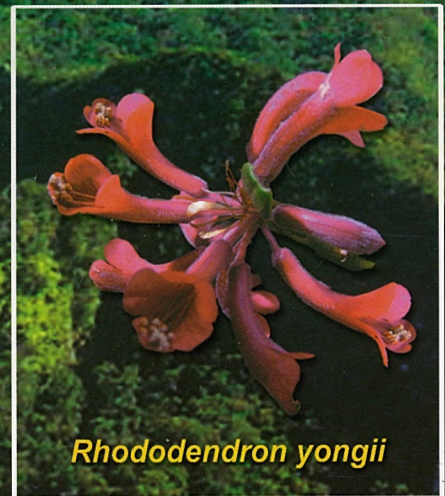


# THE FLORA OF PULONG TAU NATIONAL PARK

ITTO Project PD 224/03 Rev.1 (F)  
Transboundary Biodiversity Conservation -  
The Pulong Tau National Park, Sarawak, Malaysia

K. G. Pearce, Project Forest Botanist  
2006



*Rhododendron yongji*



International Tropical Timber Organization  
Sarawak Forest Department  
Sarawak Forestry Corporation



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**International Tropical Timber Organization  
Sarawak Forest Department  
Sarawak Forestry Corporation**

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ISBN 983-42260-2-0

The Flora of Pulong Tau National Park  
ITTO Project PD 224/03 Rev. 1(F): Transboundary Biodiversity  
Conservation - The Pulong Tau National Park, Sarawak, Malaysia

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# **Reminder**

## **Traditional Knowledge As Intellectual Property**

The ethnobotanical information documented in this report was provided by the Kelabit, Lun Bawang and Penan communities. It is traditional knowledge and the intellectual property of the communities.

The Convention on Biological Diversity, agreed in 1992 and signed by Malaysia, seeks to promote the conservation of biodiversity and the equitable sharing of benefits arising out of the utilization of genetic resources. Article 15 of the Convention on Biological Diversity notes that access to genetic resources should be on the basis of **prior informed consent** and on **mutually agreed terms** that provide fair and equitable sharing of the results of research and development and the benefits of commercialization and utilization. It also calls for the fair and equitable sharing of the benefits derived from the use of traditional knowledge. The Sarawak Biodiversity Centre (Amendment) Ordinance 2003 also relates to research on the State's biodiversity.

No living genetic resources of materials collected during the Forest Botany fieldwork have been maintained - all specimens collected were preserved and kept in the Sarawak Forestry Department Herbarium, Kuching, and are the property of the State Government. Organizations or persons seeking access to genetic resources of the species documented herein as having ethnobotanical uses would need to take due cognizance of the requirements of the Convention on Biological Diversity and the Sarawak Biodiversity Centre Ordinance.

# Glossary

Aff.	<i>Affine</i> , akin to
BRAHMS	Botanical Research and Herbarium Management System, University of Oxford Version 5.57 software (Software designed for the storage and analysis of herbarium specimen data)
Cf.	<i>Confer</i> , compare
Diam.	Diameter
E	East
<i>Gunung (G.)</i>	Mountain
GIS	Geographical Information Systems
IPNI	International Plant Names Index (A database of the names and associated basic bibliographical details of all seed plants, ferns and fern allies; the product of a collaboration between The Royal Botanic Gardens, Kew, The Harvard University Herbaria and the Australian National Herbarium) <a href="http://www.ipni.org">www.ipni.org</a> .
ITTO	International Tropical Timber Organization
LMF	Lower Montane Forest
<i>Long</i>	Confluence
N	North
N.P.	National Park
<i>Pa</i>	River
S	South
SAR	Kuching, Sarawak Herbarium, Forest Department, Kuching, Sarawak, Malaysia
SFD	Sarawak Forest Department
<i>Sungai (Sg)</i>	River
Syn.	Synonym
<i>Ulu</i>	Upriver
UMF	Upper Montane Forest
W	West
W.S.	Wild Life Sanctuary

## Executive Summary

This report summarises investigations on the flora and vegetation of Pulong Tau National Park made under the ITTO Transboundary Biodiversity Conservation Project – Pulong Tau National Park, Sarawak, Malaysia (ITTO Project PD 224/03 Rev. 1(F)). The investigations were carried out chiefly during 2005. Fieldwork involved collection of plant specimens in the N and S of the Park and in the Bario area by a team of ITTO Consultants and Sarawak Forestry Corporation staff, with assistance from informants, guides and porters from communities adjacent to the Park. Local informants provided local names and information on the ethnobotanical uses of the plants collected and contributed opinions as to the economic potential of some of the species and on eco-tourism in the Park. The specimens collected were identified by the Consultant, Mr Banyeng Ludong and specialists with expertise in particular groups. Specimens from the Park and its vicinity already inserted in the Kuching, Sarawak Herbarium (SAR) were examined and either their identity was confirmed or they were re-determined as far as possible with resources (literature and annotated collections) available at SAR. BRAHMS (Botanical Research and Herbarium Management System) software developed by the Department of Plant Sciences, University of Oxford, and designed for the storage and analysis of herbarium specimen data, was used. A BRAHMS database of the Plants of Pulong Tau National Park was established to hold records of specimens collected under the ITTO Project and SAR specimens whose identity had been confirmed or newly determined. BRAHMS was used to analyse the data, generate information on the Park's flora, derive information on the composition of particular vegetation facies/habitats and generate a *Checklist of the Plants of Pulong Tau National Park* (giving species' habitats) and a *Checklist of Plants of Pulong Tau National Park with Ethnobotanical Uses*. Guidelines for the Park's conservation management and recommendations for follow-up studies are put forward.

### The Flora of Pulong Tau National Park

At least **819** plant species represented by herbarium specimens are known occur within the Park. They include flowering plants, ferns and fern allies. A further **72** species are known from reports in the literature or observations. Newly available data from Project ecological studies indicate that a further **342** named species occur in the Park.

The **819** species comprise **668** different named species, **114** morphospecies (recognised as distinct and numbered as such) and about **36** unidentified species belonging to genera and families otherwise unrepresented in the *Checklist of the Plants of Pulong Tau National Park*. Some morphospecies may actually be the same as some of the **72** and/or **342** reported, named species so it is not justifiable to simply sum the totals.

