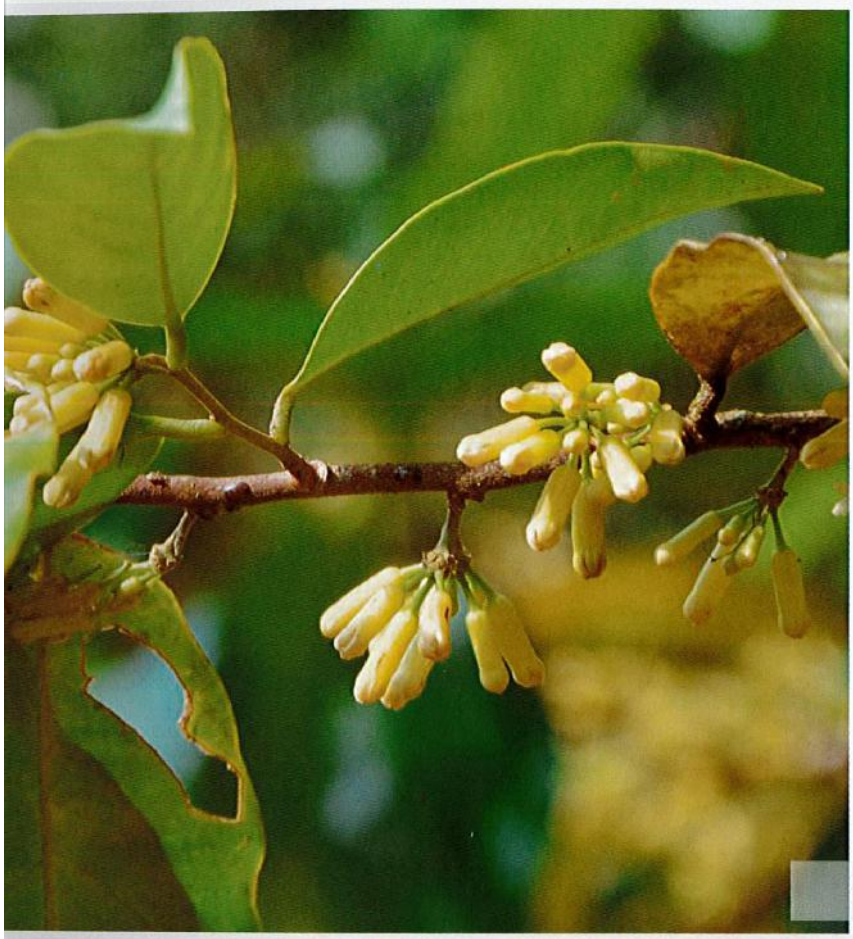


AQUILLARIA



The Gaharu trees mostly are refer to the member of the genus *Aquillaria,* belonging to the family Thymelaeaceae. The Gaharu or sometimes also known as *Engkaras* or *Karas* by the local people in Borneo or as 'black gold tree' is the most valuable tree in the tropical forest. The estimated price (market price for 2014) for 1 kilogram of super grade Gaharu is between RM8,000–RM10,000 and for essential oil is between RM19,000-RM38,000. Two *Aquillaria* species were recorded in the Mentawai, viz. *A. beccariana* and *A. malaccensis. Aquillaria beccariana* is common along the Mentawai river.





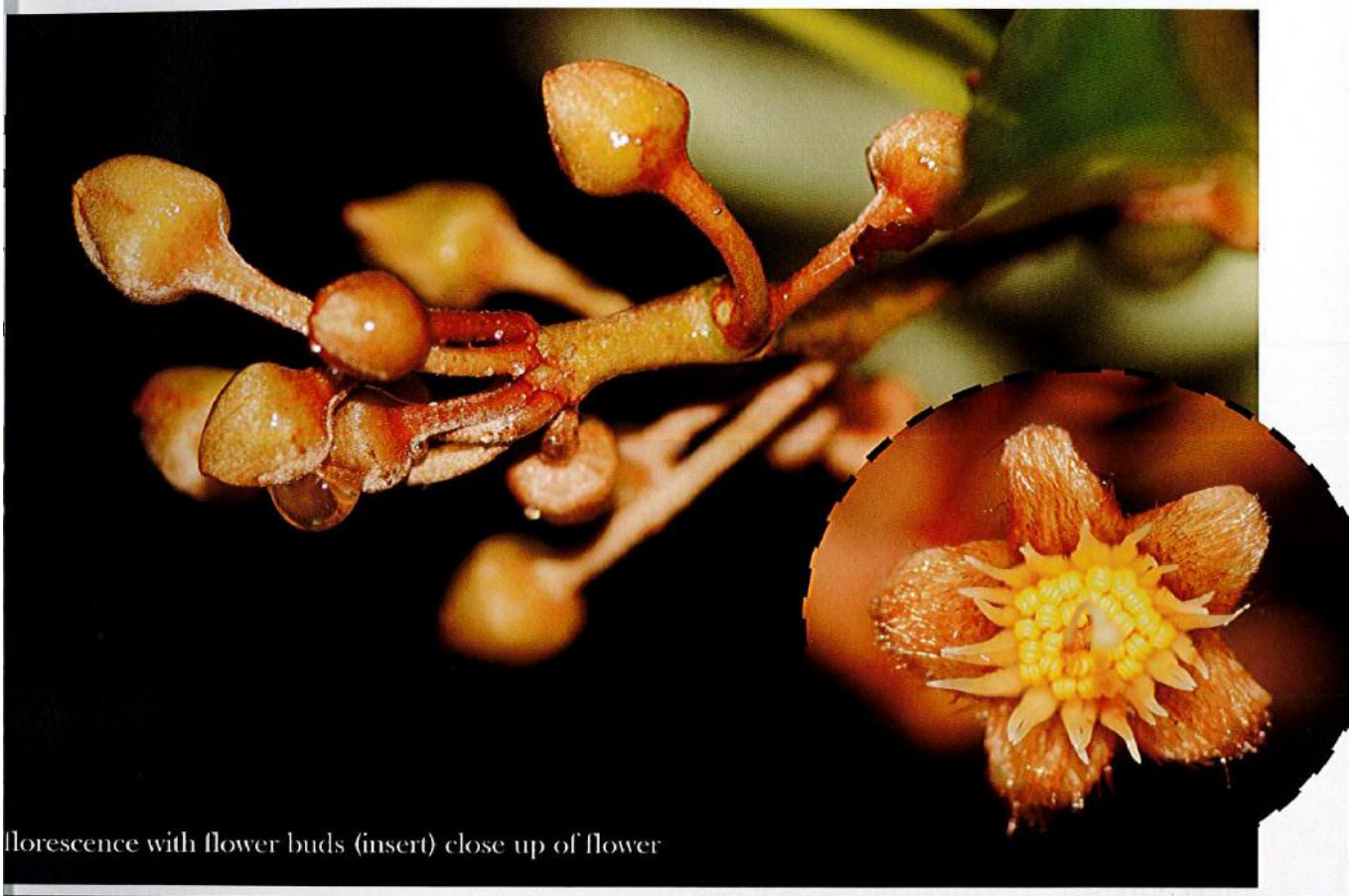
Flowers of *Aquillaria beccariana*



GONYSTYLUS

The Ramin tree or scientifically known as *Gonystylus* is also member of the Thymelaeaceae famuly. T genus *Gonystylus* is a Southeast Asia genus with 32 species of hardwood trees natively ranging from Pa New Guinea, Indonesia, Malaysia, Brunei and the Philippines. Borneo is the best representative of genus with 23 species have been recognized. Other vernacular names for this trees are includes *Mela Ramin bukit* and *Ramin telur*. Among the signficance finding of the Mentawai Scientific Expedition is discovery of a moderately large populations of *Ramin telur* [*Gonystylus bancanus* (Miq.) Kurz.] thought to be becoming rare in the Sarawak forests due to over harvested few decades ago.





florescence with flower buds (insert) close up of flower

ıe Ramin fruits



DIPTEROCARPACEAE

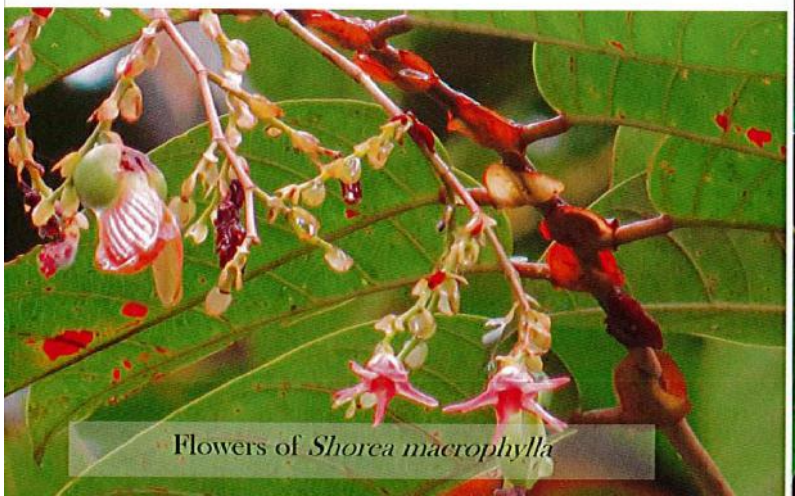
The Dipterocarpaceae have been regarded as allied to Clusiaceae, Theaceae, Tiliaceae and Sarcolaenaceae due to the morphological characteristics. The family has divided into three subfamilies; Dipterocarpoideae, Monotoideae and Pakaraimoideae. The subfamily Dipterocarpoideae comprises 13 genera with about 480 species, confined to the Asian tropics ranging from the Seychelles Islands and Southeast Asia to New Guinea, but absent in the Lesser Sunda. Most genera are occur in the Southeast Asia with the Borneo is considered as the richest area in the world with the dipterocarp species (Ashton, 2004).

The family Dipterocarpaceae is the predominant family of timber trees in tropical lowland evergreen rain-forest in Borneo and one of the most important plant family in Sarawak that contributed for State economical source. Most of the timbers such as *Meranti* (*Shorea* spp.), *Kapur* (*Dryobalanops* spp.), *Keruing* (*Dipterocarpus* spp.), Mersawa (*Anisoptera* spp.) and *Resak* (*Cotylelobium* spp. and *Vatica* spp.) are from this family.

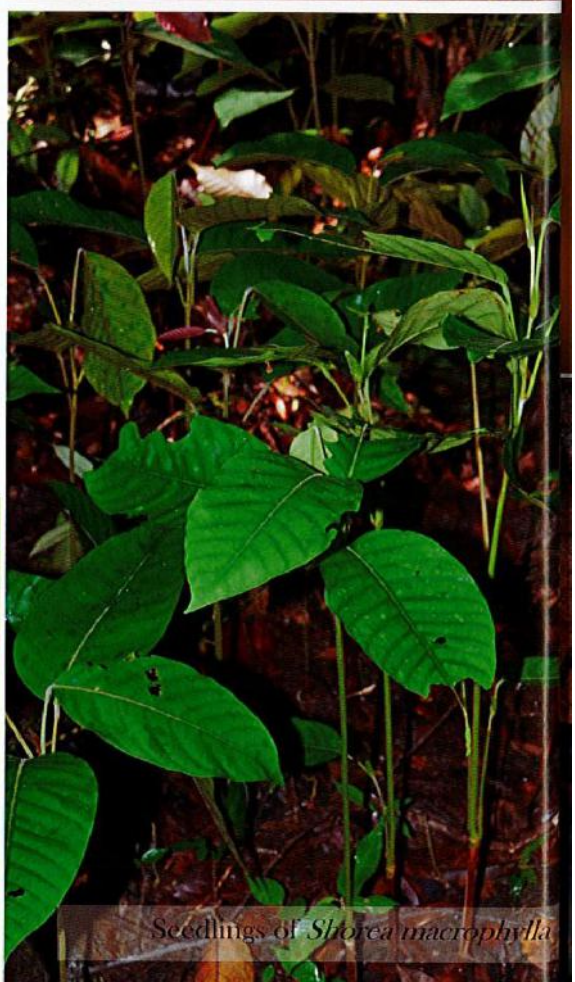
Eight from the nine genera of Dipterocarpaceae in Borneo are found in the Mentawai areas. The *Cotylelobium* is the only genus not recorded here yet. *Shorea, Hopea* and *Vatica* are the three most common genera recorded.



Alan (*Shorea albida*)



Flowers of *Shorea macrophylla*



Seedlings of *Shorea macrophylla*



Keruing (Dipterocarpus) flowers on the forest floor



Hopea flower

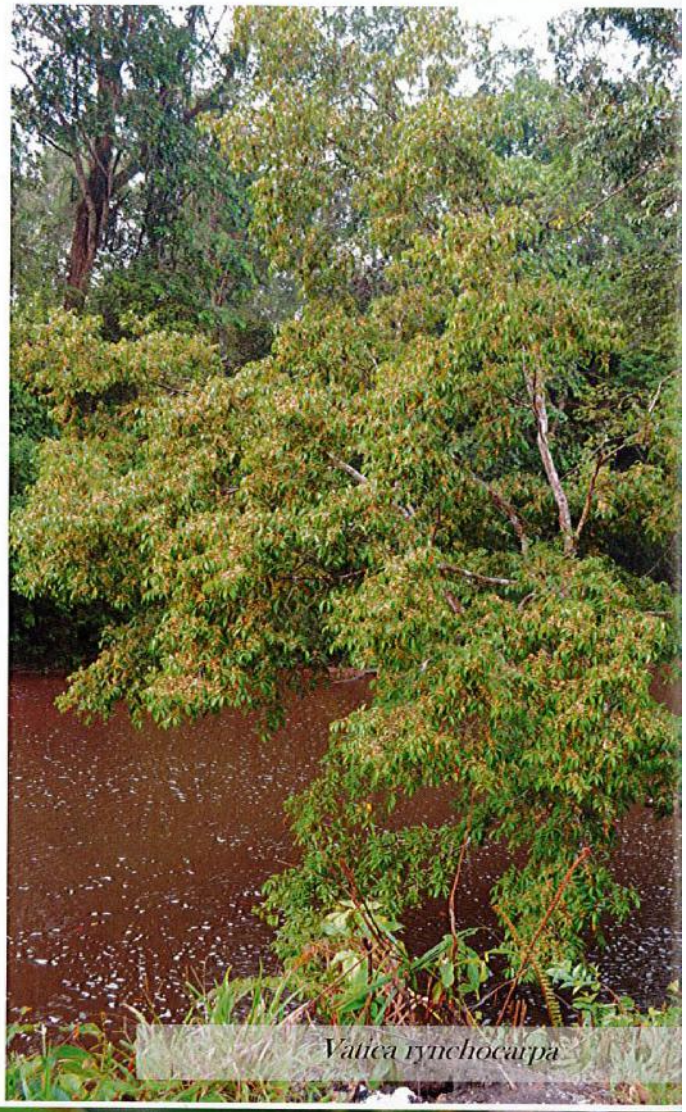


Hopea fruit on the forest floor

VATICA

Genus *Vatica* or vernacularly known as *Resak* is the third largest genus in the family of Dipterocarpaceae after *Shorea* and *Hopea* with 75 species described. Borneo with 37 species has the largest representative (Symington, 2004; Meekiong et al. 2014) and considered as the centre of diversity. A total of 34 species have been recorded from Sarawak that occur in various habitats, especially in mixed dipterocarp forest and also non-saline habitats, from the sea level up to 1,800 m altitude. The genus *Vatica* is distinguishable from the other genera in the family by the absence of looped intra-marginal nerves on the leaves, the winged-fruits enclosing less than half of the nut, anthers are glabrous and style is stout.

During the scientific expedition, nine *Vatica* species have been recorded from the Mentawai areas. The species are *V. coriacea, V. dulitensis, V. granulata, V. havilandii, V. mangachapoi* ssp. *mangachapoi, V. micrantha, V. oblongifolia* ssp. *crassilobata, V. rynchocarpa, V. umbonata* and *V. venulosa.*



Vatica rynchocarpa



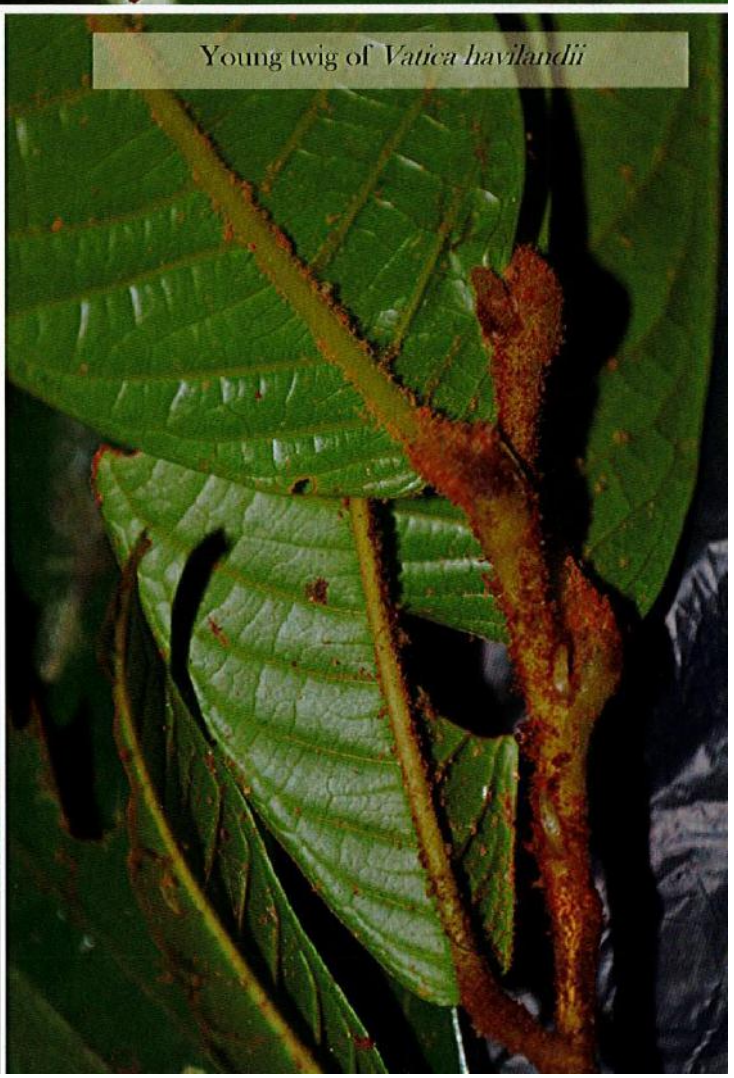
Flowers of *Vatica rynchocarpa*



Immature fruit of *Vatica sarawakensis*



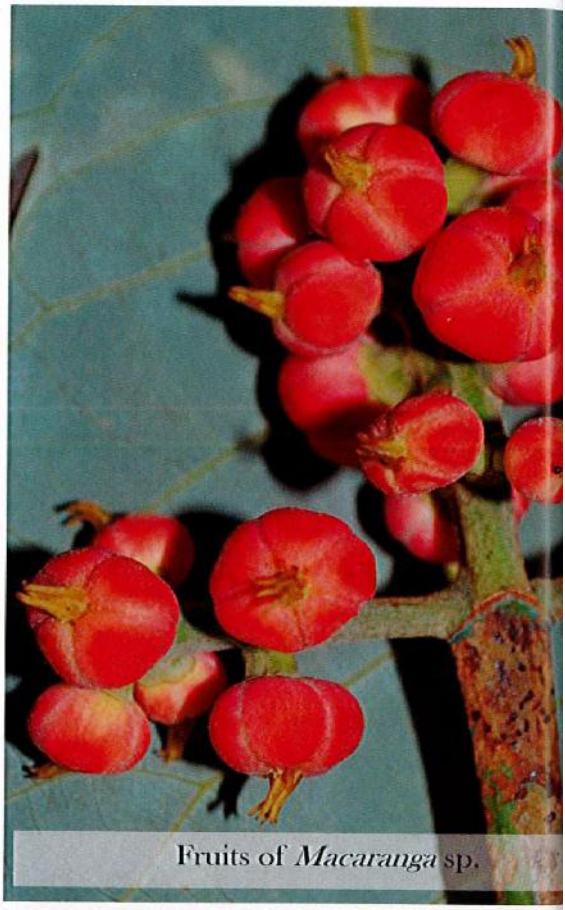
Seedling of *Vatica venulosa*



Young twig of *Vatica havilandii*

EUPHORBIACEAE

Euphorbiaceae or the spurge family is a large family of flowering plants with about 300 genera and 7,500 species that divided into 37 tribes and three subfamilies. Majority of the species are found in the Indo-Malayan region and tropical America. A number of plants of the spurge family are considerable economic importance such as cassava (*Manihot esculenta*), *Barbados nut* (*Jatropha curcas*) and rubber tree (*Hevea brasilliensis*) and many are grown as ornamental as for example the Poinsettia (*Euphorbia pucherrima*). Among the genus recorded in the Mentawai areas area *Blumeodendron, Croton, Elateriospermum, Endospermum, Macaranga, Pimelodendron* and *Ptychopyxis.*



Fruits of *Macaranga* sp.

PHYLLANTHACEAE

The family Phyllanthaceae is a family of flowering plants in the order Malpighiales. It is most closely related to the family Picrodendraceae. The distribution is ranging from the tropics to south temperate zone and few in the middle of north temperate zone. This family comprises about 2,000 species that grouped into 54 to 60 genera with majority of the member are from the genus *Phyllanthus* with about 1,200 species. Many of the genera such as *Antidesma, Aporusa, Baccaurea, Bridelia, Cleistanthus* and *Phyllanthus,* are previously treated under the family Euphorbiacea and moved into this family based on the molecular evidences. Some species of *Andrachne, Antidesma, Margaritaria, Baccaurea, Phyllanthus* and *Uapaca* are in cultivation for the edible fruits.



Flowers of *Baccaurea* sp.





FAGACEAE

Fagaceae or commonly known as Oak family is one of an important trees that are common constituents of understorey, main canopy and rarely emergent layers of the lowland to montane forests in the Borneo Island. About eight genera with more than 800 species, distributed both in the temperate and tropical regions, but mostly in the northern hemisphere. In Borneo, only four genera (*Castanopsis, Lithocarpus, Quercus* and *Trigonobalanus*) that comprisisng about 100 species with 49 species are endemic (Soepadmo et al. 2000). The genus *Castanopsis* or vernacullay known with "Berangan" and *Lithocarpus* with the names "Empenit or Empili or Mempening" are the the most two common found in the lowland forests of Mentawai areas.

The trees of this family are classified as heavy hardwood timber which is suitable for medium and heavy constructions such as house post, beam joineries and flooring. The nuts of some species are edible, and consumed after boiling or roasting.





ANNONACEAE

Annonaceae or Soursoup family or sometimes also known as "Custard Apple family" is one of the most common plants in the Bornean tropical rainforests and one of the largest family in the Order Magnoliales with more than 230 genera that consists of 2,300–2,500 species throughout the world. The habits ranging from a small plants to a large plant, up to 30 m tall and more than 60 cm dbh or shrubs and woody climbers. The distributions of this family is concentrated in the tropics regions and only few genera found in the temperate regions with the Indomalaya is tought to be the centre of species diversity.

Ten genera with about 25 species were recorded in the Mentawai areas during the expedition, which are commonly seen in the riparian forest, peat swamp and the limestone vegetation. Among the genera recorded are *Cyathocalyx, Enicosanthum, Fissistigma, Goniothalamus, Mitrephora, Polyalthia, Uvaria* and *Xylopia.*



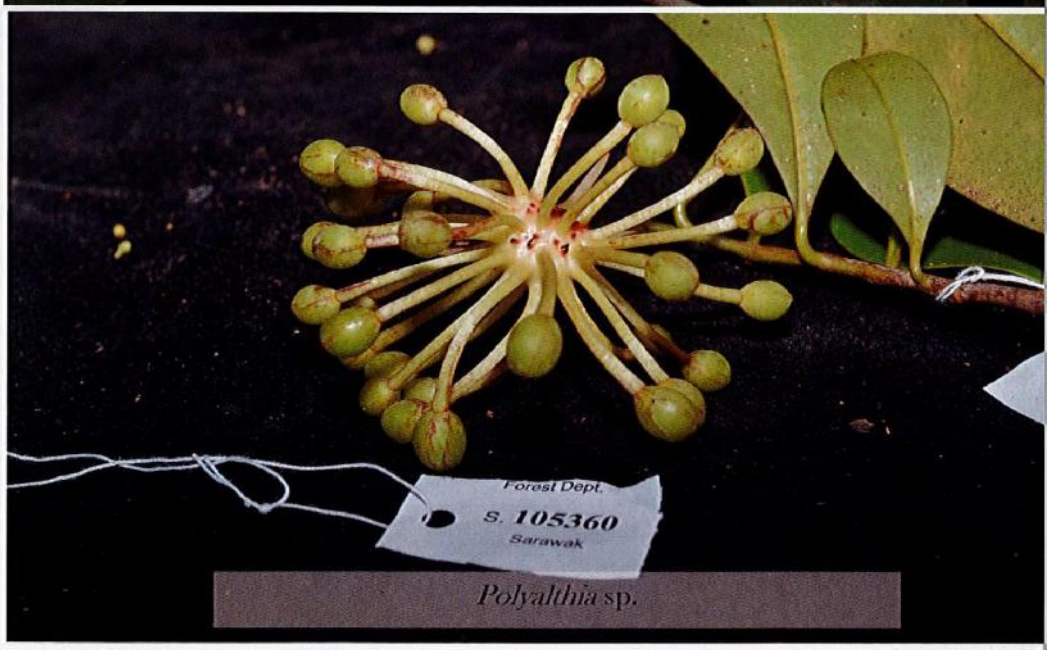




Goniothalamus sp.



a glabra



Polyalthia sp.



Polyalthia sp.

CLUSIACEAE

Clusiaceae or previously as Guttiferea is one of important trees family in the tropics. Many of the members in this family are being planted for edible fruits, spices, medicines and ornamental plants such as *Garcinia mangostana* (manggis), *G. miqueli* (Kandis asam) and *Callophyllum* spp. (Bintangor). In the field, the members of Clusiaceae are not difficultly to identify as their has opposite leaves and produced yellow or pinkish white latex on the slashed inner bark. *Calophyllum, Garcinia* and *Mammea* are the three common genera found in the riparian, kerangas and limestone forests in Mentawai.