The figures are an underestimate due to the exclusion of specimens with location data insufficiently detailed to indicate that they were collected from within the Park. The



numbers will also undoubtedly increase with collection in the Mixed Dipterocarp Forest at the W of the Park and further collection of tree species, which Project ecological data suggest are poorly represented in the *Checklist of the Plants of Pulong Tau National Park*. Further identification of specimens, especially by experts, will also improve the estimate of the number of species that occur in the Park.

The Park is home to 33 species listed as Endangered, Vulnerable, Lower Risk or Data Deficient in the 2006 IUCN Red List, as well as a number of Sarawak's Protected Plants (Wild Life Protection Ordinance 1998), namely species of *Aeschynanthus*, *Begonia*, *Ficus*, *Henckelia* (syn. *Didymocarpus*), epiphytic *Huperzia* (syn. *Lycopodium*), *Nepenthes* (9 spp.), Orchidaceae (> 150 spp.) and *Rhododendron* (19 spp).

### **Vegetation types represented in the Park**

Five major vegetation types were found to occur in Pulong Tau National Park. These are described, and include:

- Mixed Dipterocarp Forest
- Lower Montane Forest on Clay Soil
- Upland Kerangas
- Upper Montane Forest (Tall = Mossy Forest)
- Upper Montane Forest (Short = Ericaceous Scrub)

### **Species recorded as having ethnobotanical uses**

Twenty-seven plant species were recorded as having medicinal uses for humans. As many as 40 medicinal uses of Park plants for humans were provided by the local informants as well as uses as food, firewood, for veterinary purposes and many other purposes including construction, handicrafts, fishing, wrapping etc. Some of the plants used would doubtless be worthy of further investigation especially as the same species have been recorded as used for similar purposes by other ethnic groups in Sarawak.

### **Inventory of plant species of economic significance**

Currently the most economically significant species are the gymnosperm timber species, particularly *Agathis* and also *Dacrycarpus*, *Dacrydium* and *Phyllocladus*. Highly decorative ornamental species are to be found among the Park's rhododendrons, orchids, pitcher plants and gingers. *Boesenbergia stenophylla* and *Arcangelisia flava* are potentially useful species worthy of further investigation as a medicinal herb and flavouring respectively. Palms, especially rattans, need further investigation as to their potential in the development of a cottage handicraft industry by the local communities.

## **Guidelines for the conservation management of Pulong Tau National Park**

Guidelines presented revolve chiefly around enforcing existing laws that relate to the Park and involving the local communities in park matters, both as guides and custodians.

### **Recommendations**

Recommendations are made on action that could be taken to address environmental issues in the Park, add to the existing knowledge of the Park's flora and vegetation, raise awareness of the Park, upgrade services for Park visitors, empower local communities to use their traditional knowledge, set up Joint Ventures to sustainably produce and market traditional forest products and local plants, market timber and fuelwood species seedlings raised from sustainable sources and develop the local handicraft and souvenir industry.

## Acknowledgements

I gratefully thank Datu Cheong Ek Choon, Sarawak Forest Department Director, Dr Penguang Manggil and Mr Sapuan Ahmad, consecutively Project Coordinators, and Dr Paul Chai P. K., ITTO Project Manager, for giving me the opportunity to carry out this study.

I acknowledge, with thanks, all those who helped so much in making this study a success. Ms Zarina Hj Shebli, Project Chief Local Counterpart, and Mr Yap Vui Kong, Constitution Unit, SFD, organized the fieldwork, Mr Jongkar Grinang, ITTO Project Officer, assisted in many ways. Ms Josephine Wong and Mr Phira Sallang of the SFD GIS Unit provided maps and satellite images and Mr Johnny Poh H.S. and Ms Chiang Moi Sen gave administrative assistance. Ms Lucy Chong generously permitted the Consultant to examine the Sarawak Forest Department Herbarium collections and use the Herbarium facilities and the relevant records from the Herbarium's BRAHMS system. Ms Angelia Muri gave unstintingly both of her time, to enter numerous new determinations of specimens into the BRAHMS system, and her expertise with the BRAHMS software that was used to analyse the data and output checklists.

Mr Rantai Jawa, Senior Research Assistant, and Mr Shalih Rebi, Mr Tinjan Kuda, Mr Army Kapi and Mr Serukit Dubod, Technical Assistants of Sarawak Forestry Corporation's Forest Research Centre, played an invaluable role in the fieldwork for this study. Their high professional standards and ever-cheerful companionship resulted in smooth fieldwork, a fine collection of specimens and many pleasant memories. I would also like to thank Dr Lim Meng Tsai and Mr Sia Puon Chiew, fellow Consultants, for their companionship and useful discussions.

Local community members generously provided their intellectual property in the form of local plant names and uses: in the Menalio area Mr Juing Katu and Mr Solomon Sidek (Kelabit), Mr Udau Abeng and Mr No' Balan (Penan) and in the Murud area Penghulu George Sigar Sultan and Mr Morris Labo (Lun Bawang) and Mr Samuel Melai and Mr Ramli Melai (Penan). Thanks also go to all the boatmen, guides and porters who were involved in the study. Special thanks go to Mr Peter (Paran) Aran for the use of his lodge at Long Menalio, Penghulu George Sigar Sultan and others from Ba' Kelalan who generously made available their residences and other facilities at the Church Camp and to the Resident's Office, Limbang, for the use of the Upriver Agent Office, Ba' Kelalan.

Mr Banyeng ak Ludong, retired field staff member of the Forest Research Centre, cheerfully and painstakingly identified many of the specimens collected during this study. Others who generously identified specimens in their areas of expertise included Dr P. C. Boyce (Araceae), Dr P.P.K Chai, Dr R.J Johns (*Asplenium* and other ferns), Mr Julaihi Abdullah, Ms Julia Sang (*Actinodaphne*, *Nothaphoebe*), Dr R. Kiew, Dr Barbara Parris (Grammitidaceae, *Selliguea*), Mr Tang Cher Hing (*Eria*), Mr Rantai Jawa and Mr Yahud Wat (*Neolitsea*, *Alseodaphne*).

# 1. Introduction

Botanical investigations in the Pulong Tau National Park area date from 1922 when Eric Mjoberg, the Swedish zoologist-ethnographer, made an expedition to Gunung Murud (Beaman 1998). Since then both the Sarawak Forest Department and independent collectors have made trips to collect plants in the area (Appendix 1) focusing chiefly on G. Murud at the N of the Park.

The study reported here represents an effort towards the documentation of the flora and vegetation types of Pulong Tau National Park, Sarawak's 17<sup>th</sup> National Park gazetted on 24 March, 2005. The data are not only interesting for their own sake (especially as G. Murud, at 2424 m, is the highest mountain in Sarawak) but necessary for the development of a management plan for the Park that will ensure its best use as an important ecotourism destination in the State.

Pulong Tau National Park (about 59,817 ha) lies in a remote, hilly to mountainous region in NE Sarawak close to the international border with Kalimantan, Indonesia and Indonesia's Kayan Mentarang National Park. The chief access points to the Park are from Ba' Kelalan in the N and from Bario to the E. Though crossed by traditional routes, the Park itself is unpopulated. Kelabit, Lun Bawang and Penan communities are located in its vicinity.

Investigations on the flora and vegetation of Pulong Tau National Park made under the ITTO Transboundary Biodiversity Conservation Project – Pulong Tau National Park, Sarawak, Malaysia (ITTO Project PD 224/03 Rev. 1(F)) were carried out chiefly during 2005. They involved work in the field, in the herbarium and with the Botanical Research and Herbarium Management System (BRAHMS). While the Kuching Sarawak Herbarium (SAR) holds many specimens from the Park area, their identities needed to be checked and the associated information extracted. The data from all records of SAR specimens from the Park that had been thus checked, together with data from those collected during the Project fieldwork were then available for analysis using BRAHMS, to provide information on the flora and vegetation of Pulong Tau National Park.

## 2. Methods

### 2.1 Field Investigations under the ITTO Project

The Consultant and a team of field staff made two field trips to the Park under the ITTO Project.

The team included Sarawak Forestry Corporation staff and informants, guides and porters from communities adjacent to the Park. The local community members contributed local names for the plants collected and also ethnobotanical information.

From 23 April to 20 May 2005 collections were made in the Menalio River area and the Tama Abu Range at the S of the Park and also near Bario. From 2 to 25 August 2005 collections were made on Gunung Murud, at Pa Belaban and at Long Rapung (just outside the Park boundary) in the N of the Park and also at Long Rebadta (Appendix 2).

In total **1103** plant specimens were collected of which **1045** were from within the Park.

### 2.2 Compilation of a Checklist of the Plants of Pulong Tau National Park

A *Checklist of the Plants of Pulong Tau National Park* (Appendix 3a) was generated by BRAHMS from the *Plants of Pulong Tau National Park BRAHMS Database (PPTNP BRAHMS Database)*.

Records entered into the *PPTNP BRAHMS Database* were derived from two sources:

#### (a) Specimens collected during Project fieldwork

These were identified by the Consultant, with reference to the literature and herbarium collections held at the Sarawak Forest Department Herbarium, Kuching (SAR), by Mr Banyeng Ludong and by specialists with expertise in particular groups.

Of the Park specimens **943 (91%)** were determined to species (including **146** specimens to morphospecies - species recognisable as distinct but not attributable to any named species represented at SAR or in the available literature) and **1022 (98%)** to genus.

The Project fieldwork specimens represented 116 families (78 dicotyledon, 15 monocotyledon, 2 gymnosperm, 17 fern, 2 fern ally and

1 bryophyte family), about 277 genera and more than **570** species. The species included about 460 named species (including species determined as cf. (comparable to) but not those determined as aff. (akin to)) as well as morphospecies.

- (b) Herbarium specimens collected from the Park and its vicinity already inserted in the Kuching, Sarawak Herbarium (SAR)

These records were selected by:

- (i) Extracting records of specimens from locations in and around Pulong Tau National Park based on the keywords Murud, Murut, Tama Abu, Menalio, Belaban, Belapan, Lepo Bunga, Bario and Kelabit Highlands from the SAR BRAHMS Database (3776 records).
- (ii) Checking the detailed location data of individual records and selecting those definitely collected from Park locations and those with insufficient location data that were likely to have been collected within the Park (e.g. 1982 collections from the 'Proposed Gunung Murud National Park').
- (iii) Locating as many as possible of the selected specimens at SAR.
- (iv) Confirming their identity or re-determining them by comparison with reliably annotated collections at SAR and with reference to the literature. The Consultant re-determined 293 specimens during the study. Records of specimens determined by taxonomists specialising in those particular taxa in the last 8 years or so were also accepted. The International Plant Names Index (IPNI) was used to confirm spellings of species names and authorities.

The ***PPTNP BRAHMS Database*** held a total of 1885 records considered to be most likely from within the Park, comprising 1045 ITTO Project collections and 840 inserted SAR collections.

### **2.3 An Ethnobotanical Study of Forest Species**

As part of the fieldwork Kelabit, Lun Bawang and Penan informants were asked to locate species considered locally to have ethnobotanical properties and provide their local names and uses. The specimens they pointed out were collected even when sterile and the local knowledge of informants from each ethnic group concerning them was recorded. The

data were entered into the *PPTNP BRAHMS Database*, which was then used to generate a *Checklist of Plants of Pulong Tau National Park with Ethnobotanical Uses* (Appendix 3b). The uses were categorised.

## **2.4 Description of Vegetation Types**

Records from the *BRAHMS Database of the Plants of Pulong Tau National Park* were selected for each forest type based on objective attributes and/or attribute combinations such as soils (e.g. alluvium, clay, sand, peat) and morphological features (e.g. summit, riverbank). Other collection information, such as occurrence in 'Kerangas forest' (usually used locally to describe forest on white or grey sandy soils) and disturbance were used in the case of certain forest types.

The habitat and locality fields for each record extracted were checked individually to ensure that the specimen was actually from the habitat suggested by the key words used for selection.

BRAHMS was used to sort the data and to generate lists and counts of taxa, altitudinal ranges and information used to describe the vegetation types, structures and species composition, and to detail the occurrence and locations of each forest type.