Calophyllum sp.

SAPINDACEAE

Soapberry or in Malaysia popularly known as Rambutan family is a flowering family in the order Sapindales. This family has divided into four sub-families that consists of about 1,900 species in 140 genera worldwide. Plants in this family have a variety of habits, from trees to herbaceous or lianas and most of them often with pinnately compound leaves. Sapindaceae includes many species of economically valuable tropical fruit, including the lychee, longan, rambutan and pulasan. *Allophylus, Dimocarpus, Harpullia, Lepisanthes, Nephelium, Pometia* and *Xerospermum* are the genera recorded in the Mentawai. *Pometia pinnata* or Kasai is commonly found on the river bank along the Sungai Mentawai and Sungai Medalam.



Garcinia sp.



Pometia pinnata



Nephelium rambutan-ake



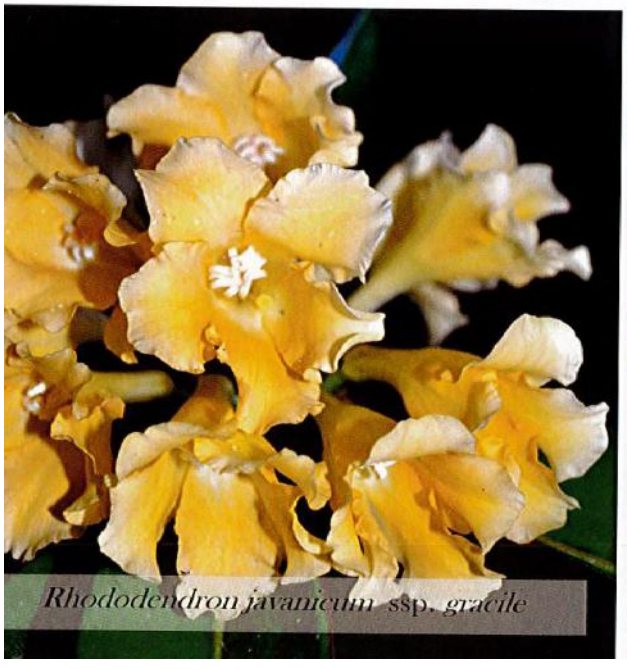
RHODODENDRON

The genus *Rhododenron* or vernacullarly known as Tassak by the Iban people in Sarawak is a member of Ericaceae family. This an attractive group of plants that have large and showy beautiful flowers are considered important plant for horticultural in many parts of the world. The *Rhododendron* is considered a large genus with about 900 species recorded in the world and majority of them are native to the highland of Himalaya Region from northern India through Nepal into western China (Argent et al. 1989).

About 55 species have been recorded in Borneo, with 42 species in Sabah (Argent et al. 2007) and 41 species in Sarawak (Meekiong et al. 2014). During the surveys, only four species of *Rhododendron* were recorded from the Mentawai areas. The species are *R. cuneifolium* Stapf. var. *cuneifolium*, *R. javanicum* (Blume) Benn. subsp. *gracile* Argent, *R. longiflorum* Lindl. var. *longiflorum* and *R. nieuwenhuisii* J.J. Sm. *Rhododendron longiflorum* var. *longiflorum* and *R. nieuwenhuisii* were the most common species spotted as epiphytes on the tree trunks or branches along the Mentawai river.



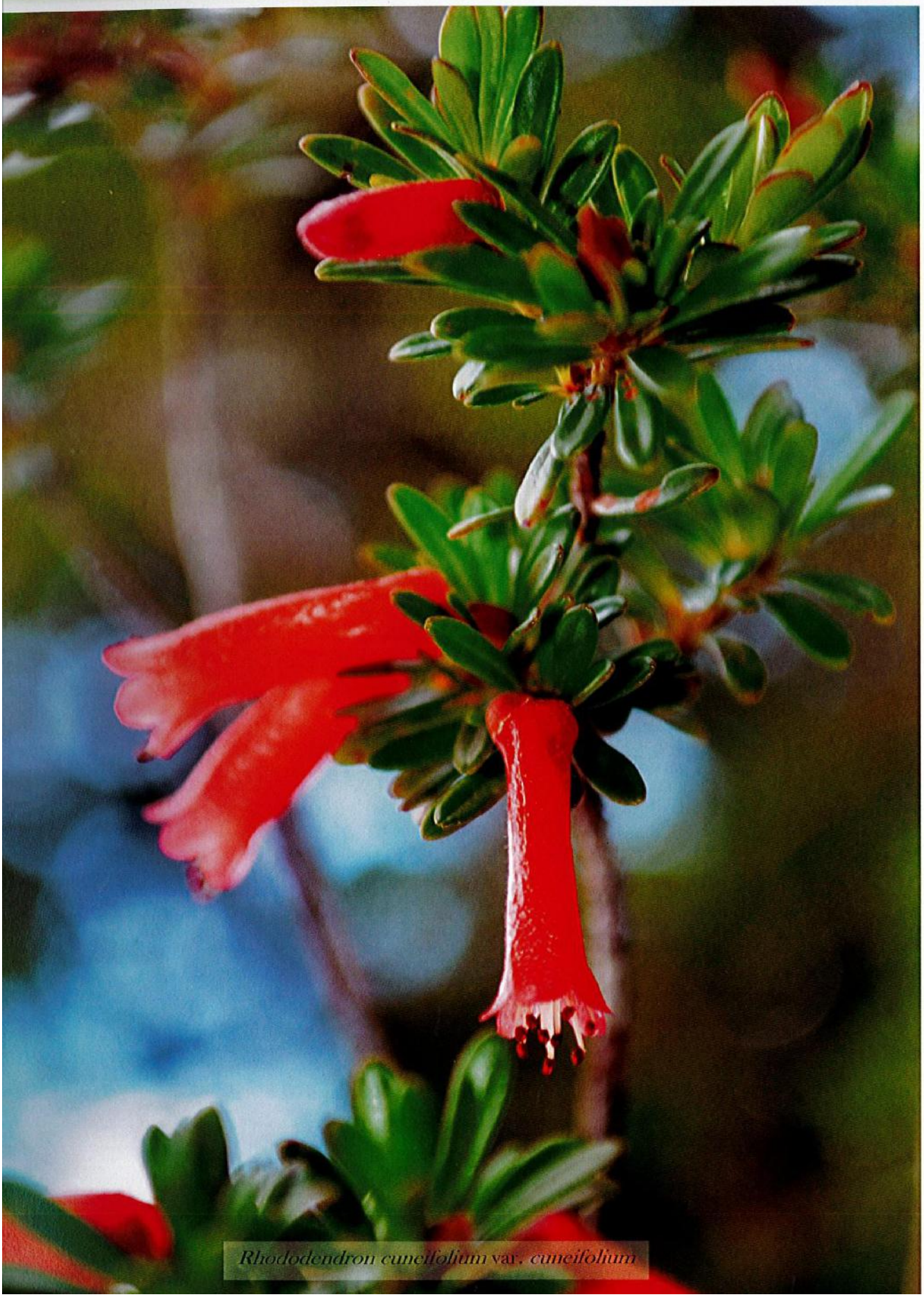
Rhododendron nieuwenhuisii



Rhododendron javanicum ssp. *gracile*



Rhododendron longiflorum var. *longiflorum*



Rhododendron cuneifolium var. *cuneifolium*

UNDERSTOREY PLANTS

Understorey is the underlying layer of vegetation in a forest that dominated by the small trees shrubs that growing between the forest canopy and the forest floor. The plants in this layer comp an assortment of seedlings and saplings of canopy trees together with understorey shrubs and h Almost all the plant components in this layer are crucially important for humans and animals life. forest layer majority is dominated by the member from the family of Arecaceae (palms), Ara (aroids), ferns, Annonaceae, Euphorbiaceae, Fabaceae, Melastomataceae, Moraceae and Rubiacea



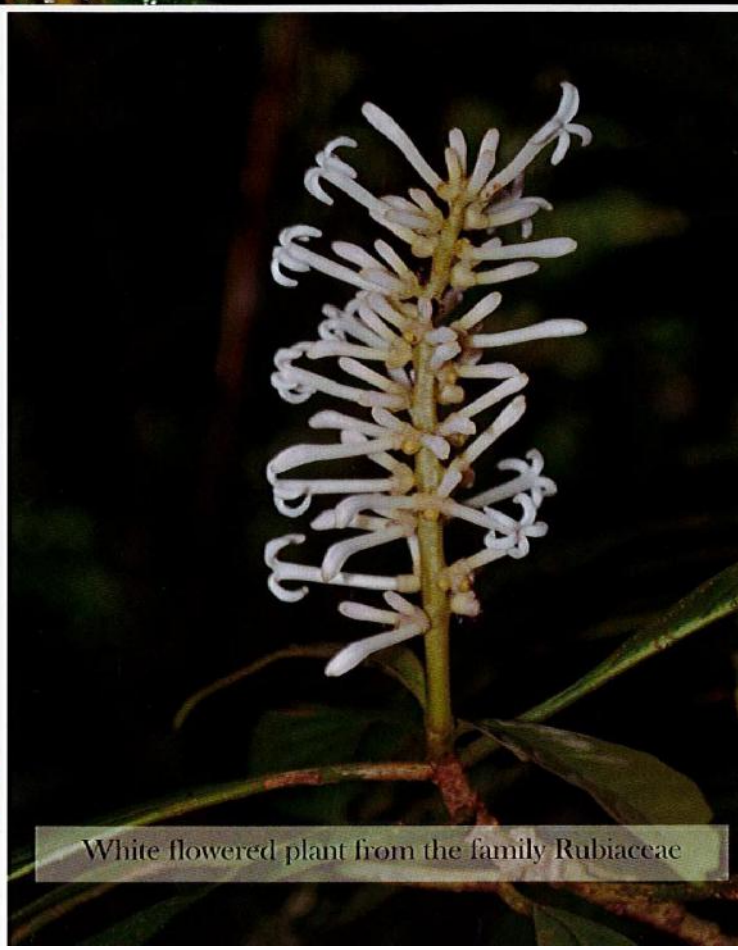
Cauliferous inflorescence of *Pongamia* sp.



The blue violet flowers of plant from the family Rubiaceae



Ixora sp.



White flowered plant from the family Rubiaceae



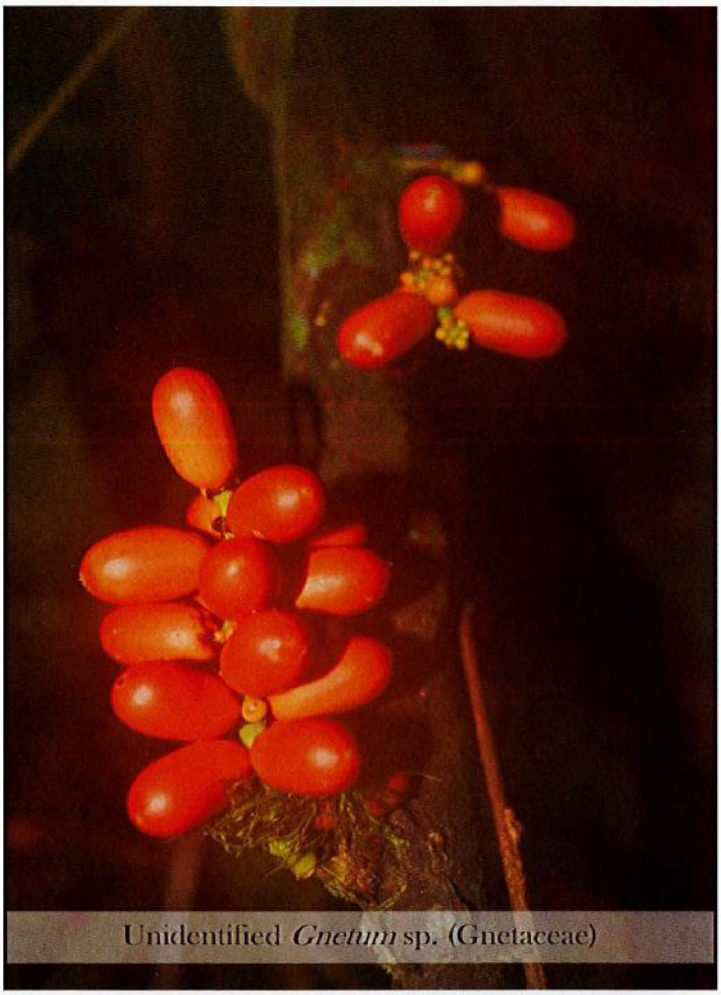
The fruits of Entimau tree (*Ficus* sp.)



The flowers of *Polygala venenosa*



iful ornamented leaves of *Sonerila cf. pulchella*



Unidentified *Gnetum* sp. (Gnetaceae)



Fruits of *Piper* sp.



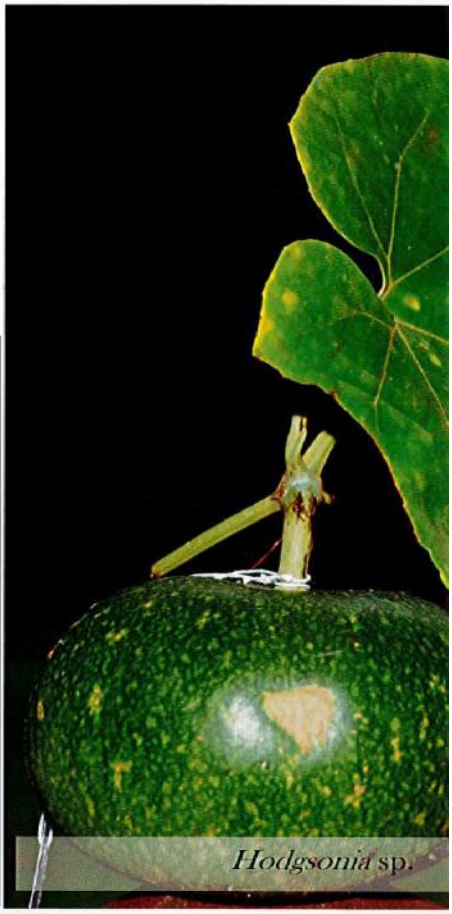
Pinkish purple fruits of *Medinilla* sp.

CLIMBERS

The common climbers families in the Mentawai areas are Apocynaceae, Araceae, Arecaceae (rattan), Cucurbitaceae, Fabaceae, Rubiaceae and Vitaceae.



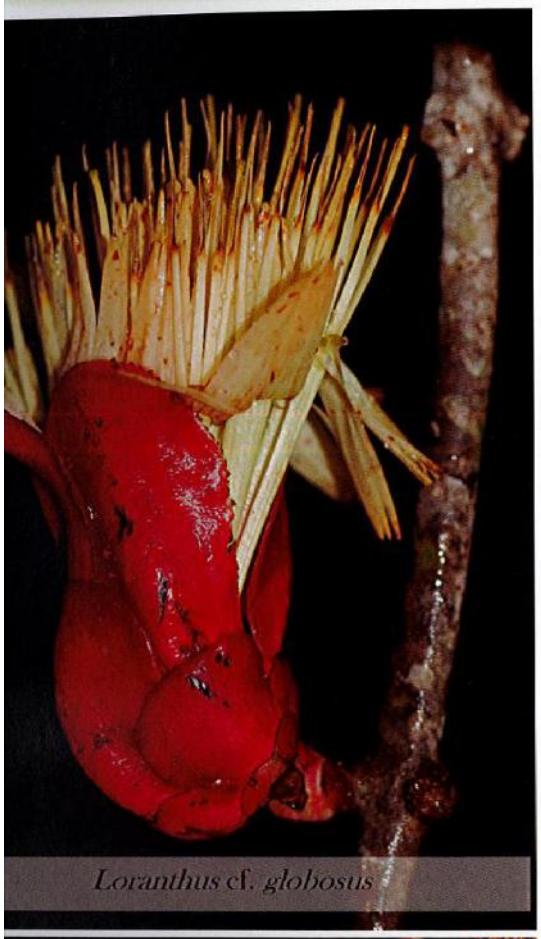
Lepisanthes polita



Hodgsonia sp.



The flowers of *Hodgsonia* sp.

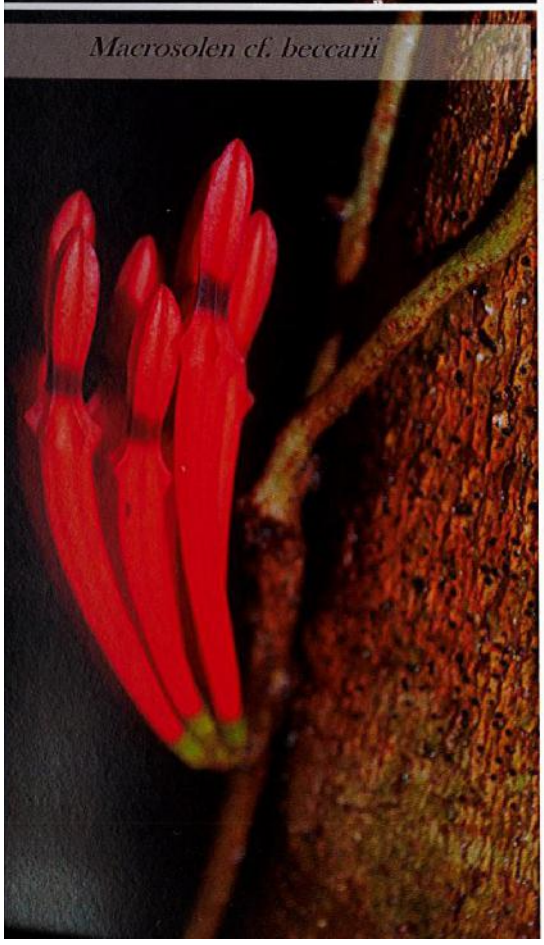


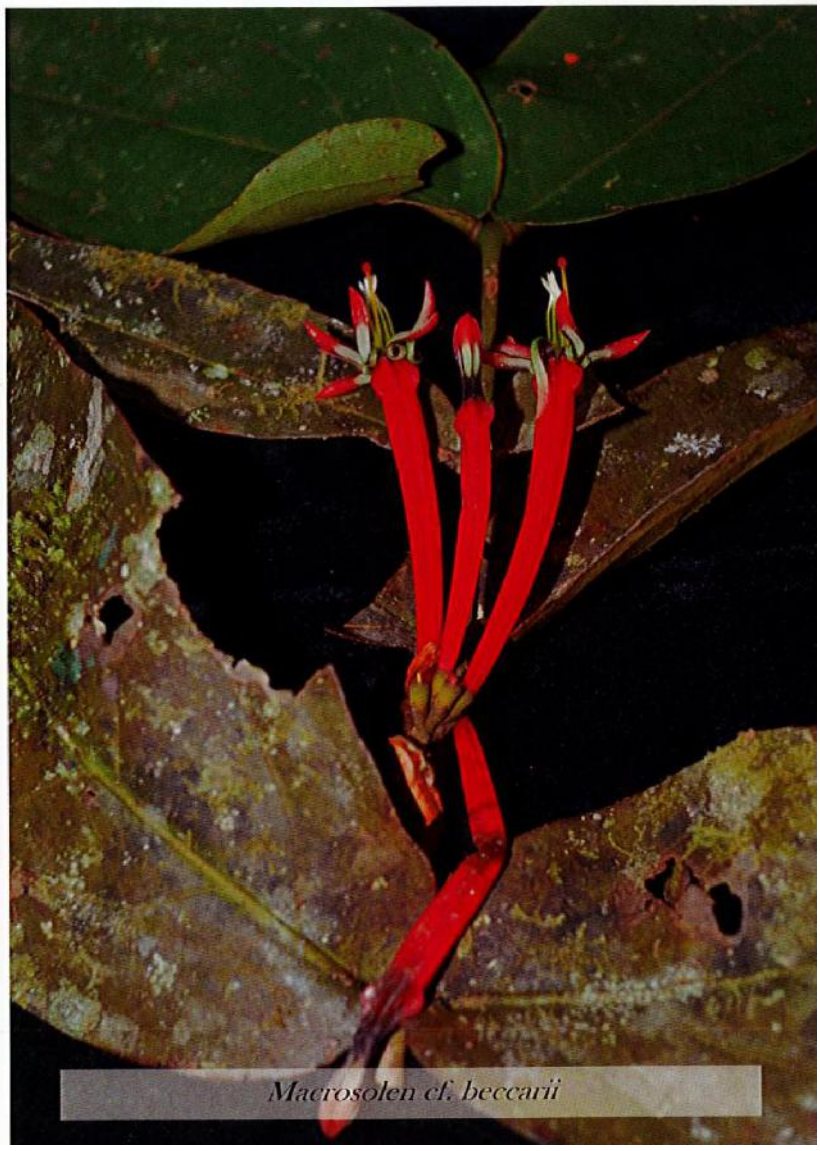
Loranthus cf. *globosus*

HEMIPARASITES

A plant that obtains nourishment from its host but at the same time also photosynthesizes also called as semi-parasite. Many of the Loranthaceae family are considered as hemiparasites. No study have been conducted on the hemiparasite plants in Sarawak, particularly the Loranthaceae family. Two genera with one species each were recorded in Mentawai area during the expedition, viz. *Loranthus cf. globosus* and *Macrosolen cf. beccarii.*

Macrosolen cf. beccarii





Macrosolen cf. beccarii

AMORPHOPHALLUS

The corpse flower or locally known with many names such as *Bunga bangkai, Bunga mayat, Mayak* or *Skot berungan,* was so-called named due to the unpleasant smell of the flower. The generic name is derived from the Greek words meaning "without form or misshapen penis" that referring to the shape of the prominent spadix. This genus is grouped into the Yam family, Araceae. One of the *Amorphophallus* member, *A. titanum* or sometimes known as "titan arum"is the world largest unbranched inflorescence, with a height of 2.5 m and width of 1.5 m. Four species have been recorded from the Mulu National Park *viz. A. borneensis, A. infundibuliformis, A. julaihii* and *A. pendulus.* However, *A. borneensis* and *A. pendulus* are the only two species are commonly spotted in the Mentawai area.



Amorphophallus borneensis plants



Infructescence of *Amorphophallus bo*



Close-up of the *Amorphophallus born*

LOCASIA

The genus Alocasia is restricted to tropical and subtropical humid forest with geophytes or terrestrial bit on the forest floor, in leaf litter or humus deposits on rocks. All the members in the genus are oad cordate or sagittate leaves that can grow to a length of 20–90 cm on long petioles. The plants rmally are rhizomatous or tuberous. There are about 70 species of *Alocasia* recorded in the word th one third of the total number representing by the Bornean species. More than 10 species were corded in the Mentawai areas during the scientific epedition. *Alocasia melo* Hay which is frequently otted on the damp and wet places in the deep shaded mixed dipterocarp forest is very attractive and ving high ornamental value. *Alocasia beccarii* Engl. is peat swamp and kerangas specialist plant, which rmally not easy to spotted as the leaves are plain green and different shaped from othe species. Other ecies that recorded are *A. robusta, A. scabriscula* and *A. infernalis.*



ng of *Amorphophallus pendulus*



Alocasia melo

sia beccarii



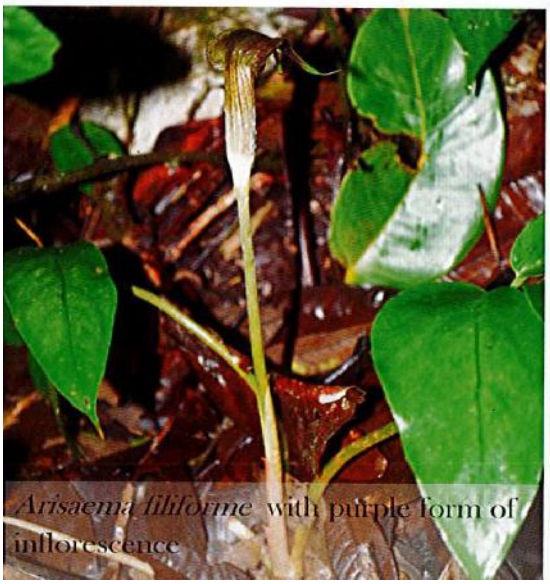
ARISAEMA

Vernacularlly known with many names, commonly as "Cobra Lilies" or in the western called as the pulpit" or Dragon root or Green dragon, which referring to the distinctive appearance of the flo consists of an erect central spadix rising from the spathe. The genus *Arisaema* is moderately la diverse genus in the family Araceae with about 180 species recorded. This genus divided int sections and the distribution is ranging from the temperate and warm temperate eastern and North America, Mexico, tropical east and northern east Africa, Arabian Peninsula, temperate e tropical south, southeast and east Asia and Malay Archipelago with China and Japan are thought t centre of species distribution. In Borneo they are normally found at damp and wet place in lowlan dipterocarp forest to submontane forest at 90–1600 m altitude and sometimes commonly found pockets or boulders in the limestone habitat. One unsual trait shared by all *Arisaema* species, those of other genera in Araceae is the sex change. *Arisaema* plants are typically male when sm female or hermaphraditic when adult, with a single plant capable of changing sex based on nutition et al. 2004) and genetics (Vitt et al. 2003), and perhaps changing sex several times during its (Renner et al. 2004).

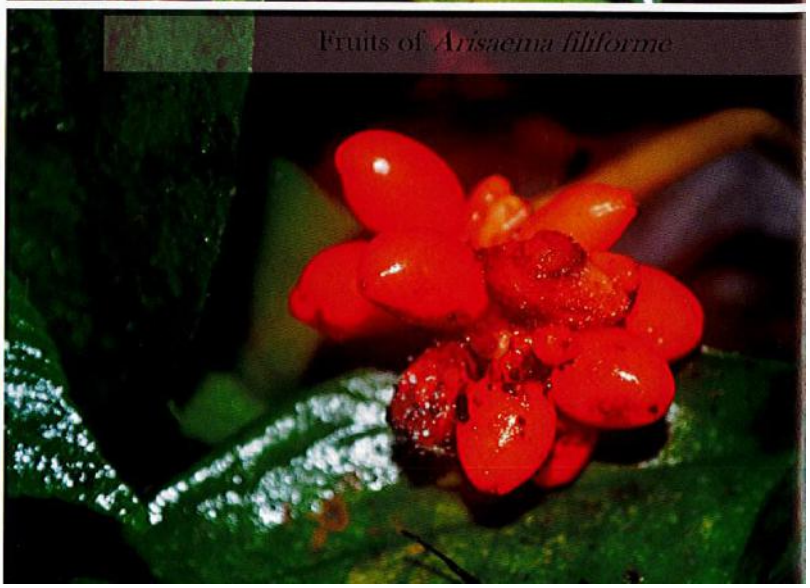
Arisaema filiforme (Reinw.) Blume was first described as *Arum filiforme* before it transferred into the genus *Arisaema* by Blume in 1836. This species is placed under the section *Fimbriata*, that native to the Southeast Asia. Small tuberous herb up to 30–45 cm, leaf normally trifoliate. The spadix may be green or purple and appendix is usually long and thin. Fruits berries, bright orange colour.