Field notes of the vegetation structure and composition at different locations were incorporated in the descriptions of vegetation types.

## **2.5 Inventory of Plant Species of Economic Significance**

Local community informants were asked about species of economic significance including those that might be important in the development of non-timber forest products. Accessible sites with a good stocking of valuable timber species noted during the fieldwork were identified as potential gene banks.

## **2.6 Studies on Ecotourism Potential**

Informal talks were held with local community informants to elicit their views on the Park's ecotourism potential.

### 3. Results

#### 3.1 Numbers of Taxa at Pulong Tau National Park

From the *Checklist of the Plants of Pulong Tau National Park* the plants recorded from Pulong Tau National Park represent:

##### **125 families**

87 dicotyledon families  
15 monocotyledon families  
2 gymnosperm families  
19 fern families  
1 fern ally family  
1 bryophyte family

##### **About 323 genera**

##### **An estimated 819 species**

Comprising:

About **668** named species (including those identified as cf. (comparable to) but excluding those identified as aff. (akin to))

##### **114 morphospecies**

##### **34 otherwise unrepresented genera not identified to species:**

(Allophyllus, Alphonsea, Alseodaphne, Amischolotype, Amyema, Anoectochilus, Antrophyum, Astronia, Beilschmiedia, Belvisia, Bidens, Borneacanthus, Canthium, Cinnamomum, Coryphopteris, Cryptostylis, Curculigo, Elaphoglossum, Elettaria, Geophila, Hanguana, Hemigraphis, Hoya, Kadsura, Meringium, Oberonia, Ophioglossum, Ophiorrhiza, Phreatia, Pilea, Schizaea, Schoenorchis, Tapeinidium, Thelasis)

**2 families (Amaranthaceae, Dicksoniaceae) not identified to genus**

The best-represented plant families are:

The **Orchidaceae** - **151** species including 40 morphospecies with 26 *Eria* spp., 23 *Dendrochilum* spp., 16 *Bulbophyllum* spp., 14 *Dendrobium* spp. and 13 *Coelogyne* spp.



The **Rubiaceae** - 45 species

The **Ericaceae** - 44 species including 19 *Rhododendron* species, 13 *Vaccinium* species and 12 *Diplycosia* species

The **Zingiberaceae** (gingers) - 30 species

The **Arecaceae** (palms) - 22 species

The **Gesneriaceae** - 14 species including ornamentals

The **Nepenthaceae** - 8 *Nepenthes* species plus *N. vogelii* reported

The **ferns** and **fern allies** (about 41 species and 8 additional genera not identified to species and otherwise unrepresented)

The most speciose genera are:

*Eria* (26 spp.), *Dendrochilum* (23 spp.), *Rhododendron* (19 spp.), *Ficus* (about 18 spp.), *Bulbophyllum* (16 spp.), *Syzygium* (16 spp.), *Elaeocarpus* (15 spp.) and *Dendrobium* (14 spp.)

The best-collected genera are:

*Rhododendron* (84 records), *Ficus* (60 records) and *Eria* (52 records)

The most frequently collected species are:

*Ficus deltoidea* and *Rhododendron crassifolium*

Seventy-two (72) species from Pulong Tau National Park reported in the literature or observed but not collected are not represented on the ***Checklist of the Plants of Pulong Tau National Park***. They are listed in Appendix 4: ***Plant Species Reported from Pulong Tau National Park Not Represented in the ITTO Checklist***. Some of these additional species may be represented by morphospecies on the ***Checklist of the Plants of Pulong Tau National Park***.

Among these species are an additional *Nepenthes* species, 21 orchid species and 18 fern and fern ally species.

### 3.2 Ethnobotanical Information Recorded for Park Species

Ethnobotanical information for Park specimens was only available for specimens collected under the ITTO Project. No such information had been recorded for Park specimens already inserted in SAR.

Ethnobotanical information was recorded for 190 (about 10%) of the 1885 specimens in the *PPTNP BRAHMS Database*. These represented 64 families and at least 148 species. Twenty seven plant species had medicinal uses.

More than one use was reported for a number of the specimens and several of the useful species were collected more than once. Uses given for any particular plant by informants from the three different ethnic groups sometimes, but not always, differed.

The ethnobotanical uses recorded included:

- 40 medicinal uses for humans
- 40 uses as food
  - 20 for fruits
  - 14 for vegetables (chiefly palm cabbages)
  - 4 for spices and
  - 2 for feeding animals
- 32 uses as firewood
- 24 veterinary uses (mostly to make hunting dogs fierce but also to improve dogs' appetite and treat worms and diseases in dogs and buffalo)
- 18 uses in house and boat construction
- 18 uses in handicraft items and implements
- 15 uses as charms
- 12 uses by children (chiefly fruits being eaten for fun)
  - 6 uses in fishing
  - 3 uses for cooking rice
  - 3 uses for wrapping rice
  - 2 uses as cordage
  - 2 uses for damar (resin)
  - 2 uses in hunting
  - 2 uses as a source of water
  - 2 uses to stop a child breastfeeding
  - 1 ornamental use

The uses are given in the *Checklist of Plants of Pulong Tau National Park with Ethnobotanical Uses* (Appendix 3b).

### **3.3 Vegetation Structure and Floristic Composition**

Five major vegetation types exist in the Park. These are:

- Mixed Dipterocarp Forest
- Lower Montane Forest on Clay Soil

- Upland Kerangas
- Upper Montane Forest (Tall = Mossy Forest)
- Upper Montane Forest (Short = Ericaceous Scrub)

The occurrence, location, soils, morphological features, vegetation structure and floristic composition of each of these are given. Some local variants within these forest types related to differences in soil, microclimate, topography, human interventions etc. are also described.

Observations noted during the Project fieldwork are incorporated.

### 3.3.1 Mixed Dipterocarp Forest

Mixed Dipterocarp Forest (MDF), which is dominated by dipterocarp species, was once widespread across the lowlands of Borneo. Such forest, though not seen during the Project fieldwork, was reported to occur at lowland sites in the Park, especially to the W.

Occurrence: From about 530 m

Location (P.C. Sia pers. comm):

- (a) S of Pa Tik from about 530 m.
- (b) Sg Tutoh at SW boundary of Park between Long Labid and Long Lellang, from about 690 m.

Description: Good Mixed Dipterocarp Forest, big trees.

Structure: Unknown.

Genera represented: *Shorea*.

### 3.3.2 Lower Montane Forest on Clay or Clay-loam Soil

The lowest altitude recorded in the *PPTNP Database* was 950 m. There were no dipterocarps among the 44 specimens from this altitude but there were species noted as 'montane' in the *Tree Flora of Sabah and Sarawak* (*Lithocarpus*, *Magnolia*, *Ficus*, *Campylospermum* and *Symplocos* spp.). The forest where these specimens were collected was therefore taken to be Lower Montane Forest (LMF) rather than Mixed Dipterocarp Forest. Martin (1977) considers that Mixed Dipterocarp Forest along the W Ridge of Gunung Mulu extends up to 800 m.

The few dipterocarps observed during the Project fieldwork were:

- (a) S of Pa Menalio near Long Menalio (*Shorea faguetiana*).
- (b) Ulu Pa Selonok, E of Tama Abu Range (*Shorea acuta*, *Sh. monticola*).
- (c) SW of Long Rapung at about 1150 m (P.C. Sia pers. comm.).
- (d) Ridge NNE of Long Belaban (Tinjan Kuda pers. comm.: *Sh.*

*ferruginea* abundant). This *Shorea* was observed at about 1500 m at an area noted as a potential genebank site).

- (e) Pa Rusu near Long Belaban at about 1150 – 1200 m (Rantai Jawa pers. comm.).

Occurrence: In patches amidst Upland Kerangas; from about 1120 – 1300 m (Pa Menalio) and 1130 – 1750 m on the way to G. Murud.

Location: SSW of Long Menalio; N of Pa Menalio, mid slopes of Tama Abu Range (Ulu Pa Menalio) about 1150 – 1200 m; NW of Bario about 1300 m; Lepo Bunga to Plank Walk (1130 – 1750 m) N and NW of Long Belaban up to 1700 m and SW of Long Rapung.

Soils and Morphological Features: On clay and sandy-clay sometimes covered with up to 5 cm humus or up to 12 cm peat; hillsides.

Structure: Canopy closed to broken to open, about 20 to 35 m, trees pole-size to >1 m diameter. Plant forms represented: trees (25 spp.), treelets (32 spp.), herbs (32 spp.), lianas/climbers (16 spp.), shrubs (4 spp.) and epiphytes (35 spp.).

Genera/species represented:

Main canopy: *Agathis* (to 1.6 m diam.), *Aglaia*, *Aporosa*, *Ardisia*, *Baccaurea*, *Calophyllum*, *Castanopsis*, *Crypteronia*, *Elaeocarpus*, *Engelhardtia*, *Fagraea*, *Garcinia*, *Knema*, Lauraceae (incl. *Beilschmiedia*), *Lithocarpus*, *Prunus*, Sapotaceae, *Shorea*, *Syzygium*, *Tetramerista*, *Tristaniopsis*.

Understorey trees: Annonaceae, *Ficus*, Flacourtiaceae, Lauraceae, Rubiaceae, Rutaceae, *Symplocos*.

Woody climbers, epiphytes and shrubs: Annonaceae, *Medinilla*, *Rhododendron*, *Schefflera*, *Smilax*, *Vaccinium*.

Palms: *Areca*, *Licuala*, *Pinanga*, rattans.

Terrestrial herbs: aroids, *Begonia* spp., ferns, Zingiberaceae (8 spp.).

Epiphytic and climbing herbs: *Alyxia*, *Aeschynanthus*, ferns, orchids (20 spp.).

### 3.3.3 Upland Kerangas

Whitmore (1984) gives an account of Kerangas forest, which, he notes, occurs on coarse, siliceous deposits which give rise to podzolised soils and is so infertile that when felled for shifting cultivation cannot support a crop of hill rice. Whitmore notes that in Borneo Kerangas forest occurs both at the coastline on raised terraces of poorly consolidated coarse, sandy, marine and riverine sediments and also inland, on sandstone plateaux and cuesta formations.

Sandstone rocks are a major feature of Pulong Tau National Park and Upland Kerangas forest was found in the Park.

Occurrence: In a patchwork with LMF on clay or clay-loam soils, located from 950 – 1370 m between Alluvial Forest and Upper Montane (Tall and Short facies).

Location: At the S of Park, S of Base Camp near Long Menalio; hill S of Pa Menalio; N of dry ridge to NNW of Pa Menalio and on the Tama Abu Range; less well represented at N of Park but found SW of Long Rapung (1320 – 1360 m).

Soils and Morphological Features: On up to 50 cm peat soil or 5 cm humus over sand and sometimes over tree roots. Sometimes on ridges.

Structure: Canopy open or moderately open, 7 – 18 m tall. Dense, pole-sized trees to about 60 cm, most < 30 - 35 cm diam. Plant forms represented: trees (29 spp.), epiphytes (26 spp. of which 23 are orchids), treelets (24 spp.), herbs (19 spp.), lianas/climbers (16 spp.) and shrubs (4 spp.), i.e. the forest is rich in small trees < 10 m tall and also in woody climbers and epiphytic orchids.

Genera/species represented:

The most speciose families are the Orchidaceae (27 spp.), Melastomataceae (8 spp.), Myrtaceae and Lauraceae (5 spp. each), Myrsinaceae, Annonaceae and Ericaceae (4 spp. each), Zingiberaceae, Rubiaceae, Clusiaceae and Theaceae (3 spp. each).

Main canopy: *Agathis*, *Alseodaphne*, *Blumeodendron*, *Calophyllum nodosum* (a Kerangas forest indicator species), *Chionanthus*, *Dacrycarpus* (sometimes gregarious), *Elaeocarpus*, *Garcinia*, *Gymnostoma*, Lauraceae, *Lithocarpus*, *Melicope*, *Polyalthia*, *Prunus*, *Pternandra*, *Symplocos*, *Syzygium*, *Trigoniasstrum*.