Leaves *Arisaema filiforme*



Arisaema filiforme with purple form of inflorescence



Fruits of *Arisaema filiforme*



Arisaema filiforme (insert photo: close-up of the flower)

CRYPTOCORYNE

The *Cryptocoryne* is an aquatic or amphibious plant genus within the Araceae family. It is native to tropical Asia with distribution ranging from India in the west to the Philippines in the east, onwards to Malaysia, through Indonesia to Papua New Guinea. The genus *Cryptocryne* was established by Wydler in1830 based on the Indian species, *C. spirale.* More than 60 species of *Cryptocoryne* have been described and many of them are endemic and localize to very specific area. The generic name is derived from the Greek words, meaning 'the hidden club' referring to the inflorescence which typical of the Arum family. Vernacullarly known as *Kiambang batu* in Malay, *Kelatai or Kelekatai* by the Iban and *Timun amun* by the Melanau in Sarawak.

Two species were recorded in the Mentawai areas, *viz. C. longicauda* and *C. striolata.* The *Cryptocroryne longicauda* was found in more or less slow-running stream or in a small forest pool, whereas *C. striolata* was normally in fast-running water.

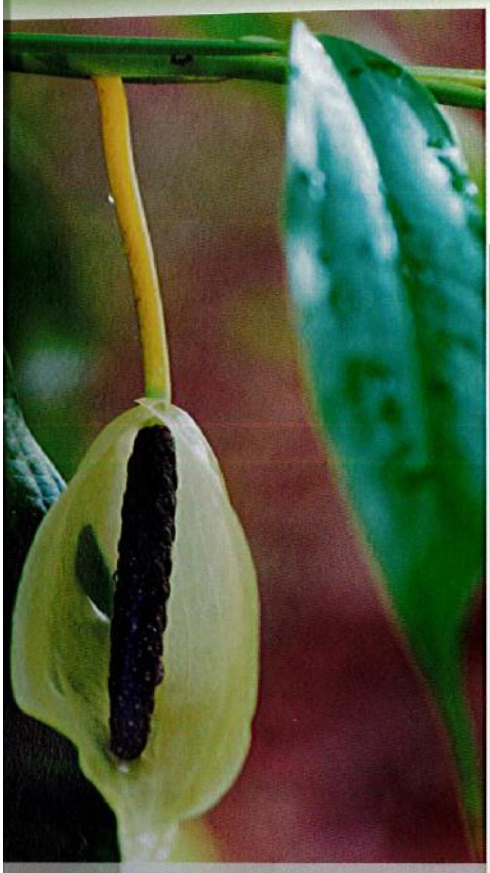


Cryptocoryne striolat



Cryptocoryne longicauda

Other aroids genera recorded in the Mentawai areas are such as *Aglaonema, Buchepalandra, Crytosperma, Homalomena, Lasia, Podolasia, Pothos, Rhapidophora, Schismatoglottis, Scindapsus* etc.



Pothos



Aglaonema sp.



Schismatoglottis sp.

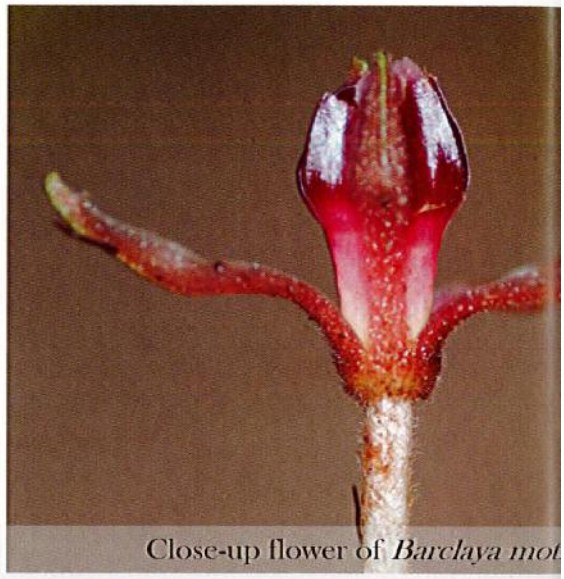
Matured fruits of *Aglaonema* sp.



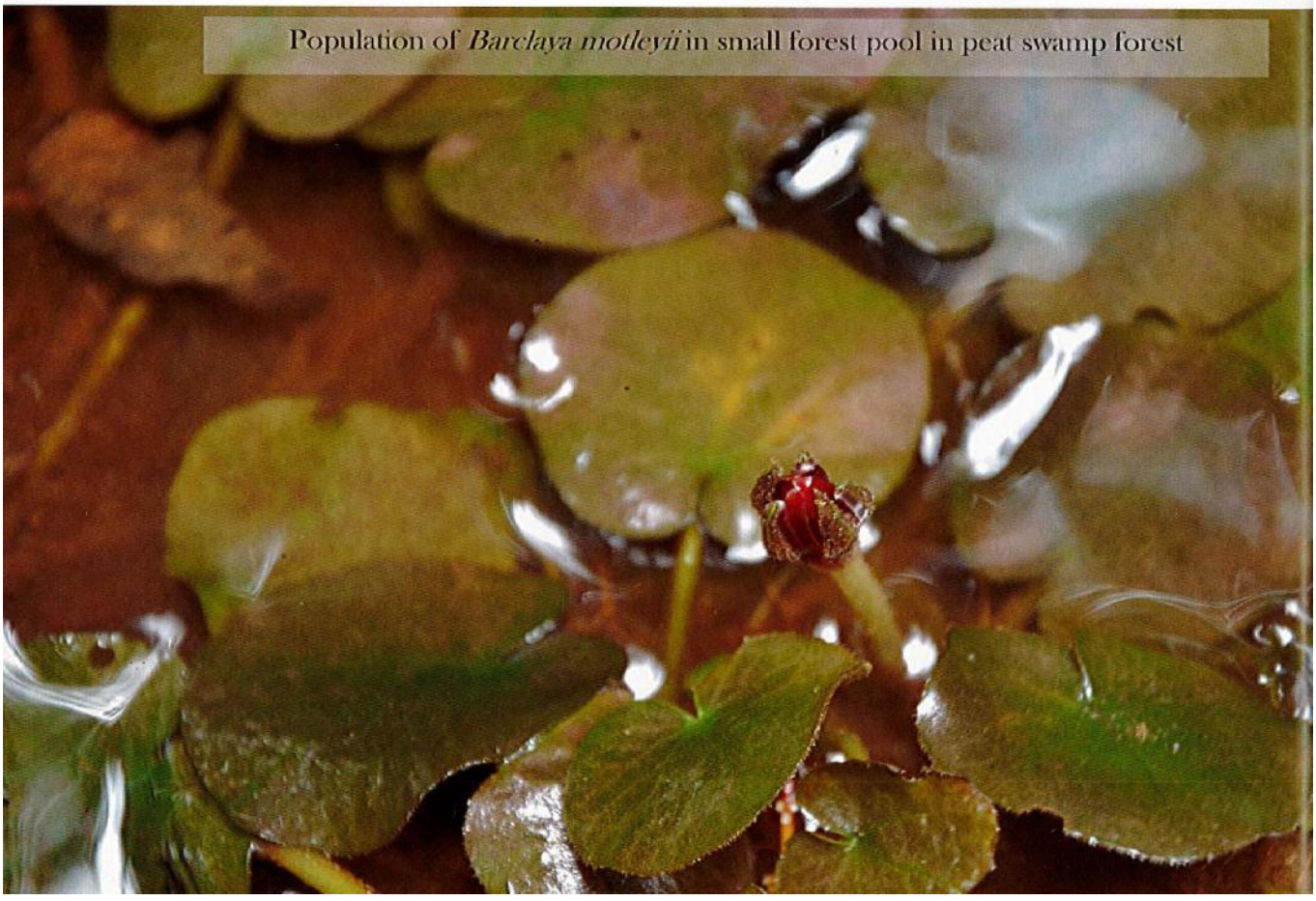
BARCLAYA

The genus *Barclaya* is a member of Nymphaeaceae family with to-date only four recognized specie *viz. B. longifolia* Wall., *B. motleyii* Hook.f, *B. kunstleri* (King) Ridley and *B. rotundifolia* Hott aquatic plant genus is endemic to the Southeast Asia. The number of *Barclaya* species in Southea however will by increased with four new species are recently discovered, two from Peninsular Mala two species from Indonesia (Jacobsen, *pers. com.*)

However, only two species recorded in Sarawak, *B. motleyii* and *B. rotundifolia. Barclaya motleyii* is the most common species that recorded from many localities with different habitats and widely distributed in Southeast Asia. Its habitat are very diverse ranging from opened cultivated areas and secondary forests to virgin forests in forest floor, ditches, small streams and rivers. While *B. rotundifolia* was described by Mitshuro Hotta based on the specimen collected from Sarawak and also found in Southern Peninsular Malaysia and Riau areas. Only one species recorded in the Mentawai area during the scientific expedition, *B. motleyii* recorded in small streams along the Head Hunter Trail and also in the small forest pools in the peat swamp and kerangas forest areas.



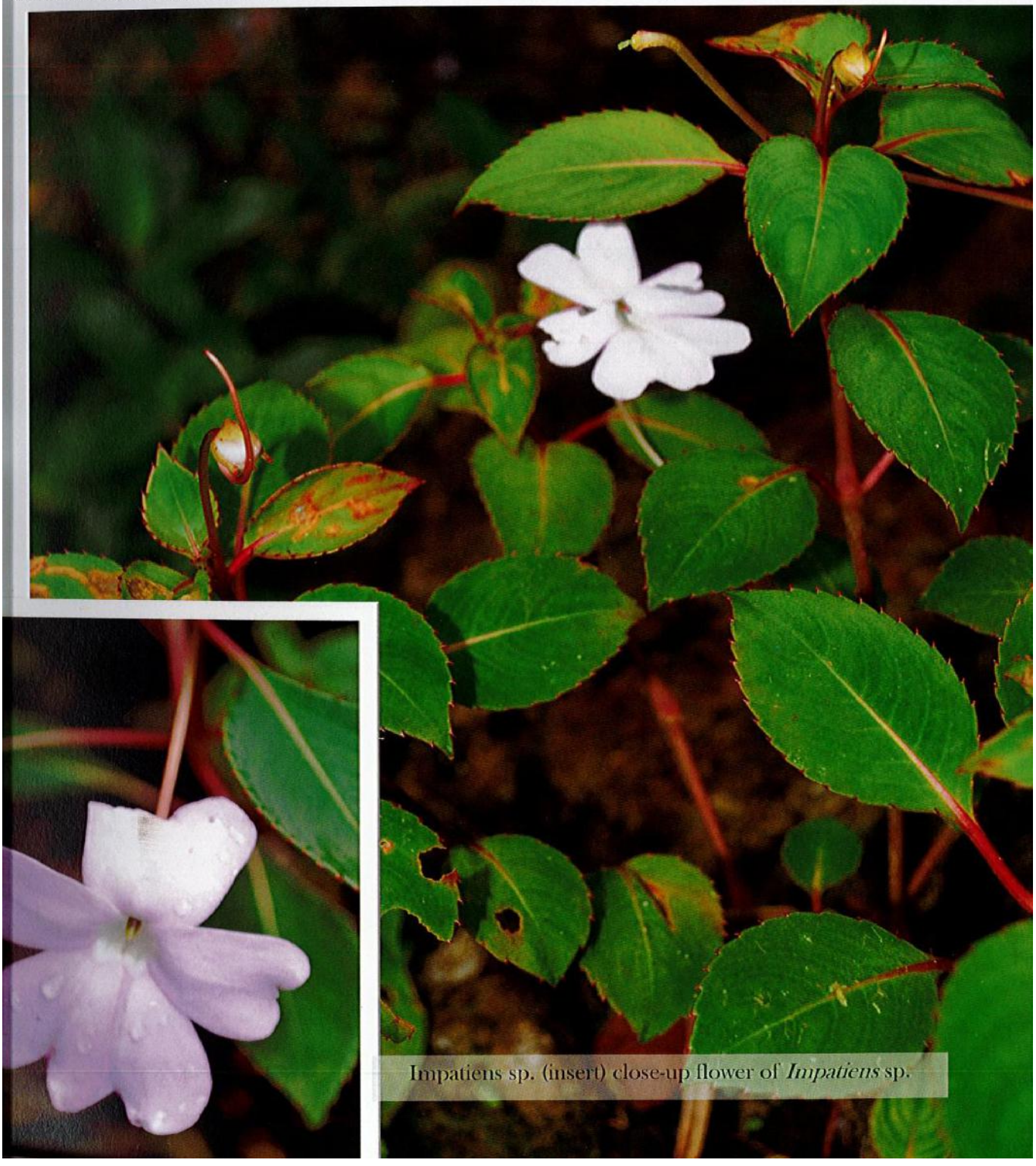
Close-up flower of *Barclaya mot*



Population of *Barclaya motleyii* in small forest pool in peat swamp forest

MPANTIENS

genus about 850 - 1000 species worldwide distributed from Northern hemisphere and the tropics, long to the family Balsaminaceae. The word *Impatiens* is from a Latin word, meaning "touched-me-t" referring to the explosive dehiscence of seed capsules. So far, no study have been conducted on this tential medicinal plant in Sarawak and it is estimated about 10 species native here. Only one species orded in Mentawai, found on the limestone pockets and boulders along the Head Hunter Trail.



Impatiens sp. (insert) close-up flower of *Impatiens* sp.

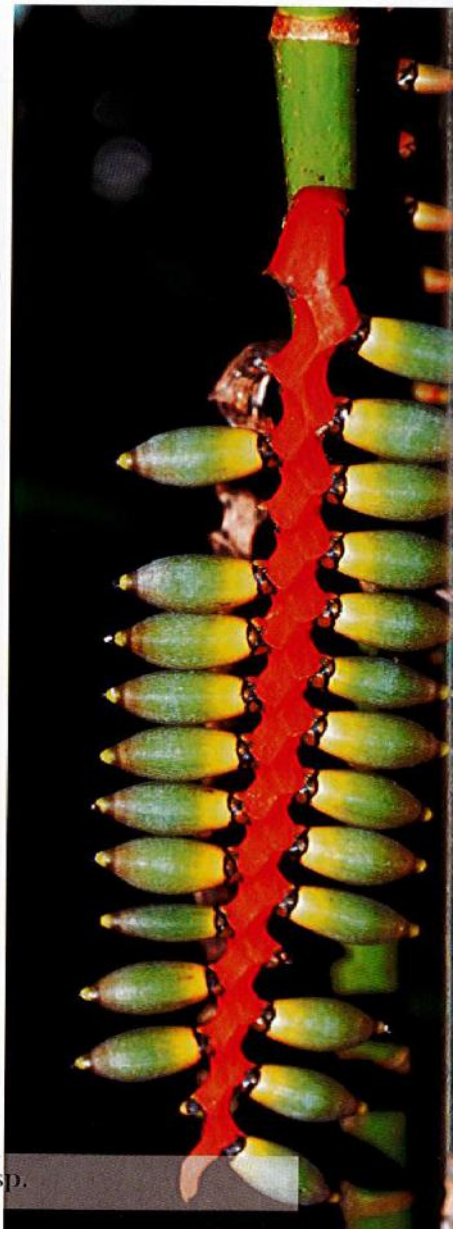
ARECACEAE

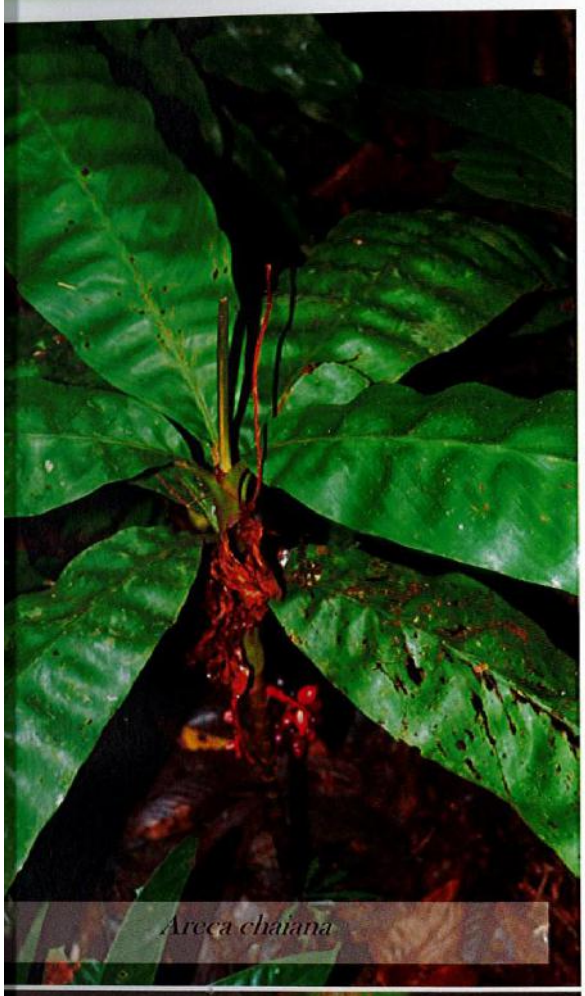
Arecaceae or Palmae or invalidly known as Palmaceae is widely distributed from tropical, sub and temperate climates. Morphologically most of the palms are trees or shrubs with unbranched branched trunks, occasionally rhizomatous with some members are climbers. The apex of stem with large apical meristem. The plants are sometimes spiny due to modified leaf segments, expose sharp-pointed roots, or petiole out growths. Arecaceae is the only family in the order Arecales. T family roughly estimated with 200 genera with around 2,600 species worldwide. Most of the me the family are restricted to the tropics, subtropics and warm temperate.

The palm flora in the Mulu National Park have been enumerated by J. Dransfield during th Geographical Society expedition, where recorded about 116 species from 19 genera in the Par then, no comprehensive study have been conducted for this family from that areas. Men exceptionally rich with palm flora, about 30 species from eight genera were recorded du expedition.



Pinanga sp.

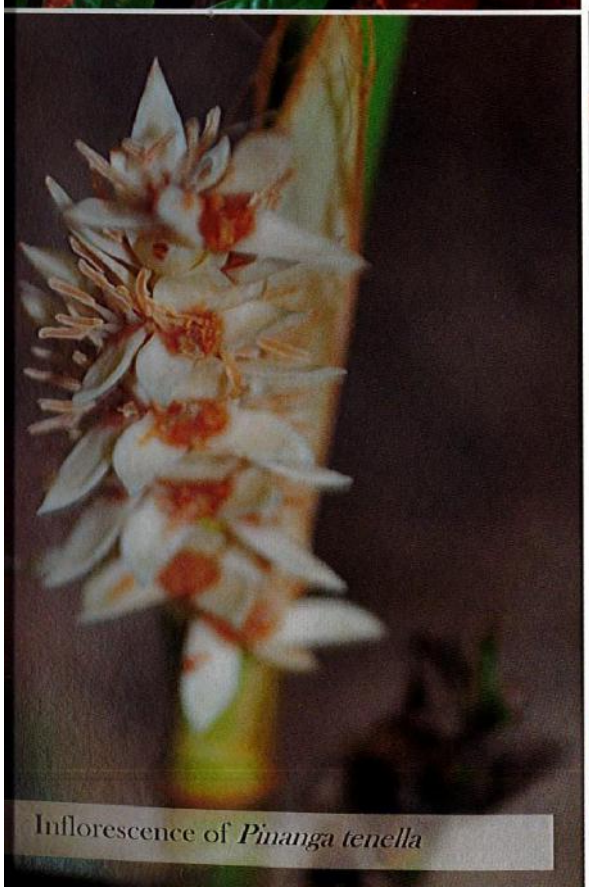




Areca chaiana

The genus *Areca* or vernacularly known as Pinang is a genus about 50 species that found in humid tropical forests from China and India, across Southeast Asia to Melanesia. The generic name is derived from a name used locally on the Malabar Coast of India and the best well known representing this genus is *Areca catechu* or betel nut or Pinang.

Pinanga is moderately large palm genus with 142 species worldwide. This genus are native to the New Guinea and eastern and southern Asia (includes China, India, Indonesia, the Philippines and Malaysia. More then 50 species recorded in Borneo and Dransfield (1984) reported about 20 species from the Mulu National Park. Only ten species recorded during the expedition with *Pinanga tenella* was the common diminutive palm growing on the rocks along the Mentawai and Medalam river banks.



Inflorescence of *Pinanga tenella*



Immature fruits of *Pinanga mooreana*



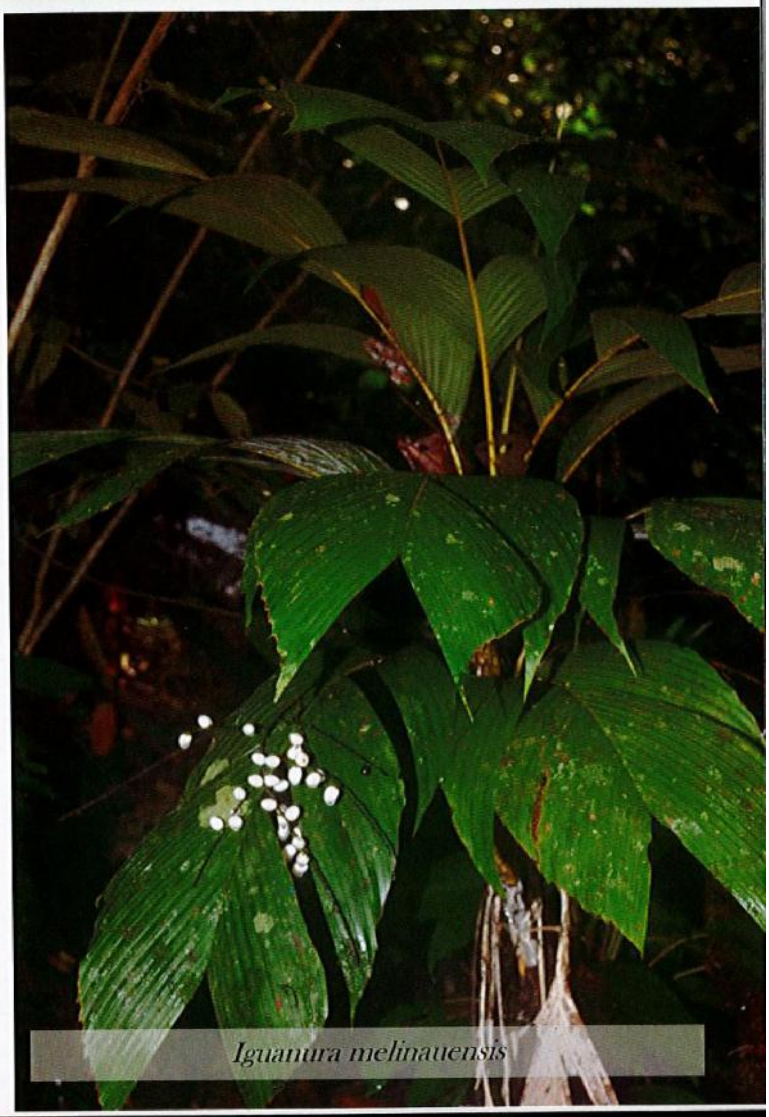
Licuala sp.



Licuala sp.

genus *Licuala* Wurmb. or commonly
n as *Palas* by the Malay in Peninsular
ysia and *Biruk* in Sarawak is a genus
nonly found in tropical rainforests from
nern China, Southeast Asia, the Himalayas,
Guinea and the Pacific islands. There about
species have been described with the Malesia
n as centre of species distribution. Only four
es have been recorded from the Mulu
onal Park areas with all the species were
ified as endemic to Sarawak and *Licuala*
a Dransfield recognized as hyper endemic to
Mulu National Park (Dransfield, 1984).

genus *Iguanura* Blume with ornamental
e as "Lizard tail palm" or locally known as
ang" is a Arecaceae genus that restricted to
Southeast Asia region. There are about 35
ies have been described. *Iguanura*
nauensis Kiew, is the only species that
ined to alluvial forest in Mulu National Park
Mentawai area. This species is clustering
erground palmlet with praemorse leaflets, the
rescence is usually long penduculate with
e immature fruits. During the expedition, this
ies recorded along the Head Hunter Trail.



Iguanura melinauensis



Immature fruits of *Iguanura melinauensis*



Begonia conipila



Begonia sapiensis

BEGONIA

Begonia or locally known as *Riang* by the Iban people or *Tengelai* by the Penan is flowering plants belong to the family Begoniaceae . The genus is one of the largest genera of flowering plants in the world, and is estimated to have more than 1,500 species. Most of the *Begonia* species are found in tropical and subtropical South America and Asia (from India to China and to New Guinea) with only few species in Africa. The family consist of only two genera, Begonia that so rich in species and the monotypic *Hillebrandia* (*H. sandwicensis*) that found only in few Hawaiian Islands.