Understorey trees: *Aglaiia*, *Ardisia*, *Canthium*, *Croton*, *Drimys*, *Eurya*, *Eurycoma longifolia*, *Ficus*, *Gironniera*, *Gymnanthes*, *Ilex*, *Illicium*, *Lasianthus*, *Lithocarpus*, *Litsea*, *Meliosma*, *Prunus*, *Pyrenaria*, *Symplocos*, *Syzygium* (3 spp.), *Ternstroemia*, *Vaccinium*.

Woody climbers, epiphytes and shrubs: Annonaceae, *Arcangelisia*, *Bauhinia*, *Capparis*, *Diplectra*, *Diplycosia*, *Dissochaeta*, *Embelia*, *Ficus*, *Helixanthera*, *Medinilla*, *Oxyspora*, *Pachycentria*, *Piper*, *Psychotria*, *Pterisanthes*, *Schefflera*, *Smilax*, *Ternstroemia*, *Rhododendron* (2 spp.), *Vaccinium*.

Palms: *Areca*, *Daemonorops*.

Terrestrial herbs: Acanthaceae, *Anerincleistus*, *Boesenbergia*, *Burbidgea*, *Dianella*, ferns including *Oleandra*, *Hedychium*, *Labisia*, orchids, *Sonerila*.

Epiphytic and climbing herbs: Orchids (about 24 spp.).

### 3.3.4 Riparian and Alluvial Vegetation

Two types of vegetation associated with rivers in the Park are **riparian** and **alluvial** vegetation. Riparian vegetation includes rheophytic

vegetation subject to (and adapted to) periodic inundation by fast-flowing water and vegetation at higher levels on river and stream banks and on river levees. Alluvial vegetation occurs behind river levees on alluvium brought down periodically by rivers which flood their banks. Temporary pools are a feature of such periodically-inundated zones.

**(a) Riverbank and Rheophytic Vegetation**

Occurrence: At river margins from about 1150 – 1370 m.

Location: Pa Menalio and Pa Selunok in the S; Pa Belaban in the N.

Soils and Morphological Features: Riverbanks, some with sandstone boulders.

Structure: Vegetation, including aroids, on boulders in river-bed, *Dipteris lobbiana* among boulders at river's edge, *Begonia* on banks and in muddy temporary stream bed, shrubs on stream banks, trees at river's edge bearing epiphytes and climbers.

Genera/species represented:

Trees: *Adinandra*, *Astronia*, *Baccaurea*, *Campylospermum*, *Croton*, *Dichroa*, *Euonymus*, *Eurya acuminata*, *Helicia*, *Knema*, *Litsea lancifolia*, *Neonauclea*, *Saurauia*, *Symplocos fasciculata*, *Syzygium* (5 spp.).

Woody climbers, epiphytes and shrubs: *Dissochaeta*, *Fagraea stenophylla*, *Medinilla*.

Terrestrial herbs: *Argostemma*, aroids (*Piptospatha* cf. *maduensis*, *Schismatoglottis venusta*), *Begonia*, *Cyathea*, *Dipteris lobbiana*, *Phyllagathis*.

Epiphytic and climbing herbs: Orchids (*Coelogyne*, *Dendrobium lancilobum*, *Eria*), *Sonerila*.

**(b) Alluvial Vegetation (Emperan)**

Occurrence: On and behind river banks and levees from 950 – 2100 m.

Location: Along Pa Dapur, S of Long Menalio and along Pa Menalio to about 6 km due W of Long Menalio at the S of the Park and Long Belaban and Long Rusu at the N of the Park.

Soils and Morphological Features: Soil alluvial (sandy, sandy loam, loam) sometimes with shallow peat layer and temporary pools and streams formed in the peat after heavy rain.

Structure: Canopy about 20 - 25 m (*Tristaniopsis*), open, light shade, pole sized trees to 50+ cm diam, *Tristaniopsis* and *Dacrydium* to 60 cm, an *Agathis* about 100 cm. A very rich forest with a wide variety of understory trees and palms, terrestrial herbs, epiphytic orchids and woody climbers and epiphytes well represented.

Genera/species represented:

Main canopy: *Adinandra*, *Agathis* (regenerating), *Artocarpus*, *Baccaurea*, Burseraceae, *Calophyllum*, *Dacrycarpus* (regenerating), *Duabanga moluccana*, *Garcinia* (3 spp.), *Grewia*, *Gymnostoma*, *Knema*, Lauraceae, *Lithocarpus*, *Litsea*, *Magnolia* (2 spp.), *Pternandra*, Rubiaceae, *Syzygium* (abundant, many species), *Tristaniopsis* (abundant), *Turpinia*.

Understorey trees: *Aglaia*, *Ardisia*, *Baccaurea*, *Campylospermum*, *Carallia*, *Chionanthus*, *Dichroa*, *Elaeocarpus*, Ericaceae, *Eurya*, *Eurycoma*, *Ficus* spp., Flacourtiaceae, *Garcinia*, *Goniothalamus*, *Grewia*, *Helicia*, *Ixora*, *Knema*, Lauraceae (*Endiandra*, *Litsea*, *Nothaphoebe*, *Persea*), *Macaranga*, *Memecylon*, *Microtropis*, *Podocarpus*, *Prunus*, *Saurauia* (abundant).

Woody climbers, epiphytes and shrubs: *Capparis*, *Embelia*, *Erycibe*, *Fibraurea*, *Ficus* spp., *Freycinetia*, *Indorouchera*, *Kadsura*, *Medinilla*, *Poikilospermum*, *Schefflera*, *Symplocos*, *Tetracera*, *Vaccinium*.

Palms: *Areca*, *Calamus* (6 spp.), *Daemonorops*, *Korthalsia*, *Licuala*, *Pinanga*, *Salacca*.

Terrestrial herbs: Acanthaceae, *Anerinckleistus*, aroids (5 spp.), *Curculigo*, ferns including *Cyathea*, *Cyrtandra*, *Henckelia* (*Didymocarpus*), *Impatiens*, *Lophatherum*, orchids (3 *Calanthe* species; *Cystorchis*, *Phaius*), *Phrynium*, *Phyllagathis*, *Pilea*, *Racemobambos*, Rubiaceae (*Argostemma*, *Acranthera*, *Geophila*, *Pavetta*, *Mycetia*), *Sonerila*, Zingiberaceae (9 spp.).

Herbaceous epiphytes: *Selaginella* and ferns, orchids (26 spp.)