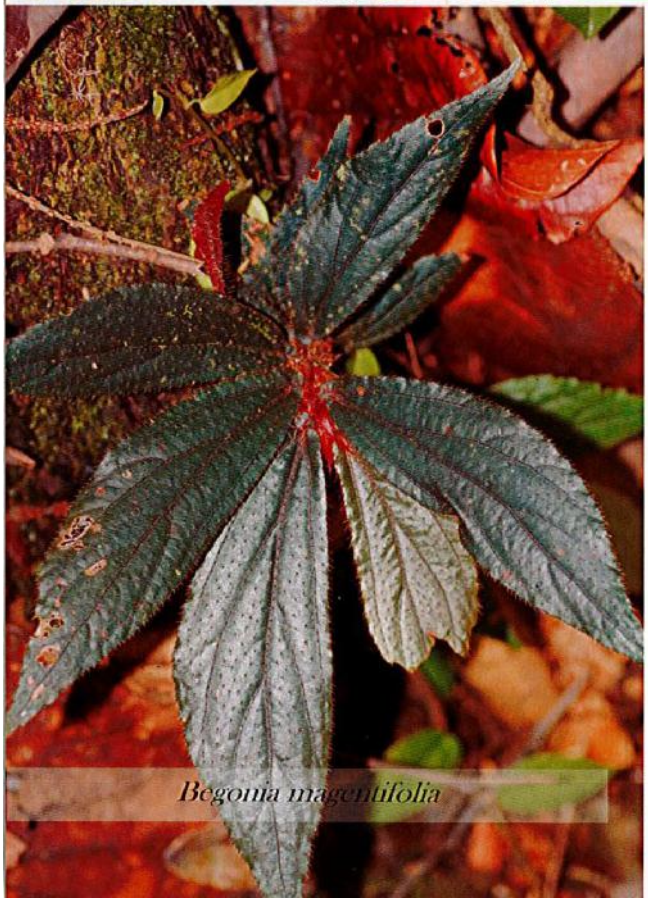
Hughes (2008) estimated there were more than one third or about 520 names species occured in Southeast Asia. Borneo with 194 species recorded is the best representative in Southeast Asia, followed by the Philippines with 104 species (Kiew et al. 2015). Fewer species occur in Peninsular Malaysia (52 spp.), Java (17 spp.) and Sumatra with 45 species recorded.



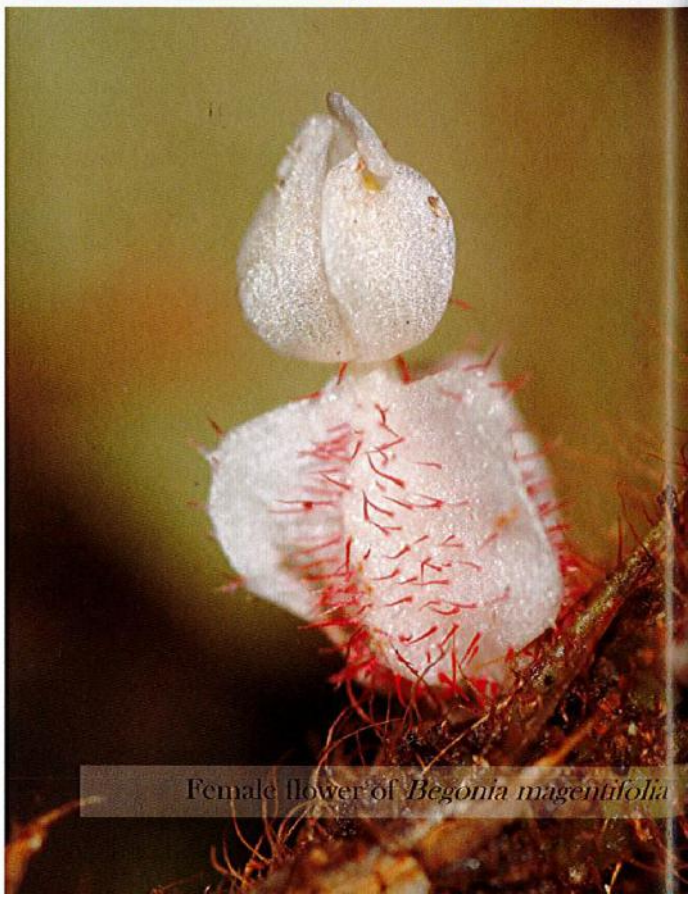
Begonia lucychongiana



Begonia mentawiensis



Begonia magentifolia

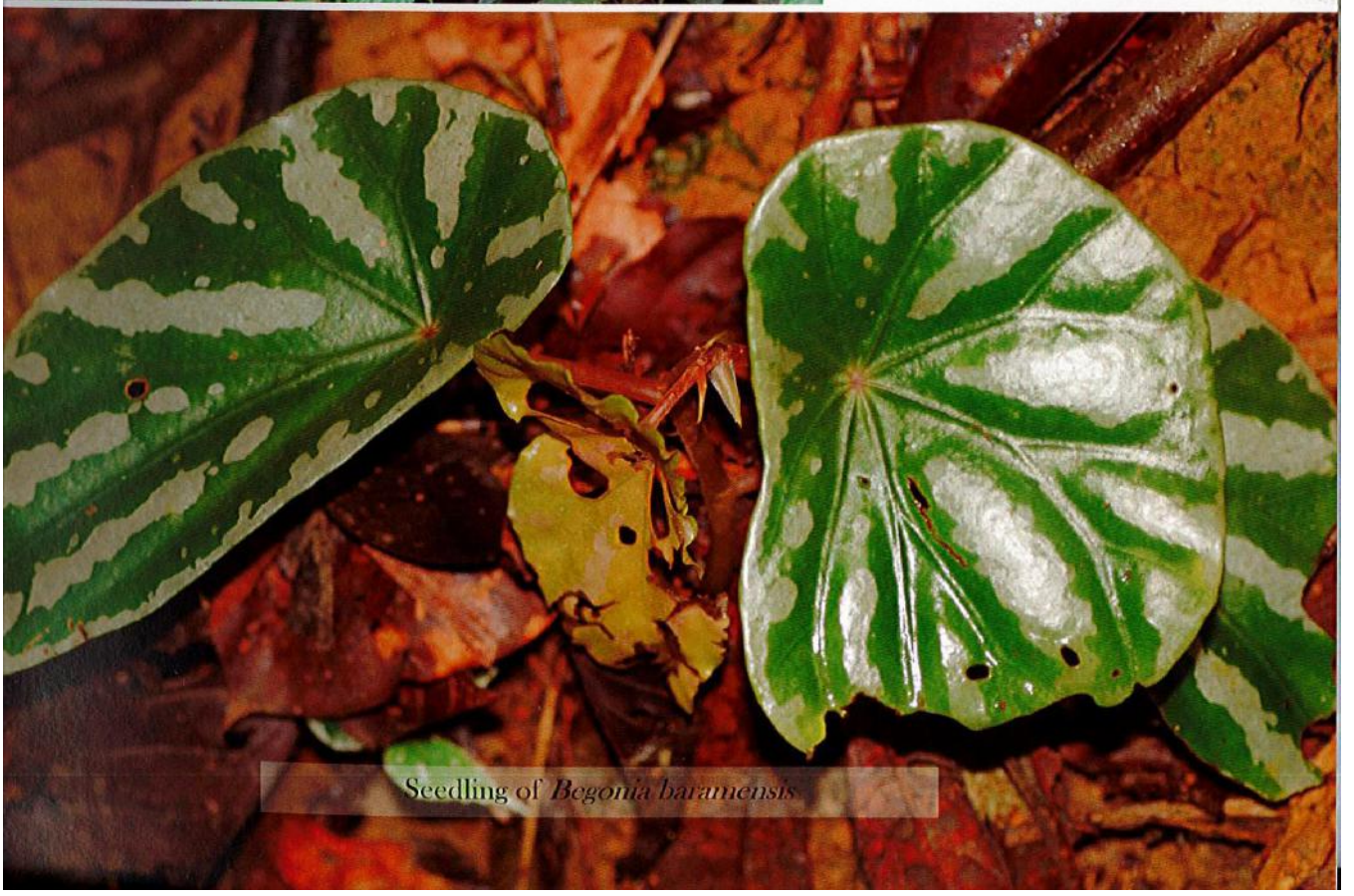


Female flower of *Begonia magentifolia*

he surveys of *Begonia* in Mulu National Park have been conducted as early of 1970s, where the Royal ographical Society recorded 14 species occuring on the Mulu National Park and the closely adjacent mung Api (Sand, 2001, Meekiong et al. 2010). The report however only listing number of species hout appropriate identification until recently, Julia et al. (2013) have revised the *Begonia* from the Mulu d Gunung Buda National Park and scientificly named them. During the Mentawai scientific expedition, more than a dozen species were collected. The species recorded such as *B. apiensis* Kiew & S. Julia, *B. baramensis* Merr., *B. benaratensis* S. Julia, *B. conipila* Irmsch. ex Kiew, *B. divergens* Kiew & S. Julia, *B. lucychongiana* S. Julia & Kiew, *B. magentifolia* Kiew & S. Julia, *B. melinauensis* S. Julia & Kiew and *B. vulgare* S. Julia & Kiew.



Begonia vulgare



Seedling of *Begonia baramensis*

Begonia sp.





Begonia fuscisetosa





Begonia sp.



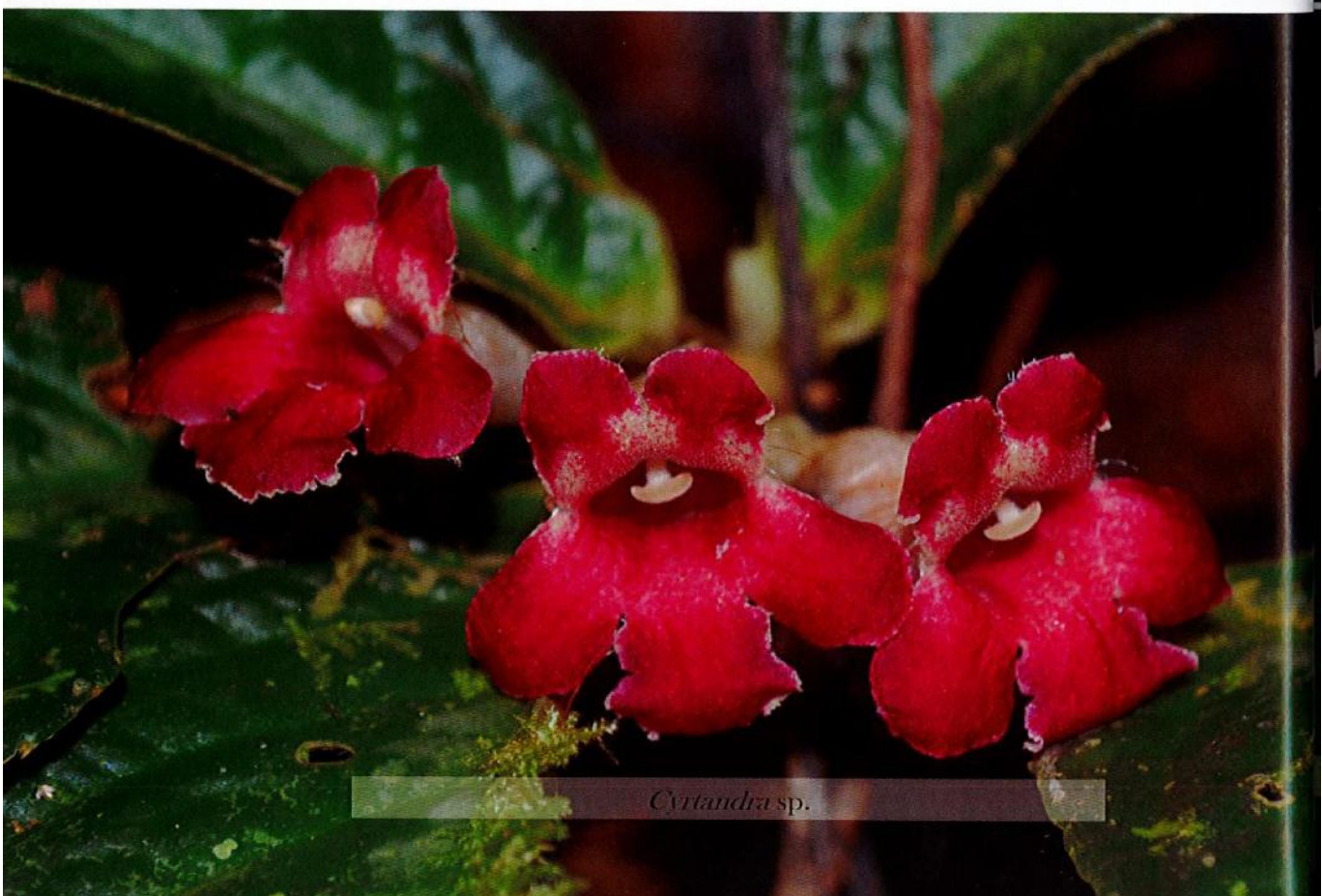
Begonia beccarii



GESNERIACEAE

The Gesneriaceae is a flowering plants family consisting of about 150 genera and 3,200 sp worldwide that distributed mainly in the tropics and subtropics regions. Most species in the famil perennial herbs and shrubs but few are woody shruby, small trees or epiphyte climbers. Many sp have colourful and showy flowers and are cultivated as ornamental plants. Fifteen genera of Gesneri are known to occur in Borneo, and no less than eleven have already been recorded in the Mulu Na Park includes the Mentawai areas. The genera are *Aeschynanthus, Agalmyla, Cyrtandra, Didymoca Didissandra, Epithema, Hexatheca, Loxocarpus, Loxonia, Monophyllaea, Paraboea.* Three genera found in the Mentawai areas, *Epithema, Monophyllaea* and *Paraboea* are there confined to limes and three others *Didissandra, Didymocarpus* and *Loxocarpus* are restricted to sandstone and de soils.

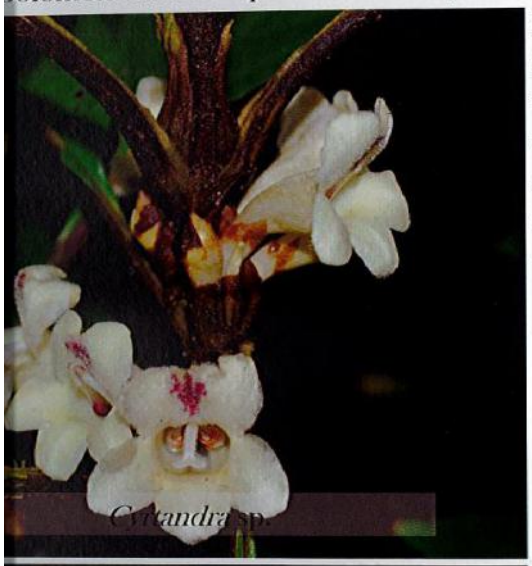
Cyrtandra is the biggest and most widespread genus with about 600 species widely distribute Southeast Asia, Australia and the islands of the Pacific as far away as the Hawaiian Islands. The Sout Asia (mainly Peninsular Malaysia, Sumatra, Borneo and the Philippines) is the centre of diversity more than two third of the total number of species recorded here. Mostly the *Cyrtandra* are commo many species within it are very rare, localized to specific habitat or area and some are endan endemic species. Information on the *Cyrtandra* from the Mulu National Park (and including Mentawai area) is still lacking and much works remains to be done. The latest available report o Gesneriaceae and particularly genus *Cyrtandra* is by B.L. Burtt in 1984, in where here reported abo species of *Cyrtandra* from the Mulu National Park.



Cyrtandra sp.

xatheca, is a Bornean endemic genus with only four described species. The generic name is derived the Greek words, referring to the flower with six theca. This species normally found growing on stone or limestone rocks, usually with the stem almost horizontally and with a fan or close-set leaves at op. However, the plant with erect growing habit usually with well-spaced leaves arrangement. Only one ies recorded in Sarawak, *Hexatheca fulva ssp. fulva* which also found in the Mentawai areas.

thema is genus of lithophytic herbs in central tropical Africa, South Asia, Southeast Asia, Malesia and Solomon Islands. *Epithema* is easily distinguish with other genera in the Gesneriacea family by the inflorescnce arrangement, sepal shape, placentation and the number of locules in the ovary. There are about 20 species recorded (Bransgrove & Middleton, 2015) with only three species recorded from Sarawak; *Epithema involucratum, E. sarawakense* and *E. saxatile.* Two species have been reported from the Mulu National Park, however only *E. involucratum* was recorded during the expedition.



Cyrtandra sp.



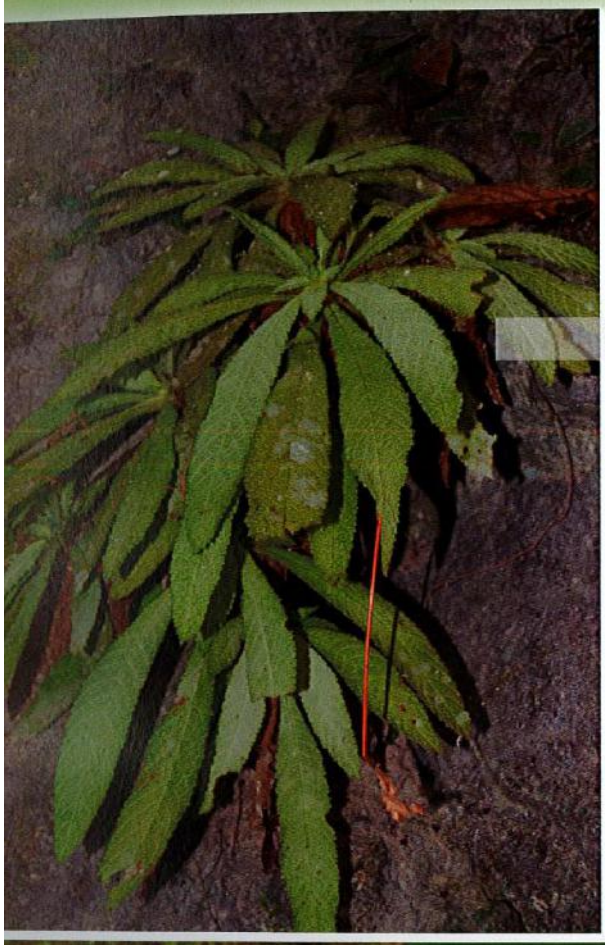
Hexatheca fulva ssp. *fulva*



Cyrtandra sp.

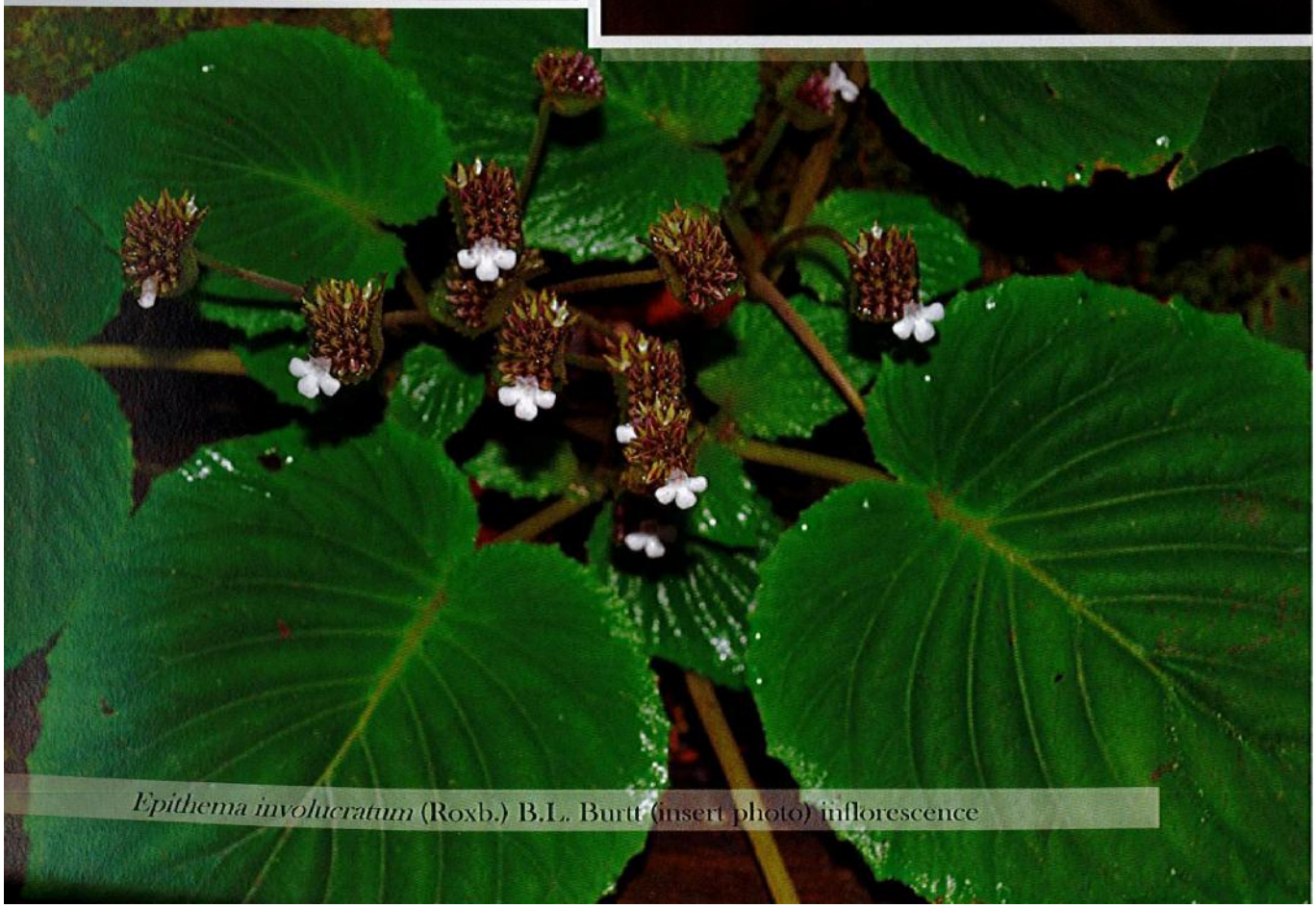


Paraboea banyengiana B.L. Burtt



Henckleia sp.





Epithema involucratum (Roxb.) B.L. Burtt (insert photo) inflorescence

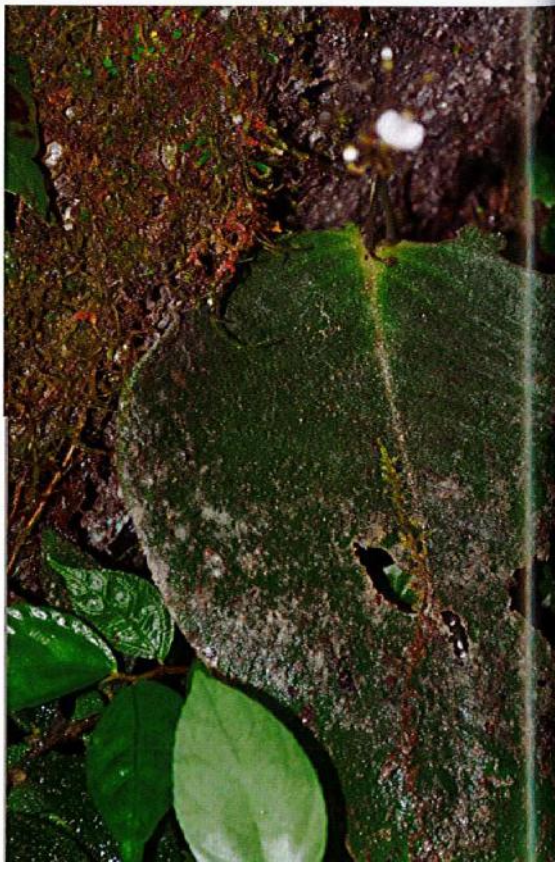
MONOPHYLLAEA

The one-leaf plant of genericly known as *Monophylleae* is a member of Gesneriaceae family. This
plant group only having one-leaf and occasi
found in very specific habitat, such as lim
boulders or clives. *Monophyllaea* are pere
or annual monocarpic herbs with fleshy
The unifoliate habit and inflores
architecture *Monophyllaea* is one of the
peculiar genera of Gesneriaceae.





Monophyllaea insignis B.L. Burtt var. *rubr*



Monophyllaea andersonii B.L. Burtt



Monophyllaea insignis B.L. Burtt var. *insignis*





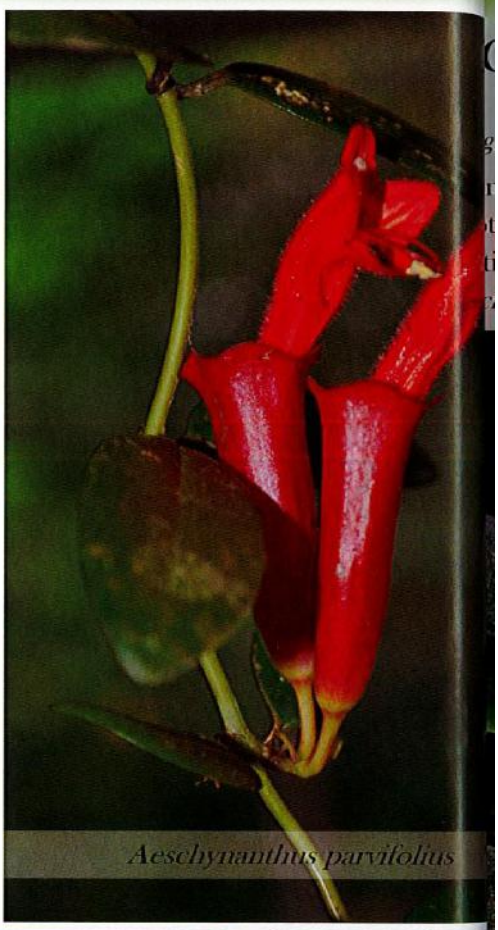


Monophyllaea pendula B.L. Burtt



AESCHYNANTHUS

Vernacullarly known as "Monkey Lipstick Flower" is a genus in the family Gesneriaceae. This genus is a tropical herb, comprising about 185 species that distributed in southern and southeastern Asia, Malaysia, Indonesia, New Guinea and the Philippines. The members of this genus are mostly are trailing epiphytes plants with bright coloured and showey flowers. The flowers are mostly pollinated by the sunbirds.



Aeschynanthus parvifolius

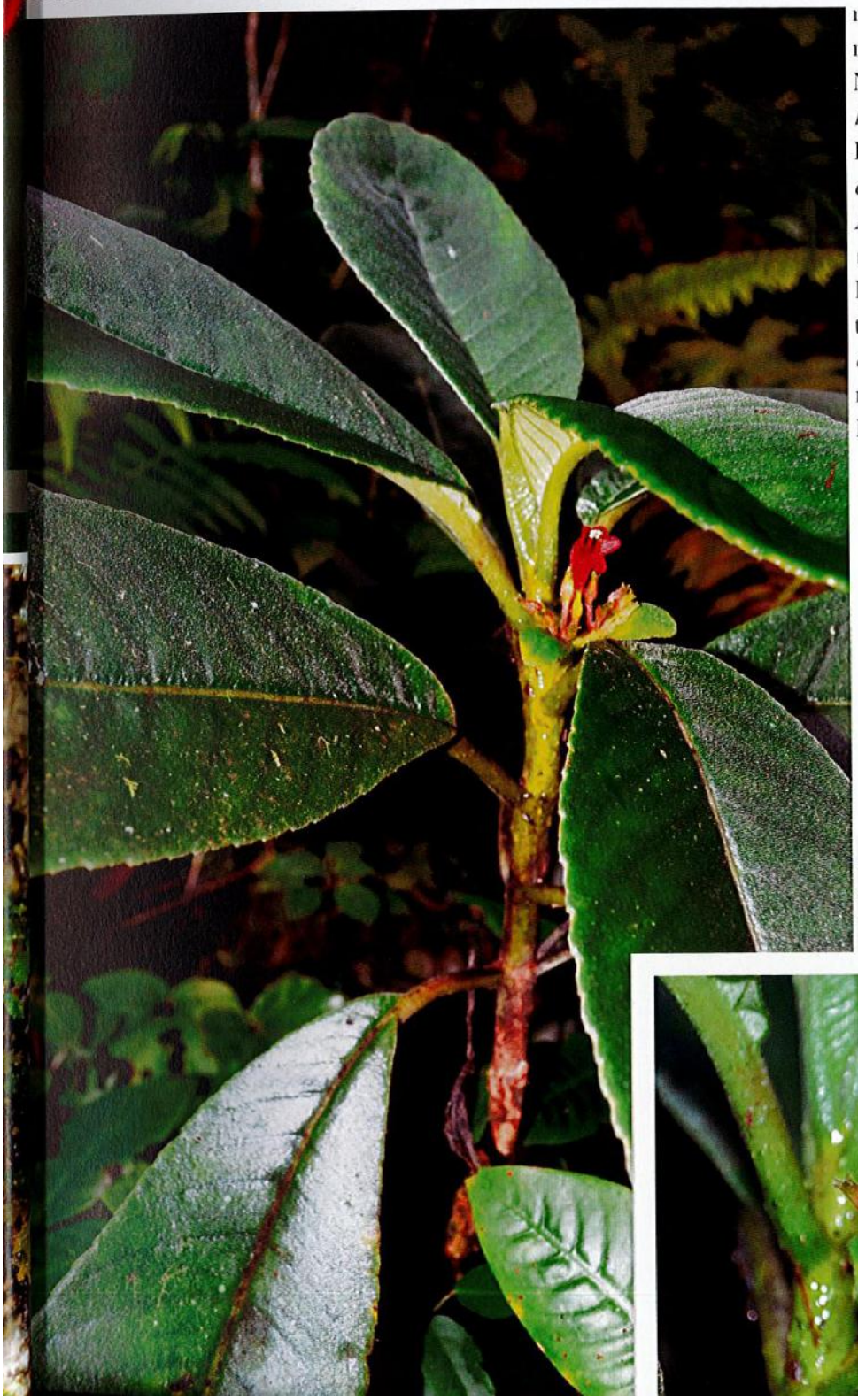




Aeschynanthus tricolor

GALMYLA

galmyla is grouped into subfamily Cyrtandroideae with 96 described species occurring in lowland and ntane rainforest of Malesia region. Mostly the member of this genus are perennial climbers with short ts produced along the stem and only few species are terrestrial herbs. The genus is divided into three tions based on their geographical distribution viz. section *Agalmyla,* section *Exannularia* and section *rotrichum*. Section *Agalmyla* with about 24 species is the only section found in Borneo. Burtt (1984) reported three species recorded from the Mulu National Park; *Agalmyla borneensis* (Schlechter) B.L. Burtt, *Agalmyla erecta* B.L. Burtt and *Agalmyla johannis-winkleri* (Kraenzlin) B.L. Burtt. However, during the expedition *Agalmyla erecta* was the only species recorded from the Mentawai area.



Agalmyla erecta with erect stem (insert photo) close-up flower



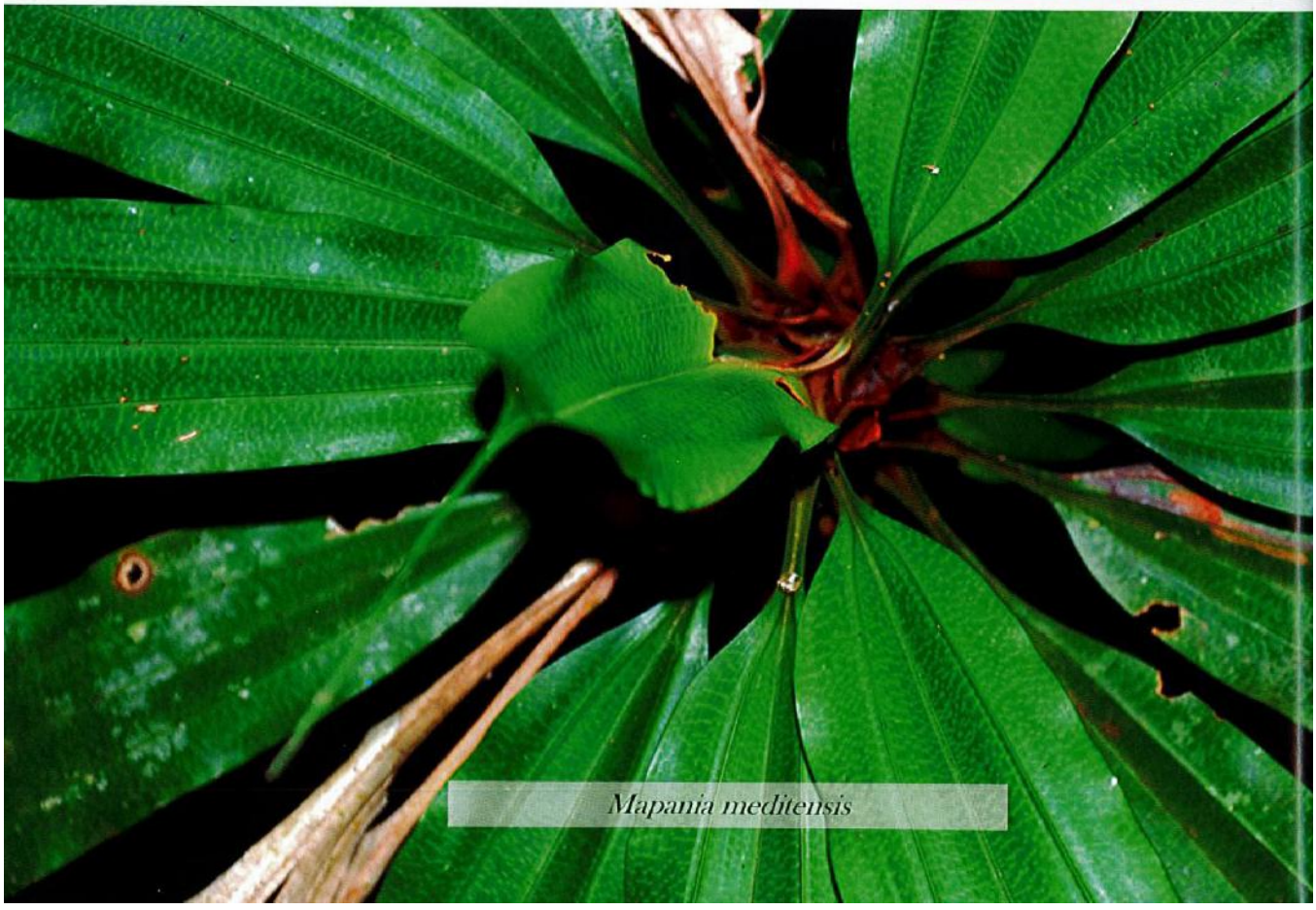
MAPANIA

The genus *Mapania* Aublet is a sedge group from the family Cyperaceae that locally known as *Pandan tikus, Rumput serapat* or *Mieng*. Currently this genus comprising about 104 species throughout the world that distributed in tropical regions from Central and South America, Western and Central Africa, the Seychelles, part of tropical Asia, Indonesia, Malaysia, the Pacific Islands and Northern Australia (Simpson, 1992). The genus is an important component of the herb layer in tropical rainforests and is valued as an ethno-botanical plant for the indigenous folks.

The study on the genus *Mapania* in Borneo was carried out by Simpson in 1990s and he listed 25 species (Simpson, 1992). The genus is often neglected in the field as most of the species are robust and with prickly leaves that make them hard to handle and always bulky for herbarium specimen. Furthermore, many of specimens in the herbaria are frequently incomplete and sometimes information is adequate. Therefore, in order to correctly identify and understand the genus, both herbarium and field practices are necessary.

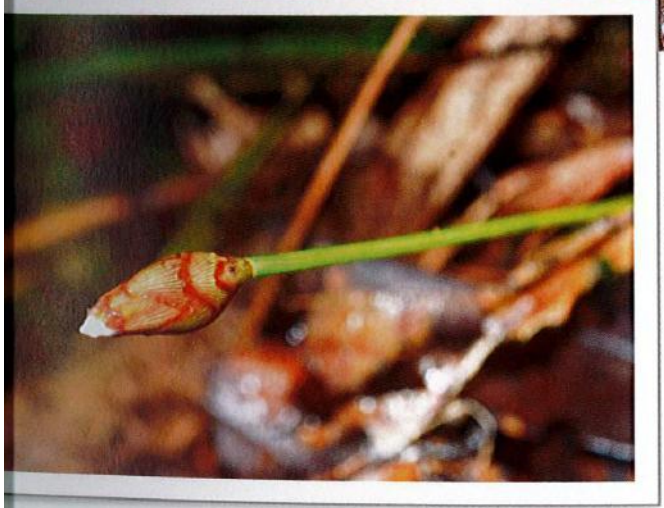


Spike of *Mapania meditensi*



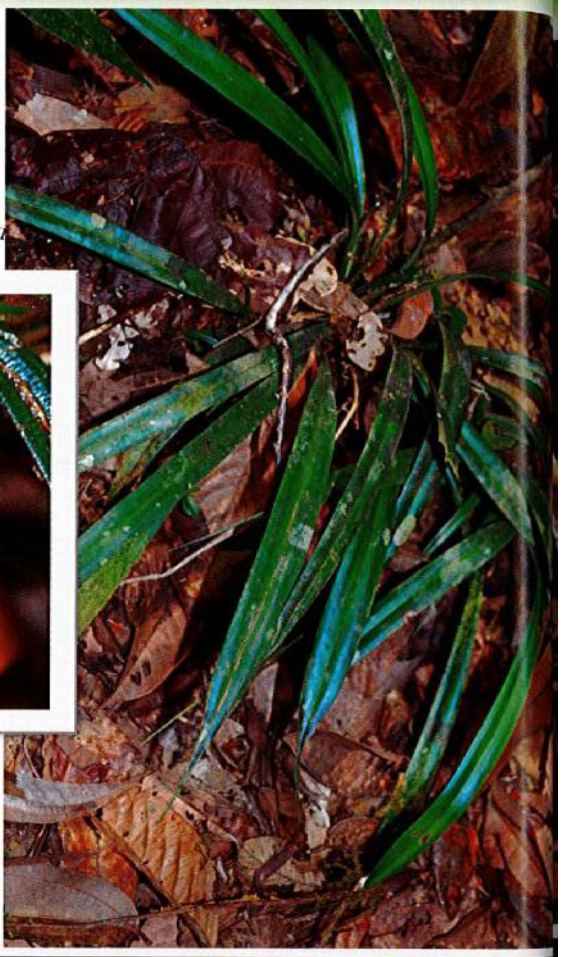
Mapania meditensis





Mapania debilis C.B. Clarke (insert photo) spike of *Mapania debilis*

cent study by Miraadila et al. (2016) reported that the number of *Mapania* species in Sarawak has reased to 40 species with 12 newly added species into the account. The Kapit Division is the most cious with more than half from the total number of species are recorded followed by the Miri and mbang Divisions. During the expedition, only eight species were recorded from the Mentawai areas. The cies that were recorded includes, *M. borneensis* Merril, *M. caudata* Kuk, *M. cuspidata* (Miq.) Uittien *cuspidata, M. cuspidata* (Miq.) Uittien var. *petiolata* (C.B. Clarke) Uittien, *M. debilis* C.B. Clarke, *M. gifiora* Uittien, *M. meditensis* D.A. Simpson, *M. palustris* (Hassk. Ex Steud.) F.-Vill. var. *palustris* and *wallichii* C.B. Clarke. Two of the species, *M. monostachya* Uittien and *M. latifolia* Uittien reported by npson in 1992, however were not found during the expedition.



Mapania caudata



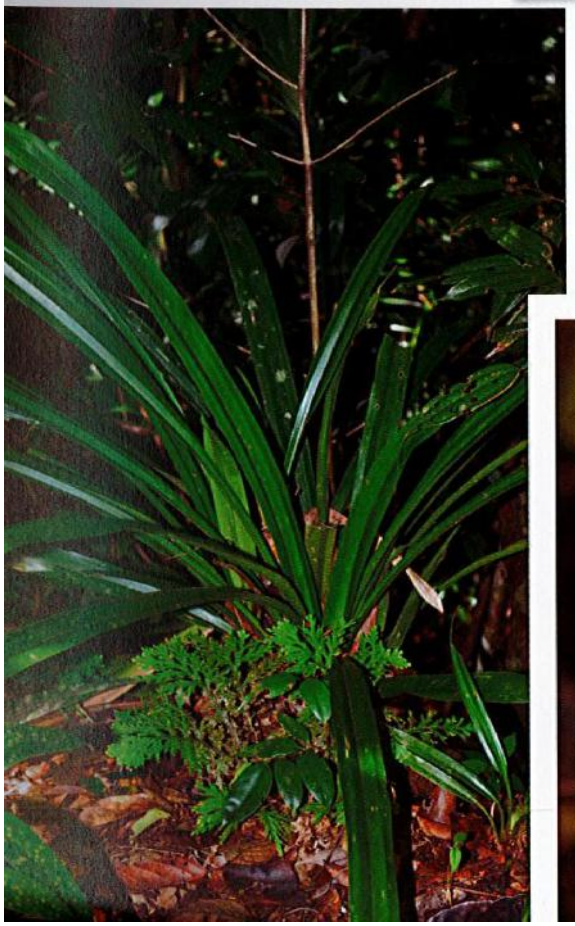
Mapania cuspidata (Miq.) Uittien var. *petiolata*





Mapania palustris



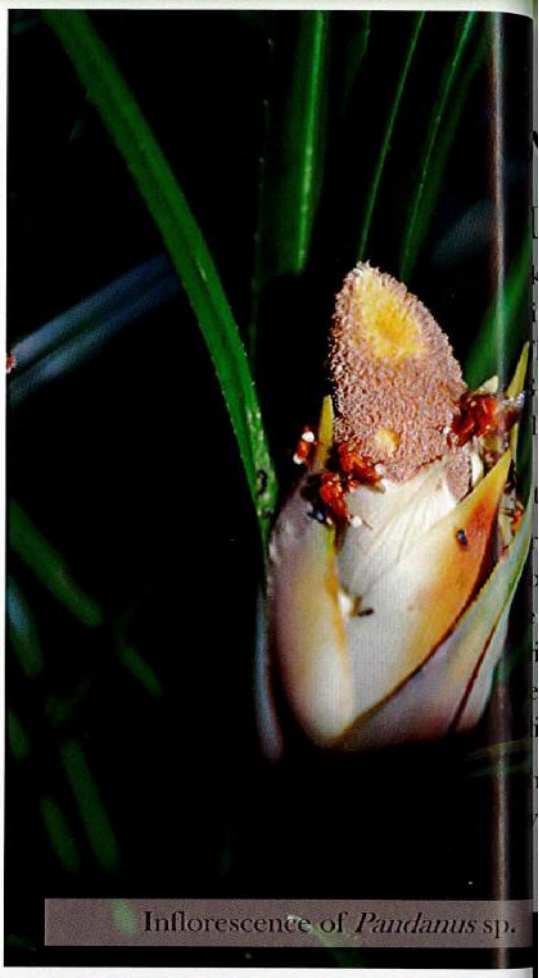


Mapania longigflora



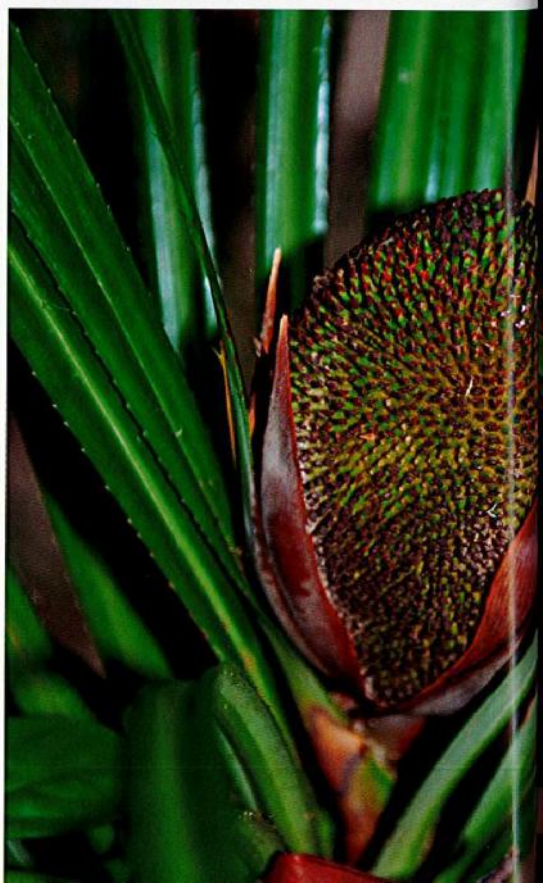
PANDANACEAE

The family Pandanaceae is family of flowering plants that native to tropics and subtropics, distributed from West Africa, India, Southeast Asia and through the Pacific. The family consisting of five genera with over 1000 species worldwide includes various forms of habit such as trees, shrubs, lianas, vines, epiphytes and perennial herbs. The five recognized genera are *Benstonea, Freycinetia, Martellidendron, Pandanus* and *Sararanga.* Two of the genera; *Benstonea* and *Martellidendron* previously are subgenus to the *Pandanus* and now considered as distinct genera based on DNA sequencing.



Inflorescence of *Pandanus* sp.



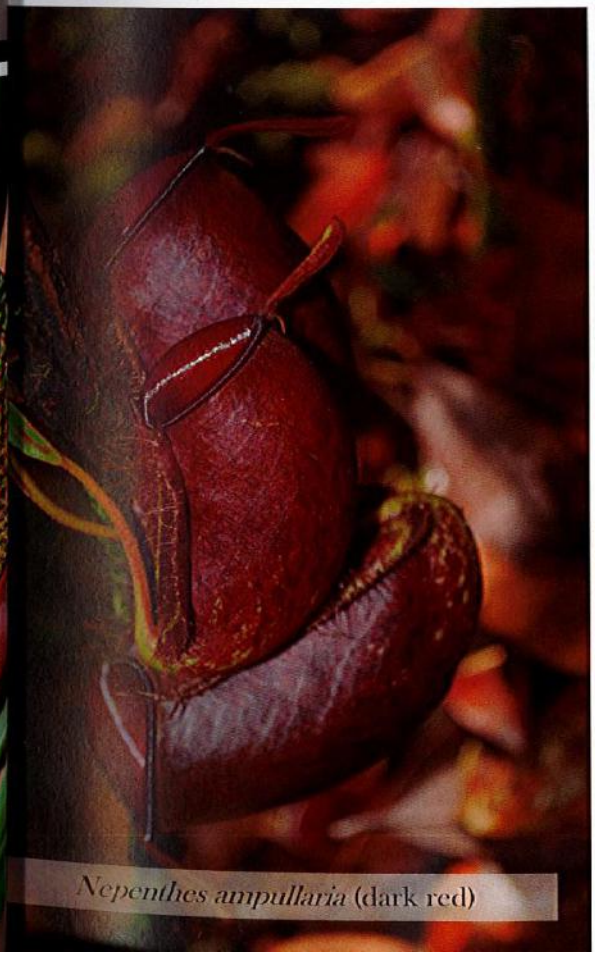


Nepenthes ampullaria

The word *ampullaria* is a Latin word meaning "flask" which referring to the shaped of the pitcher, a flask-ked. *Nepenthes ampullaria* or locally known as *Pok-yuk* by the Iban and *Entuyud* by Melanau is a very istinctive and widespread species of tropical pitcher plant. The distribution of this species is ranging from Thailand, Peninsular Malaysia, Singapore, Sumatra, Borneo, the Maluku Islands and toward the New Guinea. Unlike other member in the genus, *Nepenthes ampullaria* has evolved from carnivory and the lants are partly detritivores, collecting and digesting falling leaf litter in their pitchers.

tem of *N. Ampullaria* is light brown in colour and may climb to 15 - 20 m in height. Leaves are light reen, up to 25 cm long and 6 cm wide (or up to 70 cm long and 10 cm wide - plants that grow on fertile oils). The pitchers are produced at the stem on rossette arrangement or occasionally at the end of short endril of the leaf. The urceolate pitchers are generally small, rarely exceeding 10 cm in height and 7 cm in idth. The peristome is greatly incurved, with inner section accounting for around 85% of its total cross-ectional surface length. Pitchers range in colouration from light green throughout to completly dark red, ith many intermediate forms recorded or sometimes green with reddish purple blotches.

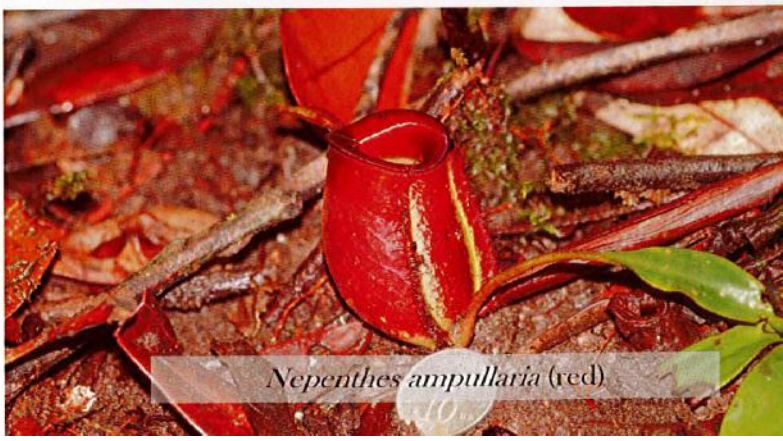
n Mentawai, this species is commonly seen in the kerangas and swampy forests where it always spotted mpatrically grown with two other *Nepenthes* species; *N. Bicalcrata* and *N. rafflesiana.*



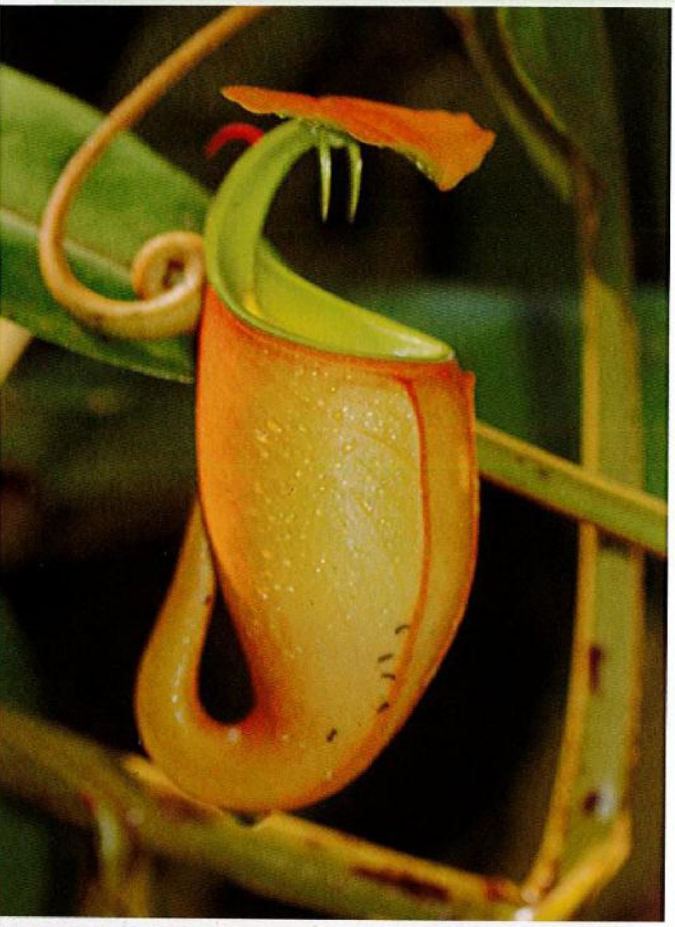
Nepenthes ampullaria (dark red)



Nepenthes ampullaria (light green)



Nepenthes ampullaria (red)







Nepenthes bicalcrata

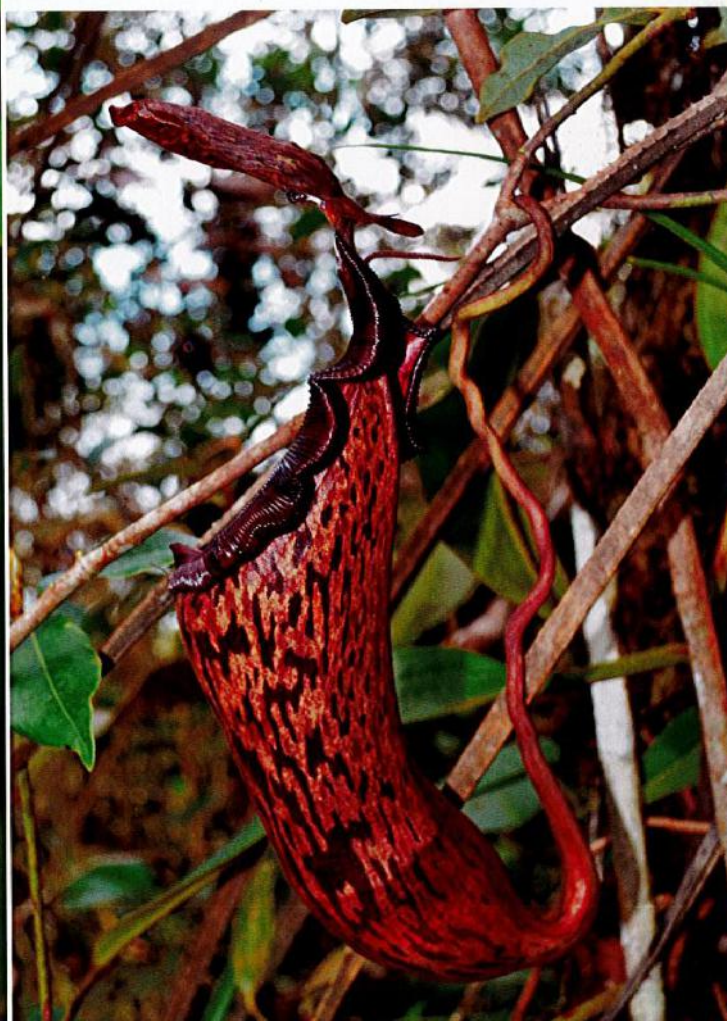
Nepenthes bicalcrata first was described by Jos Dalton Hooker in 1873 in his monograph ent "*Nepenthaceae*" based on the specimens collected Hugh Low and Odoardo Beccari near the Lawas R Sarawak (Hooker, 1873). The epithet name of species is from the Latin words, means "two sp referring to the two thorns or fangs stucture-liked below the lid. The present of that structures has been debated among the scienticts with some sugge that it might serve to deter aboreal mammals (Cla 1997) and some suggested that its serve to lure ins into a precarious position over the pitcher mouth, w they may lose their footing and fall into the pitcher fl eventually drowning (Clarke, 1993).