### 3.3.5 Upper Montane Forest

Satellite images show that the highest levels in the Park are subject to cloud cover for at least part of the day. Under such cool, damp conditions peaty or 'mor' humus soils develop and support vegetation known as Upper Montane Forest (UMF). Upper Montane Forest appears to comprise two distinct facies – a taller, mossy facies in sheltered areas and a short, scrubby facies in more exposed areas. The composition of Upper Montane Forest was described from analysis of records of plants collected from high altitudes where the soil was noted to be peat rather than clay or sand.

#### (a) Upper Montane Forest (Tall = Mossy)

Occurrence: Just below exposed summits to 2058 m and on lower summit from 1300 m.

Location: Below a summit of Tama Abu range W of Pa Selonok, about 1720 m; S of Long Menalio from 1300 m; S of Plank Walk on route to Long Belaban at about 1956 m; immediately below summit of G. Murud.

Soils and Morphological Features: Soil peaty, sometimes over bouncy

tree roots, in places loamy with broken sandstone rocks and boulders.

Structure: Canopy open, about (7) -15 – 18 - (25) m. Trees straight or crooked, < 30 cm diam. Epiphytes abundant, chiefly orchids, also ferns and Ericaceae, herbs abundant, including terrestrial orchids, ferns and giant herbs (*Racemobambos* and gingers), moss draping root systems, rocks and trunks to about 9 m.

Genera/species represented:

Main canopy: species-poor with 3 species of *Syzygium* and 3 of Theaceae and also *Phyllocladus hypophylla*.

Understorey trees: Few species, including 3 species of *Rhododendron* and 3 of Lauraceae.

Woody climbers, epiphytes and shrubs: Includes 6 Ericaceae species and 2 *Medinilla* spp.

Palms: rattans (2 spp.).

Terrestrial herbs: *Argostemma*, ferns, *Pandanus*, *Racemobambos*, (abundant below Tama Abu summit), Urticaceae.

Epiphytic and climbing herbs: 4 *Nepenthes* species; 23 orchid species.

## (b) Upper Montane Forest (Short = Ericaceous Scrub)

Occurrence: At summits, on summit ridges and slopes and in exposed locations below summits.

Locations:

- (a) Summits on Tama Abu Range including W of Pa Selonok, about 1800 m.
- (b) 'Kebun Batu', an expanse of gently sloping ground on the NE approach to G. Murud summit, about 2280 - 2360 m. The False Summit (Batu Lenanit) at 2248 m, has similar vegetation.
- (c) G. Murud summit at about 2424 m.

Soils and Morphological Features: On sandstone rocks, thick humus over sandstone and peat over roots and between sandstone rocks. With damp patches in places.

Structure:

The vegetation comprised trees and treelets (43 species), shrubs (69 species), herbs (37 species), epiphytes (32 species), lianas/climbers (19 species) and parasites/hemi-parasites (3 species). However, many species are listed in more than one life-form category.

- (a) At Tama Abu, summit vegetation about 4 m tall supported on tree branches and roots, in places over hard, pale grey-brown sandstone rocks.
- (b) At Kebun Batu, low, open vegetation and scattered taller trees (*Dacrydium xanthandrum*, *Leptospermum flavescens*) to about 5 m between sandstone boulders; some herbs present.
- (c) At G. Murud summit, peat between sandstone boulders supporting



scrub 2 m high with some epiphytes, climbers and terrestrial herbs.

Genera/Species represented:

The flora is rich with more than 160 species and morphospecies represented. The most speciose families are the Orchidaceae (about 31 spp.), Ericaceae (about 21 spp.), Myrtaceae (8 spp.), Rubiaceae (8 spp.), Myrsinaceae (6 spp.), Theaceae (6 spp.), Aquifoliaceae (5 spp.), Araliaceae (5 spp.) and Nepenthaceae (*Nepenthes*) (5 spp.).

Park species with distributions restricted to high altitudes include:

<i>Elaeocarpus nanus</i>	≥ 2400 m
<i>Weinmannia aphanoneura</i>	≥ 2347 m
<i>Agathis kinabaluensis</i>	≥ 2300 m
<i>Elaeocarpus murudensis</i>	≥ 2300 m
<i>Rhus borneensis</i>	≥ 2200 m
<i>Syzygium ampullarium</i>	≥ 2187 m
<i>Arthrophyllum collinum</i>	≥ 2150 m
<i>Dacrydium xanthandrum</i>	≥ 2134 m
<i>Elaeocarpus glaberrimus</i>	≥ 2134 m
<i>Leptospermum flavescens</i>	≥ 1800 m
<i>Schima brevifolia</i>	≥ 1800 m
<i>Ternstroemia</i> PTNP 2	≥ 1800 m

Damp flushes and crevices lower down Kebun Batu support *Gentiana borneensis*, *Patersonia lowii*, *Pentaphragma* PTNP 1 and *Sphagnum*.

### 3.3.6 Variants of Vegetation Types

#### (a) Disturbed Ridge Forest on peat

Along the Plank Walk to G. Murud at 2060 m there is disturbed, open forest with the canopy to about 12 (25) m, with frequent broken tops. *Agathis* has been felled for timber to construct the Plank Walk and stumps to about 50 cm diam. and *Tristaniopsis* to 40 cm diam. were noted. Other species reached about 35 cm diam. Collections comprised chiefly herbs, shrubs, climbers and epiphytes and a few treelets. *Racemobambos* was abundant in disturbed areas. Epiphytes were also abundant and included basketing, litter-collecting aroids, arecoid palms and moss draping some trunks almost to their tops. *Dendrochilum* was conspicuous.

- (b) **Damp valley Lower Montane Forest on sandy soil**  
S of Pa Menalio at about 1120 m in a sheltered valley. *Argostemma* and *Sonerila* present.
- (c) ***Gleichenia* (resam) on cleared Lower Montane Forest on sandy soil**  
Penan informants mentioned that a patch of ground just S of Long Menalio was settled in 1973/4. This area was observed to be still open, covered in *Gleichenia* (resam).
- (d) **Modified forest**  
Satellite images clearly show cleared areas around the settlements at Bario. These are due to modification of the Lower Montane Forest due to human activities. *Agathis* and other species are extracted for local use, land uphill from Arur Dalan has been cleared for buffalo grazing, a stretch of land has been cleared for a dam and pipeline for a mini-hydro project and trees at the skyline have been cleared to make a gap ('kawang') - a local tradition to mark a special occasion.