Nepenthes bicalcrata is one of the largest plant in genus that climbing up to 20 m into the forest can (Clarke, 1997). The cylindrical stem up to 3.5 diameter is thicker than any other *Nepenthes* spe and the internodes are longer, up to 40 cm l Although most parts of the plant are large, the siz pitcher however do not rival the *N. rajah* Hook f., species with the largest picther in Borneo. The lo pitcher however can grow up to 25 cm high and 16 wide that can contain up to one litre of water. A pai prominent fringed wings that normally seen at lo pitchers are usually reduced to ribs in aerial pitchers. Mentawai, this species is commonly found in the swa



Nepenthes faizaliana

Nepenthes faizaliana is endemic pitcher plant to limestone cliffs of Mulu National Park. This species was described by Jumaat Adam and C.C. Wilcock in 1991 after Jumaat Adam's son. *Nepenthes faizaliana* is closely related to *N. boschiana* and sometimes also treated as synonym to *N. Stenophylla.* This species is typically occurs at altitude of 1,000 - 1,600 m above sea level but also found as low as 400 m altitude. Commonly found along the way to Pinnacles view of Mount Api. *Nepenthes faizaliana* occurs both as terrestrially and as an epiphyte on the limestone outcrops and exposed ridges tops.



Nepenthes rafflesiana

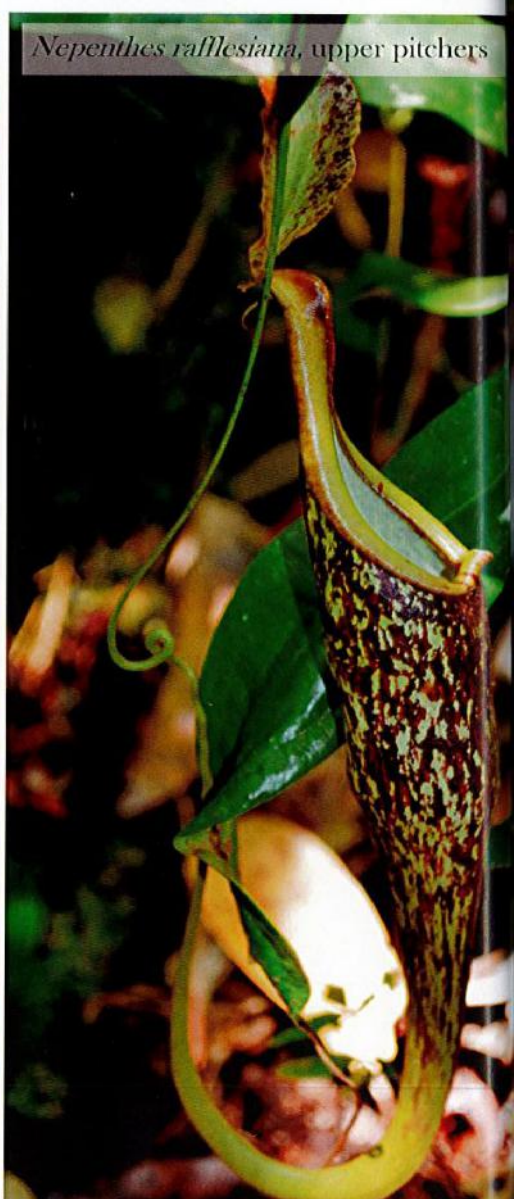
This species was first described by Dr William Jack in 1835, named after Sir Stamford Raffles. T species is a tropical pitcher plant and has wide distribution that covering Borneo, Peninsular Malay Singapore and Sumatra. This species is extremely variable with many forms and varieties are descrit Generally occurs in open, sandy and wet areas such as kerangas and margins of peat swamp forest at altit ranging from the sea level up to 1500 m.

Nepenthes veitchii

Nepenthes veitchii was described by Joseph Dalton Hooker in 1859 after the nurseryman of the Vei Nurseries, James Veitch. This Bornean endemic species is widespread in north-western Borneo and also be found in parts of Kalimantan. *Nepenthes veitchii* are grows as an epiphyte and sometimes found as terrestrial.



Nepenthes rafflesiana, lower pitchers



Nepenthes rafflesiana, upper pitchers



Nepenthes veitchii

ORCHIDS

The Orchidaceae is one of the largest and most widespread flowering plant family. The family consists of 880 genera with about 30, 000 species that distributed everywhere and almost every habitats except the Artic circle. The word's richest diversity of orchid genera and species is found in the tropics. The Borneo island with more than 3,000 species recorded or 10% of the world total number is considered as among the highest diversity spots for orchids.



Plocoglottis javanica

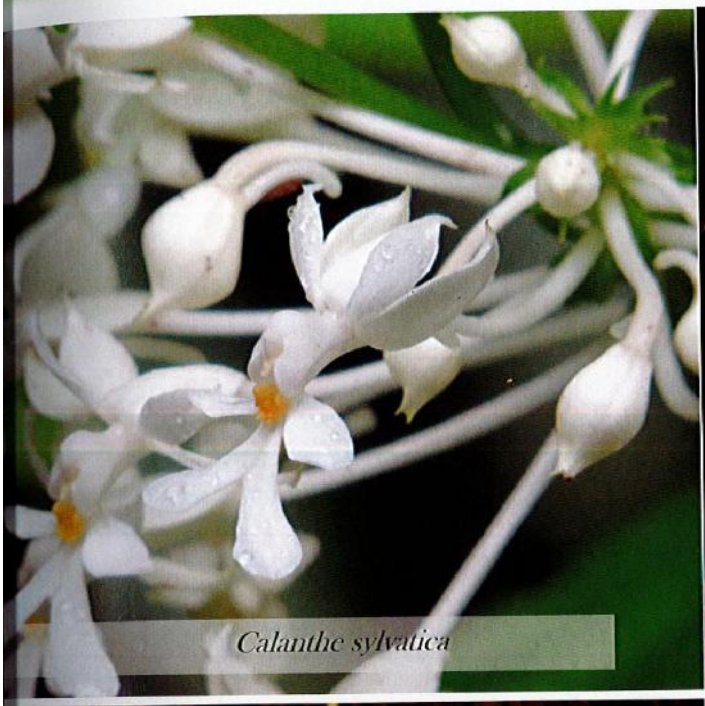


Corymborkis veratrifolia

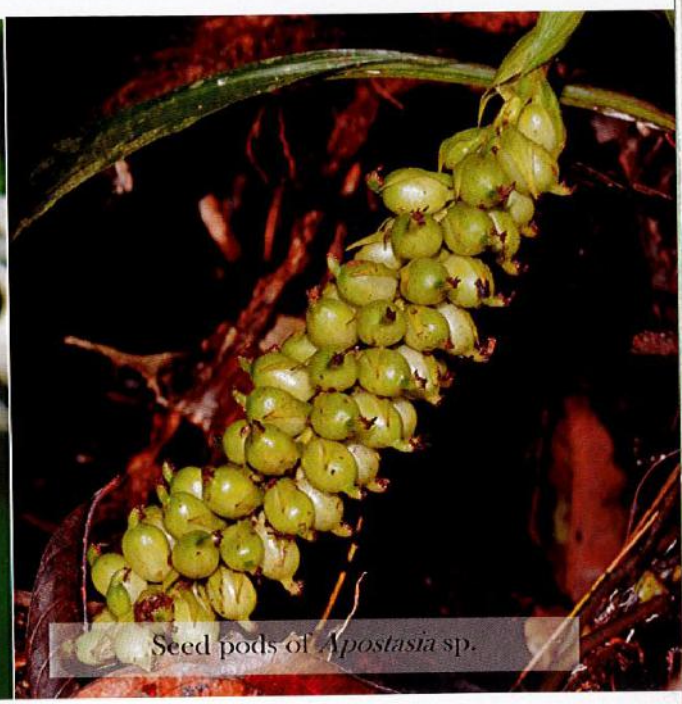
Malaxis sp.



Goodyera sp.



Calanthe sylvatica



Seed pods of *Apostasia* sp.





Tania pauciflora

ORCHIDS

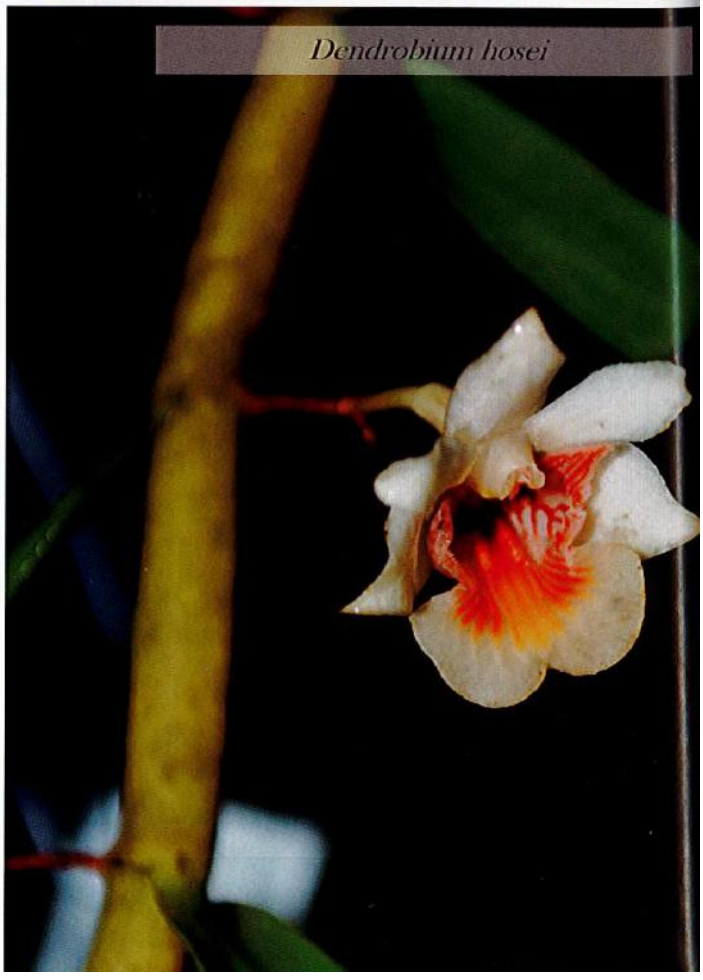
The orchids flora in Sarawak has been extensively collected as early as 1886 by Odoardo Beccari, the botanist who made botanical collection in Sarawak. His orchids collection, however were not systematically reported. The first account listing a significant number of Sarawak orchids was by H.N. Ridley in 1896 in his enumeration of the orchids of Borneo. The list however, includes his collection from the Mount Kinabalu (Beaman et al. 2001). Since then, many collections have been made by various researchers in various locality in Sarawak. Among them are G.D. Haviland (1888 –97), Charles Hose (1894 - 95), Eric Mjoberg (1922), Carr (1932), J.A.R. Anderson (1955–72) and many others. Beaman et al. (2001), in their enumeration in the book, *Orchids of Sarawak*, have reported 1019 taxa with 879 taxa were fully determined. The number also includes 235 new records for Sarawak. Among the genera with most taxa in Sarawak are *Bulbophyllum* (118), *Dendrobium* (98), *Eria* (61) and *Dendrochilum* (56).



Dendrobium aurantiflammeum



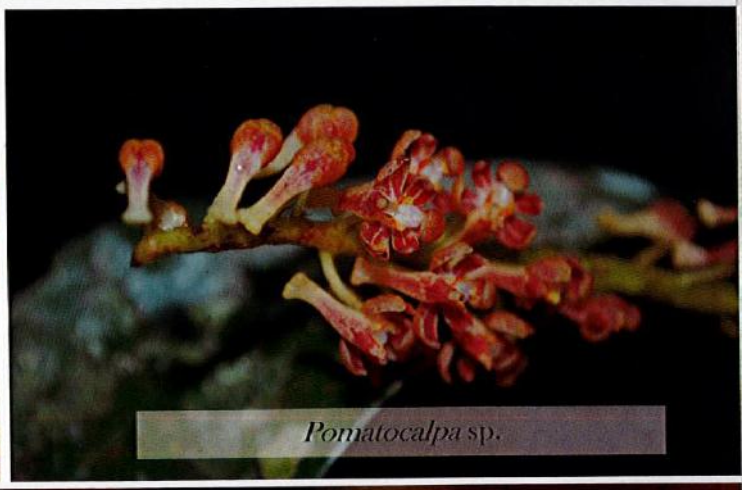
Bulbophyllum biflorum



Dendrobium hosei



Thrixspermum sp.



Pomatocalpa sp.

Bulbophyllum sp.

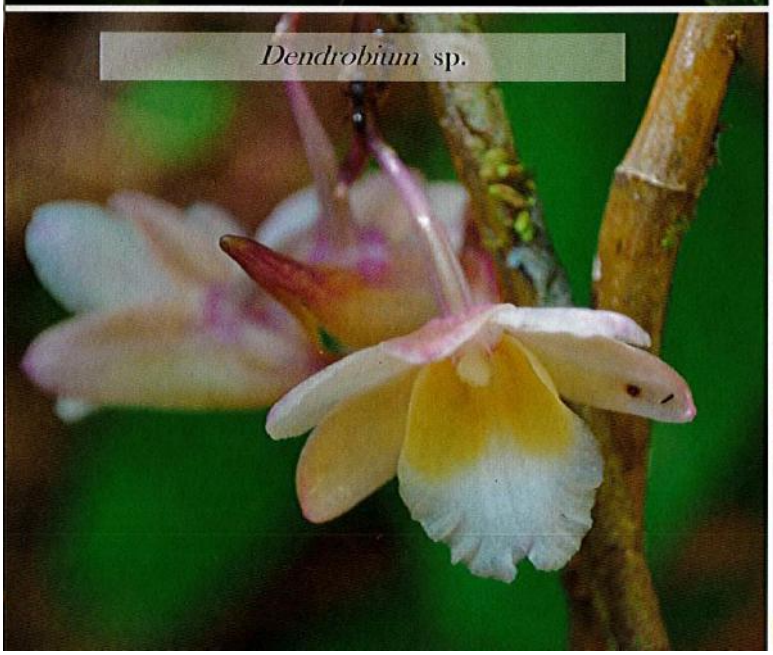
ORCHIDS



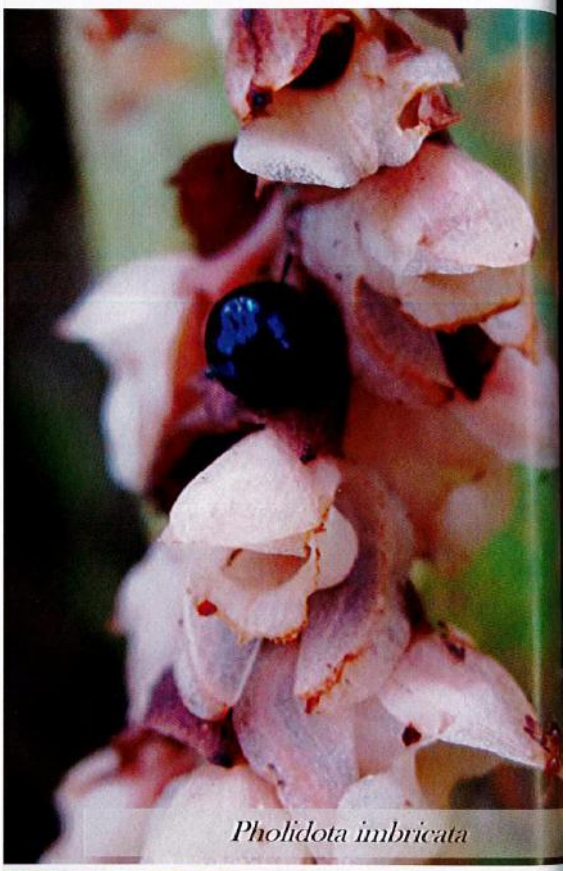
Bulbophyllum brienianum



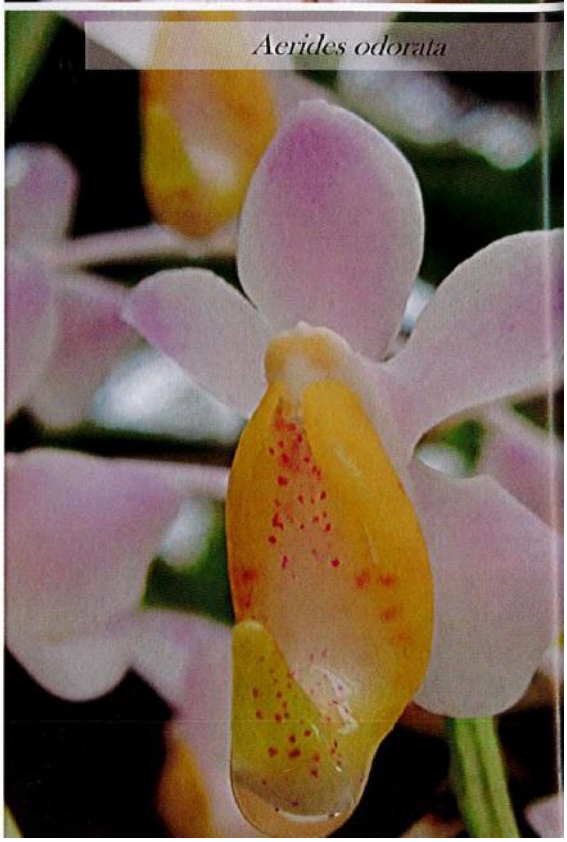
Dendrobium anosmum



Dendrobium sp.



Pholidota imbricata



Aerides odorata



Cleisostoma discolor

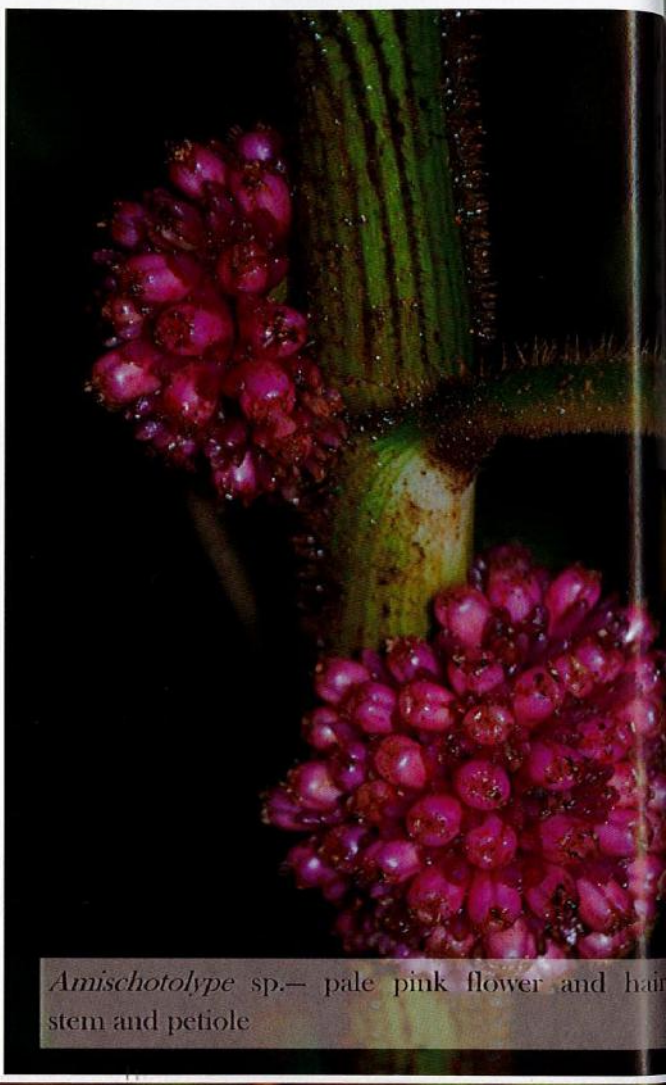
Between 1961 and 1976 the Mulu National Park areas were the focus of seven major expeditions that involves researchers from the Forest Department Sarawak, the Royal Botanic Garden, Edinburgh, Kyoto University and the Royal Geographic Society / Sarawak Government. The orchids collection resulting from these expeditions were enumerated by Wood (1984), who recognized 170 species and intraspecific taxa in 54 genera. Since then, no major reports on the orchids diversity from the Mulu National Park has been published.

Mulu National Park is the only natural home for *Paphiopedilum sanderianum,* a slipper orchid with its long dangling petal that can reach a meter or more in length and one of the most striking of all orchids. It was discovered in 1885 by J. Forstermann and thought to be a monstrosity or hybrid orchid until it was rediscovered by Ivan Nielsen in 1978. Since then, this species always become primary target for orchid hunters due to the high prices in the International market.

Paphiopedilum sanderianum



Amischotolype sp.– white flower



Amischotolype sp.– pale pink flower and hai stem and petiole



Amischotolype mollissima

AMISCHOTOLYPE

Previously known as *Forrestia*, is a perennial monocotyledous flowering plant genus in the Commelinaceae family. It is native to Central Africa and India through the Southeast Asia and New Guinea with Malesia as centre of distribution. The species in this genus are charaterized by its rather compact inflorescence which are composed on two or more cincinni that pierce through the base of the leaf sheath, and also by its seeds that are embendded in red aril. About 23 species have been described and nine species reported in Borneo. Only four species were recorded in Mentawai areas during the expedition.



POIKILOSPERMUM

Poikilospermum is a tropical genus of shrubs or tall woody climbers that placed in the family Urticaceae. The classification of this genus has been dyanamic and sometimes also placed in the family Cecropiaceae. There about 30 names of *Poikiloserpmum* have been published but to-date only four species has accepted. During the surveys, at least four to six different taxa of *Poikilospermum* have been observed in the Mentawai areas.

Poikilospermum sp.





Colony of *Musa campestris* var. *limbangensis*



Male bud of *Musa campestris* var. *limbangensis*

MUSACEAE

Italian botanist, Odoardo Beccari was the first to describe four wild bananas from Borneo in his classic book "Nelle Forestre di Borneo" (Beccari, 1902). He described and named four species: *Musa borneensis* Becc., *M. campestris* Becc., *M. hirta* Becc. and *M. microcarpa* Becc. All the four species are common in the southern part of Mulu National Park, particularly near to the Penan and Berawan settlement and the Park Headquarter. However, only two taxa were recorded in the Mentawai areas during the expedition. The taxa are *M. borneensis* Becc. var. *flavida* (M. Hotta) Hakkinen & Meekiong and *M. camprestris* Becc. var. *limbangensis* Hakkinen.

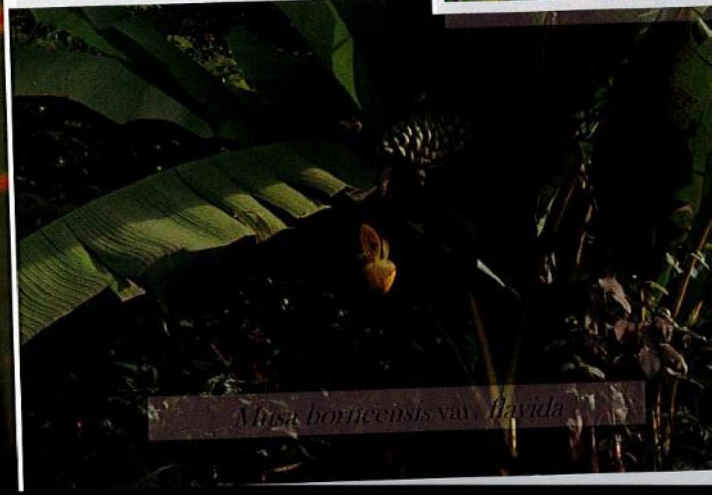
Musa campestris or locally known as *Pisang kera, Pisang monyet* by the Malay or *Baliek putey* by the Melanau is the most common species found throughout Borneo. This species occupying in any habitats, from interior of mangrove forest to submontane forest up 1,700 m above sea level exclude the kerangas forest. The word *campestris* is a Latin word, meaning plain colour which referring to the unchanged colour of the ripe fruits.



Male bud of *Musa borneensis* var. *flavida* with creamy yellow bracts



Fruits of *Musa campestris* var. *limbangensis*



Musa borneensis var. *flavida*

PARACOSTUS

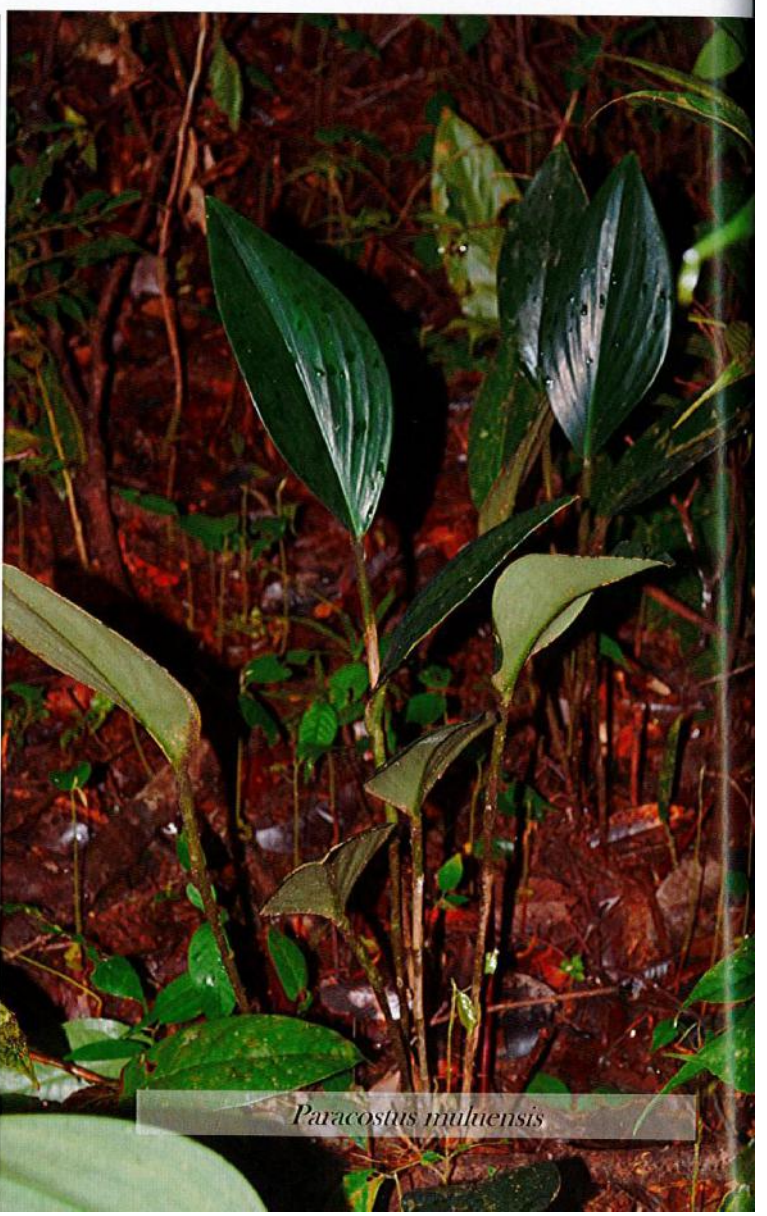
The genus *Paracostus* was introduced by Specht in 2000 based on the data of molecular phylogeny studied. The genus which perviously treated as subgenus *Paracostus* consist only five species; *P. bullatus* (Meekiong et al.) Meekiong, *P. eburneus* (Meekiong et al.) Meekiong, *P. englerianus* (K. Schum) Specht, *P. muluensis* (Meekiong et al.) Meekiong and *P. paradoxus* (K. Schum.) Specht. All the species in this genus are clearly differs by its inflorescence emerging from the node of rhizomes or from the upper part below the first leaf, with flowers that are solitary or in cluster of 2–5, but never more than 10 flowers per cluster, and by one-leafed stem and terminal inflorescence (in the case of *P. englerianus*). The plants are only occasionally more than 1.5 m tall and are not branching.

Due to lack of field information and poor herbarium specimens, all the cauliferous species from Sarawak had been erroneously identified as *P. paradoxus*. Among them, one species is common in Mulu National Park and Mentawai areas with white flower and fan-shaped yellow band on the median of labellum. That species then was described by Meekiong et al. (2006) known as *Paracostus muluensis* [synonym: *Costus muluensis*].



Close-up flower of Paracostus muluensis





Paracostus muluensis



Donax canniformis

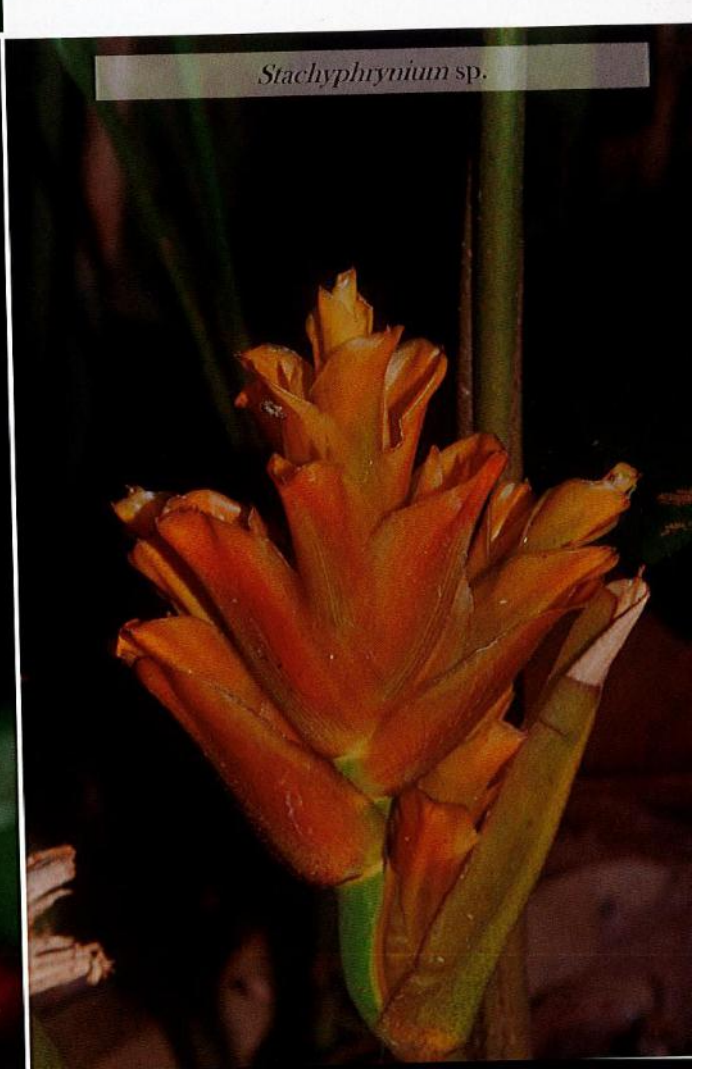
MARANTACEAE

Also known as Arrowroot family, the Marantaceae are a family of rhizomatous group herbs with a pantropical distribution that comprising about 550 species in 31 genera (Anderson,1998). In Asia, the family comprises about 55 species in eight genera Suksatham et al. 2009). They are found in lowland and montane forest from sea level up to altitude of 1,700 m. They distributions are ranging from India eastward to South Pacific islands (Vanuatu), including New Guinea and the Philippines, with species diversity occuring in Borneo. The Bornean Marantaceae were very poorly known as not many studied have been conducted. To-date only five genera with about 20 species have been reported. In Mentawai, three genera with five species recorded viz. *Donax* (Bemban), *Phrynium* and *Stachyphrynium* (both locally known as Daun Lerek).

Phrynium sp.



Stachyphrynium sp.



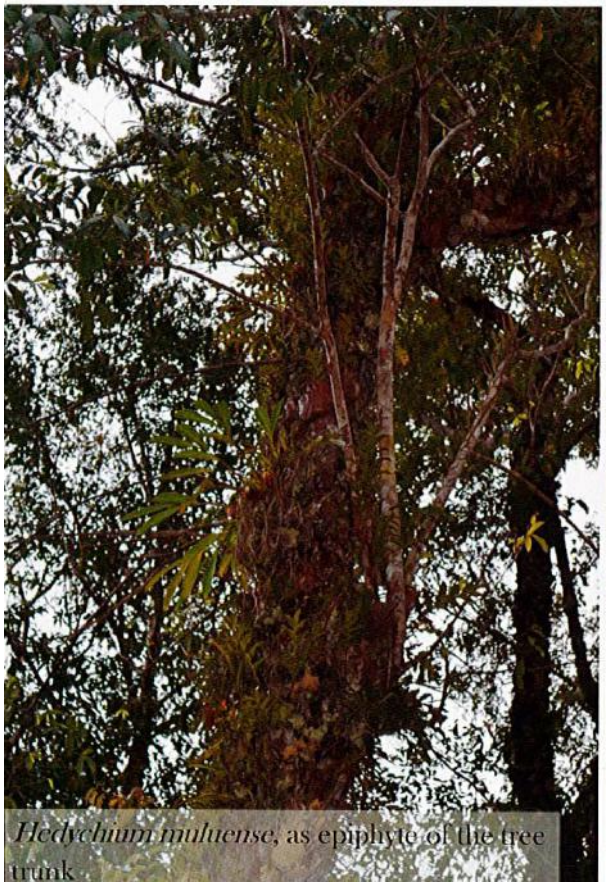
ZINGIBERACEAE

The word "ginger" actually refers to the edible ginger of commerce that locally known as *halia* and scientifically recognized as *Zingiber officinale,* while "gingers" is a common term for members or species of the Zingiberaceae family. The Zingiberaceae are part of the order Zingiberales, which forms an isolated group among the monocotyledons. There are eight families in the order Zingiberales, which includes Musaceae, Lowiaceae, Heliconiaceae, Strelitziaceae, Cannaceae, Marantaceae, Costaceae and Zingiberaceae. The family Zingiberaceae is the largest family in the order with 55 - 60 genera, comprising about 1,300 species, of which about 1,100 occurs in tropical Asia. The number of gingers in Southeast Asia increasing year by year with many new gingers are discovered and being described. For example, new genus that recently described are *Johalia, Kedahalia, Maxochlamys* and *Newmania.*

Sarawak also tremendously rich with gingers. To-date nineteen genera with more than 200 species have been described with many more still awaiting to be discover in the forests. The gingers occurs in almost all type of habitats from the sea level of mangrove forest up to 1,800 m altitudes of montane forest. Typically found as terrestrial herbs in the opened spaces along the roadside to the deep shaded of mixed dipterocarp forest or occasionally as litophytes on the rock surface of mudstones and limestones. Infrequently also found as epiphytes on the tree trunks or branches. Almost all genera are found in the Mentawai except the genus *Camptandra, Haplochorema* and *Haniffia.*



Plagiostachys bracteolata, as terrestrial herb in kerangas forest



Hedychium muluense, as epiphyte of the tree trunk



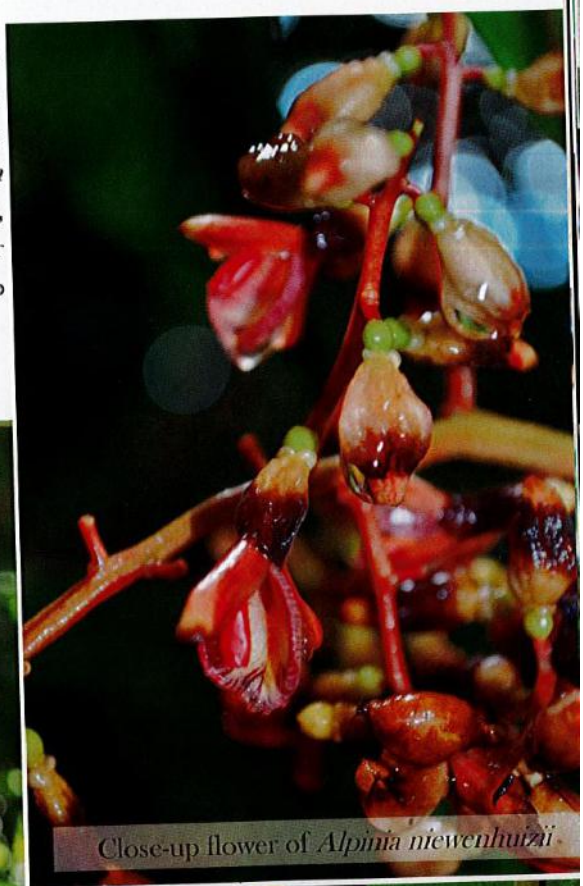
Boesenbergia grandis, as lithophyte on the limestone pocket

ALPINIA

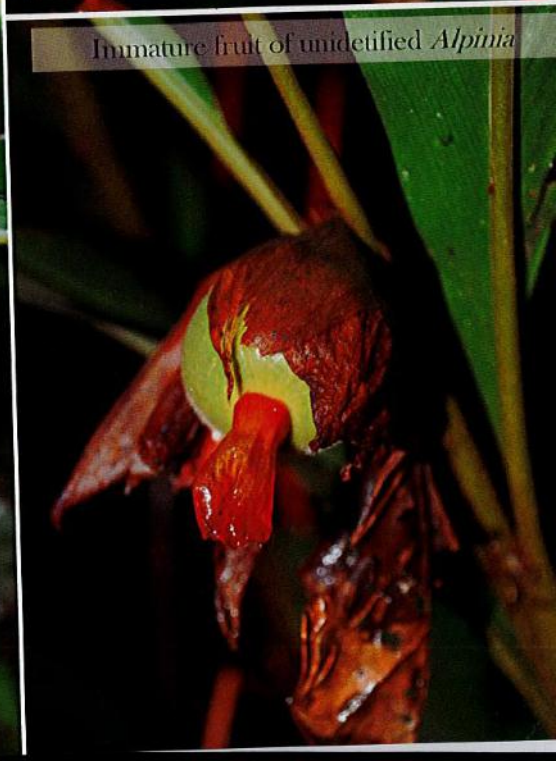
The generic name of this ginger genus is given after the Italian physician and botanist, Prospero Alpini (1553–1616) by Carl Linnaeus. This genus occur in tropic and subtropic regions, includes Asia, Northern Australia and the Pacific Islands. Almost all the member of the genus are bearing terminal inflorescence at the top of the the leafy shoot and most have long petioles to the leaves and grow in clumps. It is one of the common gingers in the pristine forests in Sarawak. About 18 species have been recorded in Sarawak. However, only two species recorded in the Mentawai areas during the expedition period. *Alpinia niewenhuizii* is common in the lowland mixed dipterocarp forest, particularly in damp and wet places near the streams and river banks. The second species however is still indetermined as no flowers are collected during the survey.



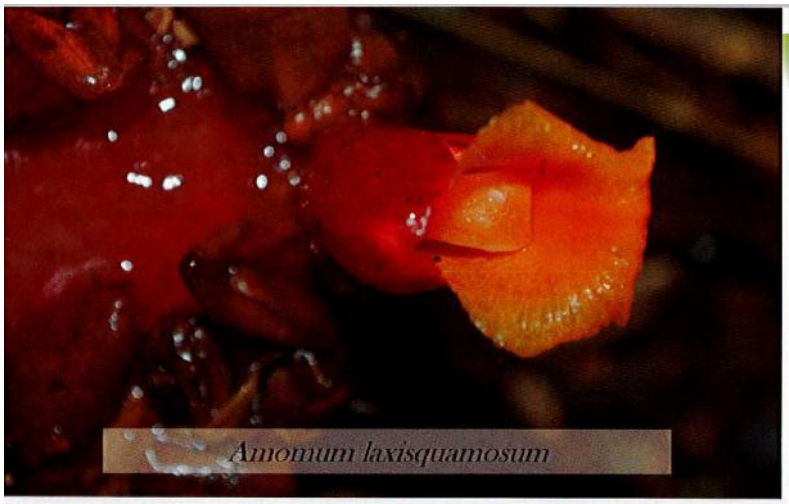
Alpinia niewenhuizii



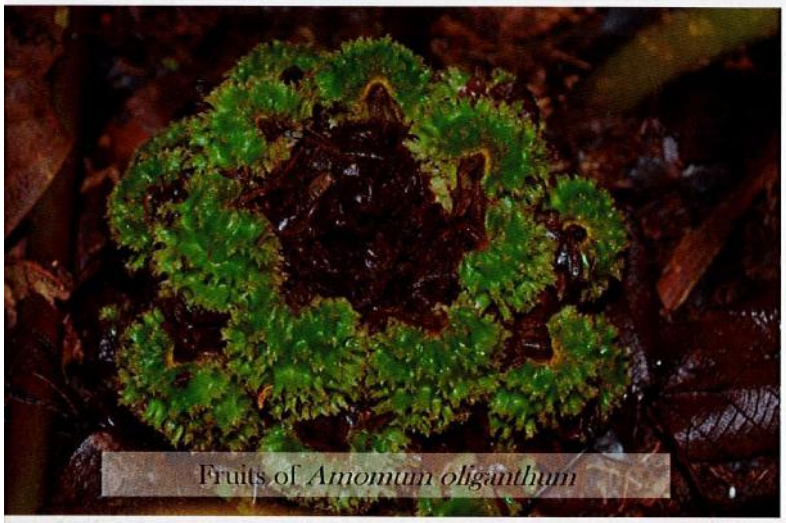
Close-up flower of *Alpinia niewenhuizii*



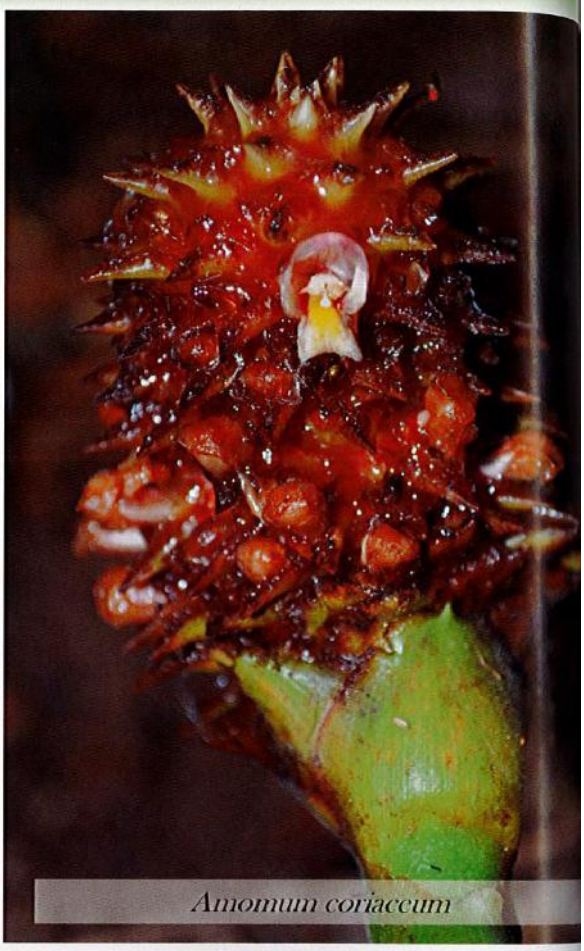
Immature fruit of unidetified *Alpinia*



Amomum laxisquamosum



Fruits of *Amomum oliganthum*



Amomum coriaceum



Amomum oliganthum

AMOMUM

The generic name *Amomum* is derived from the Greek word, *amomum* referring to a kind of an Indian spice plant (most probably referring to the *Amomum costatum*– the black cardamom) that reported to have anti-toxic properties. *Amomum* is one of the largest genus in the Zingiberaceae with more than 400 names recorded that natives to China, India, Southeast Asia, New Guinea and Northern Australia. It is the second largest ginger genus in Borneo with 36 taxa have been recorded. Smith (1984) recorded only four *Amomum* species occurred in the Mulu National Park (viz. *A. anomalum* R.M. Sm., *A. coriaceum* R.M. Sm., *A. laxisquamosum* K. Schum. & *A. oliganthum* K. Schum.) and all of them were also found in the Mentawai areas. In additional, three *Amomum* species added into the list that discovered during the expedition. The species are *A. dictyocoleum* K. Schum, *A. dimorphum* M.F. Newman and *A. gyrolophos* R.M. Sm.



Amomum anomalum

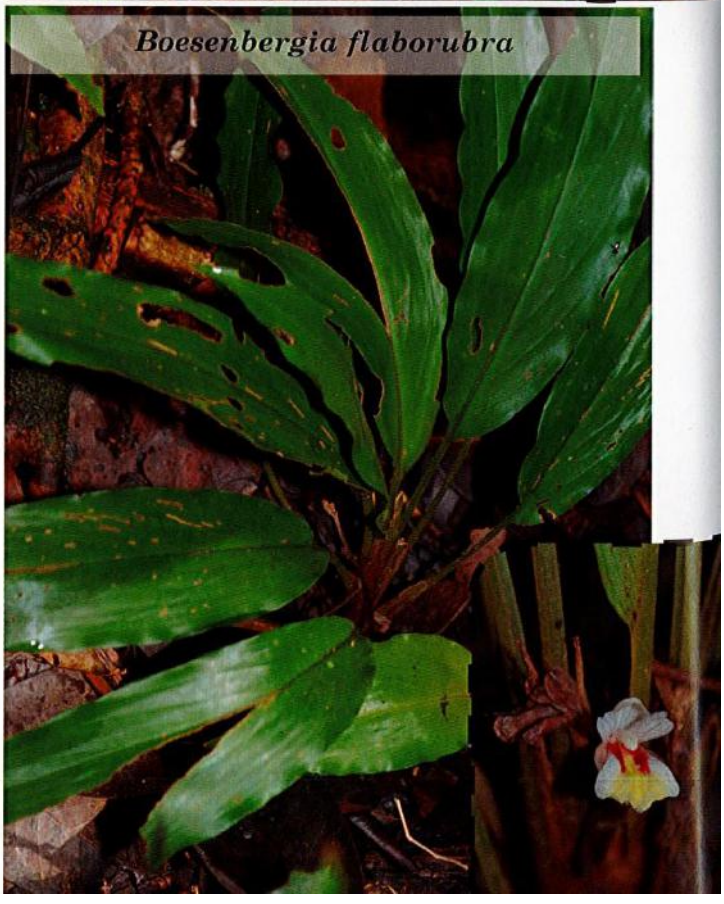


Boesenbergia armeniaca

Boesenbergia cordata



Boesenbergia flaborubra



BOESENBERGIA

The genus *Boesenbergia* was first established and introduced by the German merchant –botanist, Carl E.O. Kuntze as tribute and honour to his sister, Clara's husband named Walter Boesenberg. The plants are native to South China, India subcontinent and Southeast Asia (Brunei, Indonesia, Malaysia, Singapore, Thailand and the Philippines). There are about 60 - 70 species have been recorded with Borneo considered as the centre of species diversity. Sarawak alone recorded 25 species where 75% of them are endemic. Genus of *Boesenbergia* in Sarawak has been revised by Smith (1982) and since then being used as key references for Sarawak. Most of the species that she described were located from Mulu National Park as that the only place in Sarawak that she had visited during her study in Borneo. The Mulu National Park, however, has unique with many types of habitat that also a home of twelve spesies and therefore the area also known as 'Home of *Boesenbergia*'.

The *Boesenbergia* are small forest plants whith shoots consisting of 1 - few leaves, often with purple sheaths. The inflorescence arises between the leaves and is more-or-less enclosed by the leaf sheaths. All floral parts are extremely delicate and shortlived and thus described why field observations are crucial because few species are similarly in habits and appearences.

During the Mentawai Scientific expedition, only 8 species recorded *viz. B. armeniaca, B. cordata, B. flaborubra, B. gracilipes, B. hutchinsonii, B. orbiculata, B. pulchella* and *B. variegata*. Five of the species are limestone specialist where they found on the sheer cliffs, limestone pockets, crevices and limestone boulders. The other three species, *B. armeniaca, B. orbiculata* and *B. pulchella* are found in the damp and wet places under the deep shaded on forest floor, but sometimes also found on the limestone foothills.



Boesenbergia gracilipes



Boesenbergia hutchinsonii

Boesenbergia orbiculata



Boesenbergia variegata

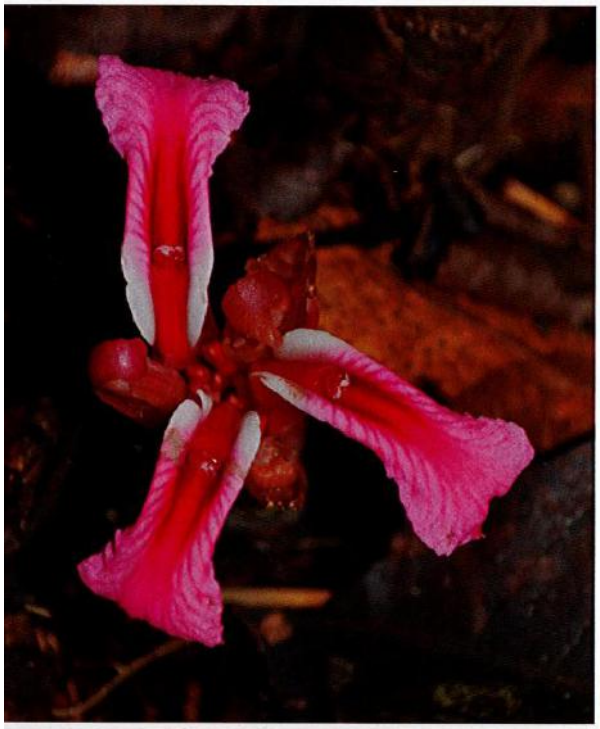




Boesenbergia pulchella

ETLINGERA

Etlingera is one of the most common ginger found in the Bornean forests, including the Mentawai areas. Among the most common *Etlingera* species found in the Mentawai areas are such as *Etlingera baramensis*, *E. bracychila* var. *vinosa*, *E. brevilabrum*, *E. burttii*, *E. elatior* and *E. nasuta*.

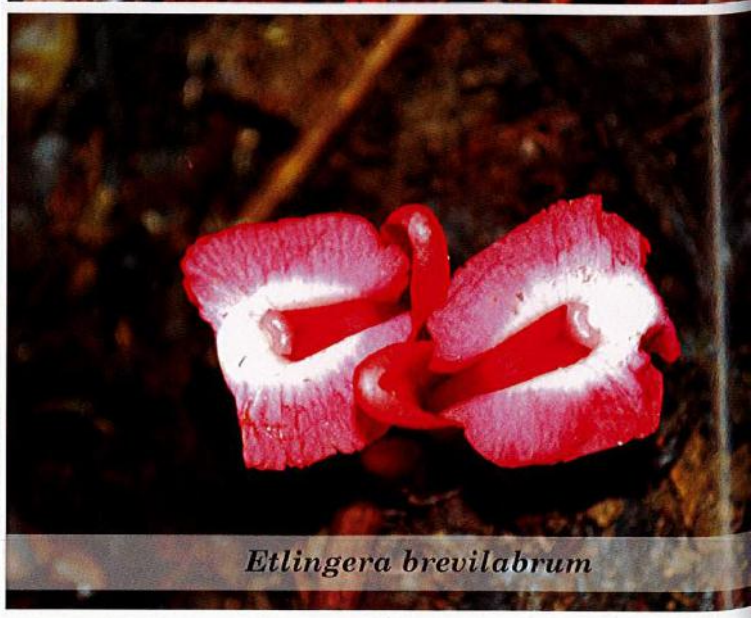




Etlingera nasuta



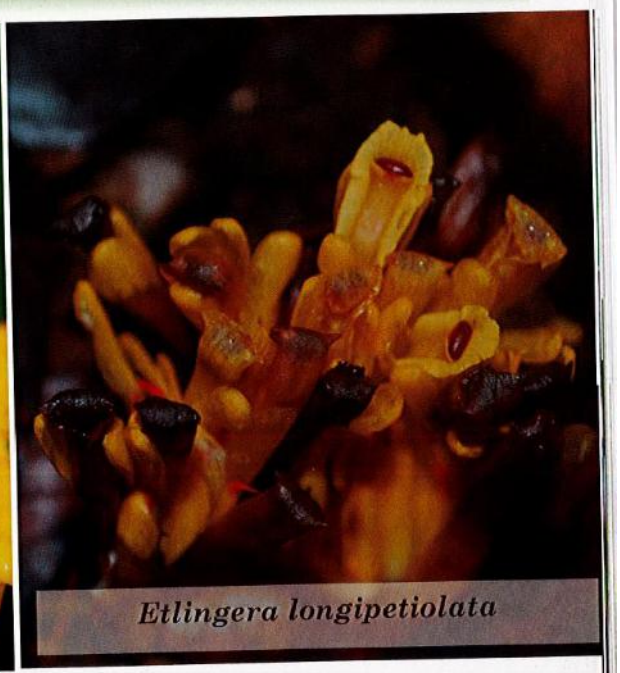
Etlingera baramensis



Etlingera brevilabrum



Etlingera burttii



Etlingera longipetiolata





Etlingera brachychila var. *vinosa*

GLOBBA

The generic name is based on an Indonesia plant named Galoba - a spice from Ambon that actually referring to the species in the genus *Etlingera*. The species in this genus are small to medium size, up to 50 cm tall, leafy shoot with terminal inflorescence. The inflorescence can elongate up to 30 - 45 cm long, with overlapping to widely spaced bracts which are bright coloured in some species. In several species bulbils replace the flowers. The flower is very characteristic with its lip joined to the stamen and the long-exserted, curved stamen.

The dstribution of this genus ranging from China, Southern India, Southeast Asia, New Guinea and Northern Australia. To date about 100 species have been described with Thailand is considered as the centre of distribution. Most of the species are very localized and high endemism. Thirteen taxa have been recorded for Borneo so far. During the expedition, five *Globba* species have been recorded, viz. *Globba atrosanguinea, G. franciscii, G. muluensis, G. pendula* and *G. tricolor.*



Globba franciscii



Globba atrosanguinea



Globba muluensis



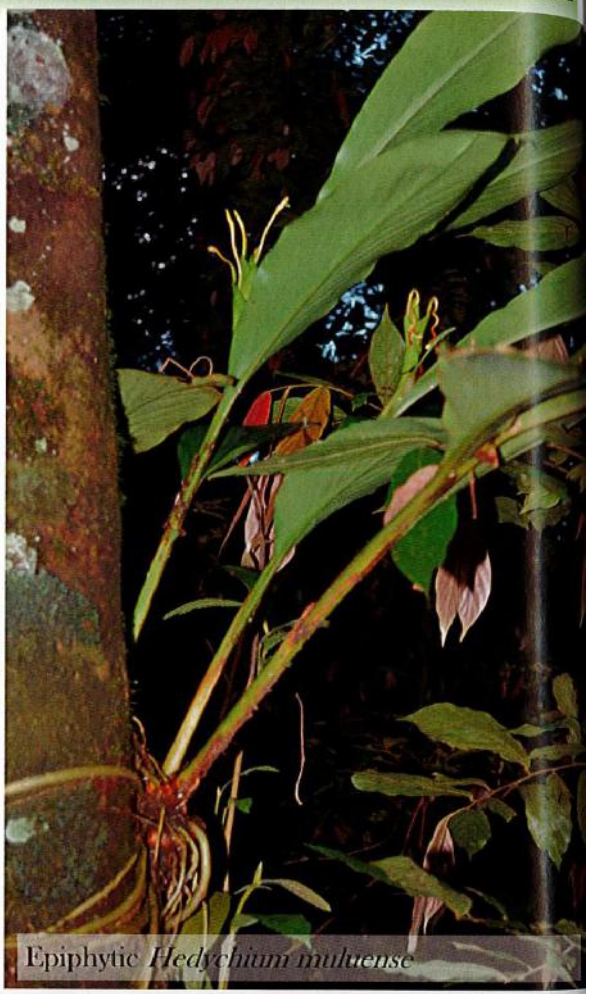


Globba pendula

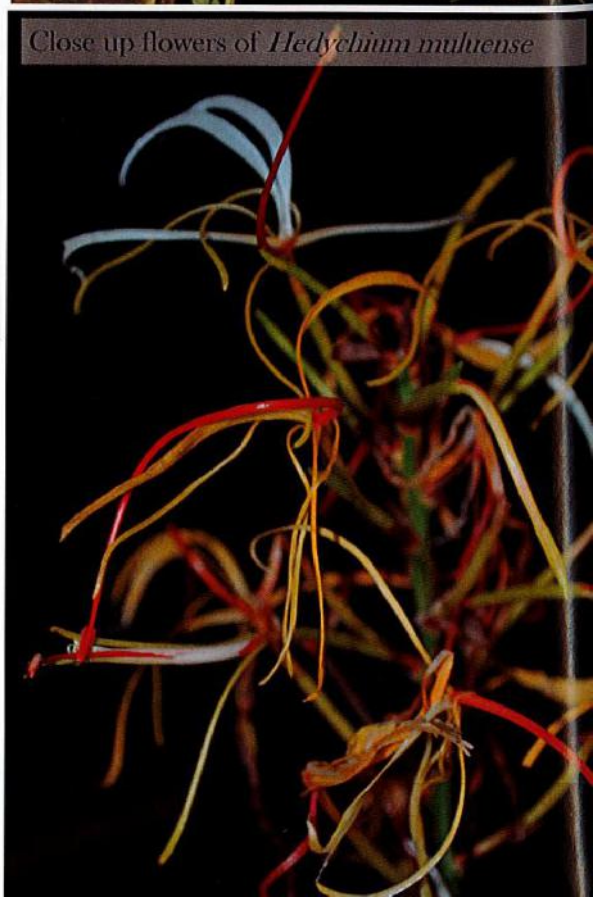
HEDYCHIUM

The genus *Hedychium* J. Koenig is native to Asia with approximately 70–80 known species. The distribution is ranging from Southeast Asia, Southern China, India, The Himalayas and toward the Madagascar with centre of distribution tought to be the Himalayas. The genus *Hedychium* is derived from the Greek words means 'sweet snow" that referring to the fragrant white flower of the generic type, *Hedychium coronarium* or vernacularly known as "Garland flower", "ginger lily" and "Kahili ginger".

Members of the genus *Hedychium* are rhizomatous perennials commonly growing as terrestrial or epiphytes. The long-exserted stamen in *Hedychium* is unique among the gingers in Borneo. Only three species reported as native to Sarawak and two of the species *viz. H. borneense* and *H. muluense* are reported from the Mentawai areas. *Hedychium muluense* was described by R.M. Smith based on the specimen collected from the Mulu National Park, which is common as epiphytic on the tree trunks or branches along the Sg. Mentawai, while *H. borneense* only recorded twice as lithophyte on the rock surfaces near to Lubang Cina of the Head Hunter Trail.



Epiphytic *Hedychium muluense*



Close up flowers of *Hedychium muluense*

Photo (below): matured fruits of *Hedychium muluense* splitting showing the reddish aril that covering the orange seeds to attract the birds or mammals for dispersal.





Inflorescence of *Hornstedtia reticulata*

HORNSTEDTIA

The genus *Hornstedtia* was established by Anders Jahan Retzius, a chemist, botanist and entomologist from Sweeden in 1791. The generic name is given after his fellow countrymen, Swedish naturalist, Claes Fredric Hornstedt who amassed rich collections in field of natural history and ethmology during his journey to Java in 1783 and 1784 (Leong-Skornickova, 2010). Most of the member of this genus are medium-sized or more commonly very tall gingers reaching a height of 7 m or more.

The inflorescence, arising on a separate side shoot from the rhizome, is somewhat spindle-shaped on a very short peduncle. The flower is without lateral staminodes, and corolla lobes and the labellum are equal in length, somewhat developed into a duck-bill liked structure. Two species were recorded in Mentawai areas, *viz. H. reticulata* and *H. tomentosa.*

Inflorescences of *Hornstedtia tomentosa*

ZINGIBER

The word "ginger" usually refers to the edible ginger of commerce known in the Malay language as *halia* and botanically as *Zingiber officinale*, while "gingers" is a general term for species of the ginger family. This name had been used for centuries, but its origins are uncertain. The words may provide a clue, Arabic called it 'Zenjabil', Persian 'Zengabil' or Sanskrit '*Singabera*' (meaning horn-root), then gave rise to the classical Greek name *Zingiberi* and finally *Zingiber* in Latin. All these words were used to refer to ginger rhizomes which resemble the shape of deer's antlers. Most of the *Zingiber* in Sarawak has erect candle-like inflorescence with closely overlapping bracts and has white or pale yellow diurnal or nocturnal flowers. It was classified as monophyletic group which produce radical inflorescence and characterized by having pulvinus petiole and anther crest wrapped around the exerted style. The *Zingiber* species can be divided into two types; one group produced flowers with a purple or pink lip mottled cream or pale yellow and the other group produces flowers with lips entirely white or cream, not mottled at all (Kress, 2002) and all the wild *Zingiber* species in Sarawak are in group two. Four sections have been recognized, with only three sections are recorded in Sarawak, namely *Cryptanthium*, *Lampujum* and *Pleurathesis*. The last section, *Dymczewiezia,* is possessed a terminal inflorescence which borne on the leafy shoot, however not yet been discovered in Sarawak.

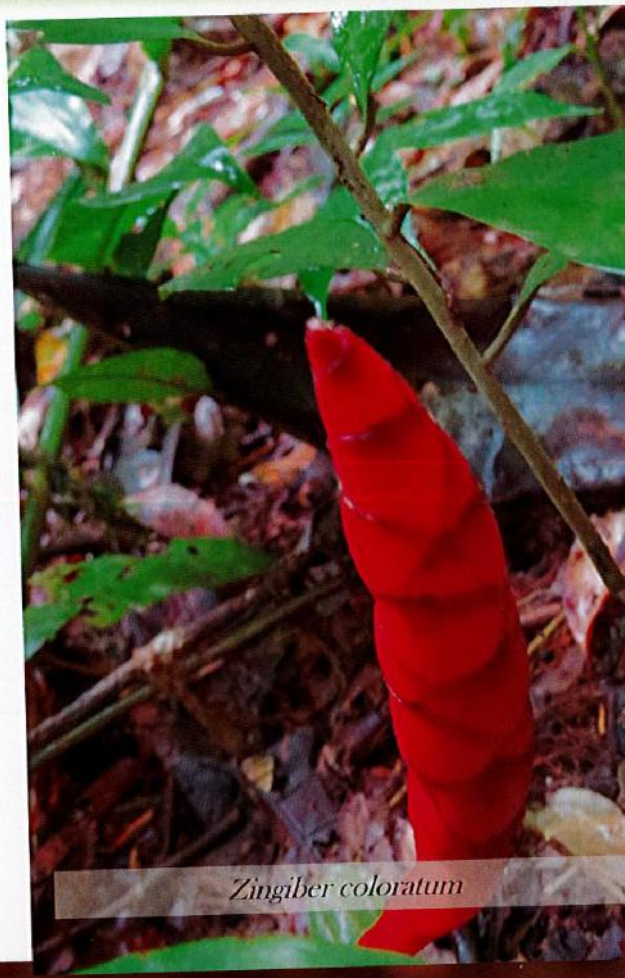


Zingiber leptostachyum



Zingiber kelabatianum

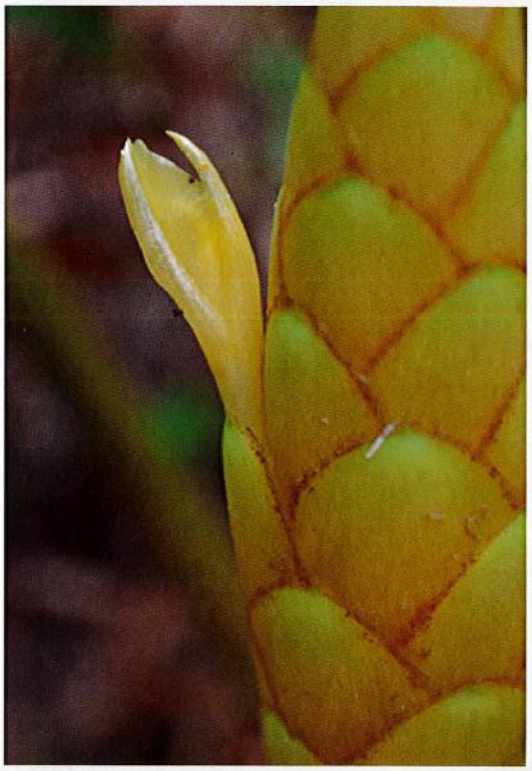
Mulu National Park is considered as the richest spot for *Zingiber* species with 12 species out of total number 16 species recorded for Sarawak. The species are *Zingiber albiflorum, Z. argenteum, Z. coloratum, Z. griffithii, Z. kelabitianum, Z. martinii, Z. leptostacyum, Z. longipenduculatum, Z. pachysiphon, Z. porphyrosphaerum, Z. pseudopungens, Z. puberulum* var. *borneense*. During the surveys, only eight species recorded in the Mentawai areas.



Zingiber coloratum



Zingiber martinii





Zingiber griffithii







Zingiber pachysiphon







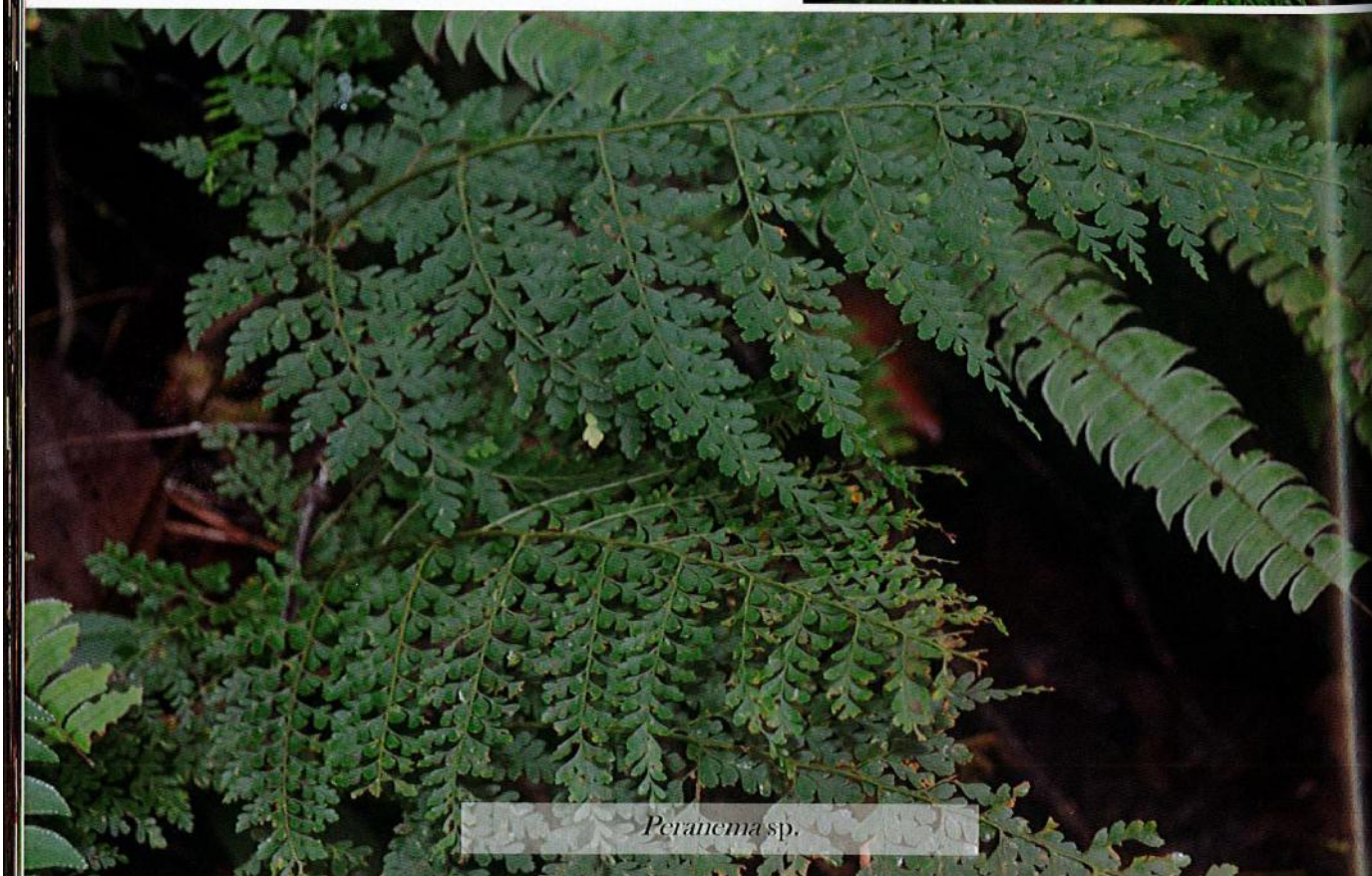
Zingiber pseudopungens

FERNS AND FERN ALLIES

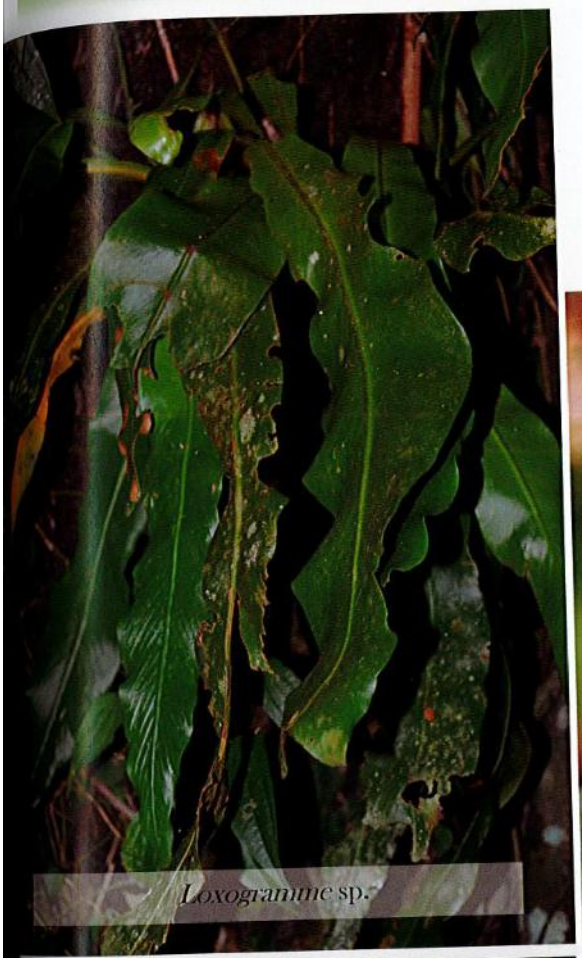
The pteridophytes flora of Borneo is rich both in number of species and in their importance in the vegetation. The knowledge on the pteridophytes in Borneo are mostly referred to works by Christensen and Holttum (1934), Holttum (1959, 1965, 1978, 1982), Parris et al. (1984, 1992) and Beaman and Edwards (2007). Until today, there is no certain number have been estimated for the pteridophytes diversity in Borneo. The only site with a better known number of pteridophytes in Borneo is Mount Kinabalu, where Parris et al. (1992) and Beaman and Edwards (2007) listed more 590 taxa recorded. The surveys of the pteridophytes in Mulu National Park have been conducted during the Royal Geographic Society in 1977–78, where Parris et al. (1984) reported about 425 taxa recorded. The number however are from the specimens collected and plants observed in the field from one third of the total park areas. It is believed that the number of pteridophytes in the Mulu National Park (includes the Mentawai) might be reach more than 550 taxa.



Huperzia squarossa



Peranema sp.



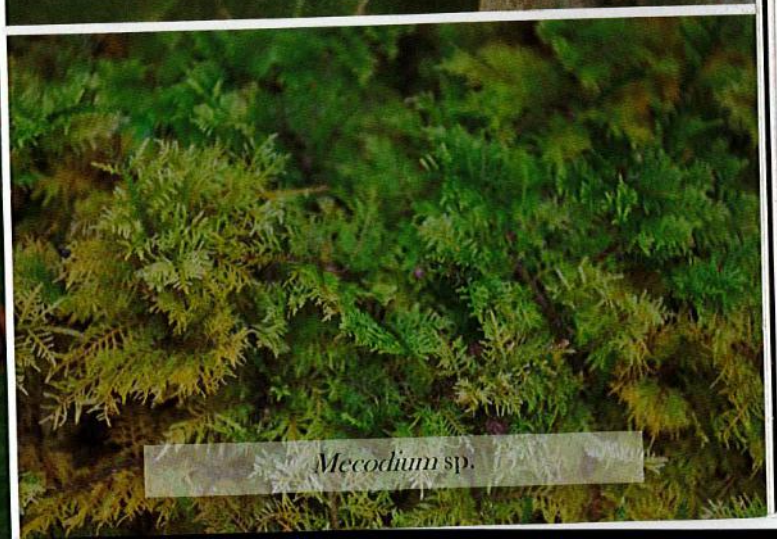
Loxogramme sp.

Huperzia nummularifolia





Lindsaea sp.



Mecodium sp.



Selaginella sp.



Aglaomorpha sp.



Mecodium sp.



Christensenia aesculifolia

Mapania cuspidata* var. *cuspidata

(Rumput Serapat)



MEDICINAL

Plants are reservoir of medicines and almost all the drug research are derived from vascular plant since few decades ago. Plant based traditional knowledge has become essential tool in identifying potential medicinal plant. The ancient medicines based on plant are obtained through many trial and errors to treat various kinds of diseases, wounds or even poisons from venomous snakes. The trials could cause death and many adverse impacts resulted from toxicity of the plant. In most communities, peculiar names are used to describe the plant form based on the appearances, uses or association of the plant with nature, people and animal. Thus helps in reducing the complexity of selecting plants to treat diseases. For example, any plants with the names of "Fatimah" are usually relating to the used for women consumptions or treatments.

Among the plants recorded during the expedition are Kacip Fatimah (*Labisia pumila*), Rumput Serapat or Pandan Tikus (*Mapania* spp.), Tongkat Ali (*Eurycoma longifolia*), Dukung Anak (*Phyllanthus* spp.), Kayu Hujan Panas or Selukai (*Goniothalamus* spp.), Sireh Hutan (*Piper* spp.) and many more. The most common plants used by the local communities are from the family Annonaceae. For example, the dried bark that peeled off from the Selukai tree (*Polyathia* spp.) and Kayu Hujan Panas are burned to scare away the mosquitoes and also the chase away the evil spirit.



Eurycoma longifolia

(Tongkat Ali)



Labisia pumila
(Kacip fatimah)



Piper sp.
(Sireh hutan)

" I am very happy to see this such big trees are still standing here and hoping that it will still be there for our next generations"

- Apai Buyu



THE WAY FORWARDS

The Mentawai as a small part in the Mulu National Park is very rich in the plant diversity. The State Government has taken the right step to gazette the area as a Totally Protected Area and initiate a comprehensive documentation of the area for further consideration. However, a further study and research in the area could unveil much more biodiversity treasure of Mentawai for future generation to savour and the future planning.



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ACKNOWLEDGEMENTS

Many people have made contributions to this books in various ways. First and foremost, we would like to extend our gratitude to the Ministry of Natural Resources and Environment Malaysia (NRE) and the State Government of Sarawak for providing the fund under the Heart of Borneo (HoB) Initiative to enable us to publish this book on the Heart of Borneo Series.

Our Sincere thanks also to the former Director of Forests, Datu Haji Ali Yusop and the Dean of Faculty of Resource Science and Technology, UNIMAS, Associate Professor Dr Othman Bojo for their support, encouragement and valuable advice.

This book is mainly based on the provisional report and field observations by the authors from the Mentawai Scientific Expedition 2012.

We wish to record our appreciation to:-

Expedition crews and expedition participants for photos contribution.

International Affairs Division-Heart of Borneo Programme of the Forest Department Sarawak

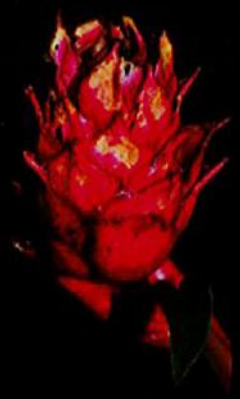
Plant Science and Environmental Ecology Department of Faculty Resource Science and Technology, UNIMAS.



***Bauhinia* sp. (Fabaceae)**

Autograph





Forest Department Sarawak