Satellite images also show disturbed forest within the Park near Pa Lungan.

### 3.4 Inventory of Plant Species of Economic Significance

The gymnosperm *Agathis* produces a prized softwood with a smooth surface and a natural sheen. The timber is easily worked. Both Kelabit and Lun Bawang communities around Pulong Tau National Park fell *Agathis* for house construction. *Agathis* has been used to construct the Plank Walk to G. Murud (though the timber does not last in the open). Three *Agathis* species are recorded in the Park: *Agathis endertii*, *A. kinabaluensis* and *A. lenticula*. All can reach large sizes though *A. kinabaluensis* becomes 'relatively stunted on exposed ridges and summits' (Yii 1995).

Other gymnosperm species found in Pulong Tau National Park that reach timber size include *Dacrycarpus imbricatus*, *D. steupii*, *Dacrydium xanthandrum*, *Phyllocladus hypophylla* and *Podocarpus laubenfelsii*. The wood of all these species was reported to be used locally for planks.

Other potential timber species that occur in some areas are *Shorea* species and also *Tristaniopsis*, said to be sought by logging companies operating in the area.

Potential locations for genebanks to provide seed of timber species are:

- (a) SW of Long Menalio, along the Pa Menalio and near Mr Paran Aran's lodge at about 1050 m, N3° 34.13' E115° 24.377'. Here *Agathis* and *Dacrycarpus* are common and *Dacrydium* is present. The site is accessible by boat along the Pa Dapur.
- (b) Ridge NNE of Long Belaban at about 1450 m, N3° 54.475' E115° 32.467'. The site has a high density of large *Agathis lenticula* trees (six trees up to 1.3 m diam. observed beside the trail) and *Shorea* was also present. This site is accessible from Lepo Bunga in less than five hours.
- (c) Ridge S of Pa Rapung at about 1300 m, N3° 51.490' E115° 32.865'. At this site a number of *Agathis* trees reach 90 cm diam. The site can be reached in one or two days from Bario by the trail to Ra'an Bulu via Pa Lungan.

*Boesenbergia stenophylla* (keburow apad, jerangau merah) is a medicinal herb well known to the Kelabits and Penans and marketed outside the area by local community members. A dense stand on the hill S of Pa Menalio about 1.5 km W of Long Menalio is suitable for a genebank and needs to be protected for this purpose as it is a well-known location for this herb.

*Arcangelisia flava* is a flavouring agent used by the Kelabit, Lun Bawang and Penan communities. It occurs sporadically in both the N and the S of the Park and can be cultivated. Its properties as a flavour enhancer need to be investigated.

The Park is rich in orchids, some of which are very attractive. Some local species are seen planted in gardens in the communities around the Park and there appears to be considerable movement of orchids in the area. A detailed investigation is needed to identify what orchids are being collected, from where, and by and for whom and in what amounts. This could be followed by studies on the culture of some of the popular species so that the local community can profit by selling them under licence.

The 19 rhododendron species, most of which have large, colourful flowers, and nine pitcher plant species, are another potential resource which could be developed as souvenirs and for the horticultural trade.

Species used for handicrafts include various rattans (four *Calamus* and one *Daemonorops* species) for mats and baskets, *Licuala* for sunhats and raincoats ('samit'), *Pandanus* spp. for making men's decorative hats and coarse mats and (formerly) a Cyperaceae species for weaving soft mats. Further studies are needed on the most useful species, their occurrence and culture.

### 3.5 Studies on the Park's Ecotourism Potential

Local community informants told us that:

- (a) Currently the most popular tourist routes involve visits to Kelabit or Penan settlements and do not fall within the park.
- (b) Fishing trips can be arranged from Bario via Pa Dapur to Long Menalio but precautions need to be taken to prevent over-fishing and river pollution.
- (c) There are traditional routes:
  - Pa Berang - Long Lellang (3 days: 1 to a Penan camp E of the Tama Abu Range at about 1200 m, 1 to cross to the W of the Tama Abu Range and 1 down to Long Lellang; 5 – 6 days for tourists)
  - Long Lellang - Sg Keramoh - Long Labid – Long Lobang (3 days, 5 for tourists)

Other tourist routes are

- Arur Dalan to Pa Tik via Long Semeriang
- Ba' Kelalan to G. Murud
- Ba' Kelalan to Bario

### 3.6 Threatened and Protected Species

The Park is home to 33 species listed as Endangered, Vulnerable, Lower Risk or Data Deficient in the 2006 IUCN Red List. Seven of these are pitcher plants (*Nepenthes*) species, and eight are gymnosperm trees that reach timber size (Appendix 6). At least 182 named species of Sarawak's Protected Plants (Wild Life protection Ordinance, 1998) occur in the Park (Appendix 7). These include ornamentals ((112 orchid species, 19 *Rhododendron* species, *Aeschynanthus*, *Begonia*, *Cyrtandra*, *Didymocarpus* and *Henckelia* species, tree ferns (*Cyathea* spp.) and epiphytic 'ekor tupai' (*Huperzia* spp.)) as well as species with pharmacological potential (*Calophyllum teysmannii*, *Eurycoma longifolia*) and 19 species of *Ficus* which can provide food for wildlife.

## 4. Discussion

### 4.1 The Park's Flora

#### The Park's botanical richness

The figures in Table 1 indicate that the Park is botanically rich. The higher figures for Total Plant Species at Lambir Hills N.P. and Lanjak Entimau W.S. are the result of the inclusion of numbers of specimens from ecological studies whereas the figures for Niah N.P., Usun Apau Plateau and Pulong Tau N.P. represent species collected during general (herbarium) collection.

Table 1: Numbers of plant species reported for selected Sarawak locations

	Location	Tree spp.	Non-tree spp.	Total Plant spp.
1	Lambir Hills N.P. (52 ha plot)			1173
2	Lanjak Entimau W.S.	1896	911	2807*
3	Niah N.P.			556
4	Pulong Tau N.P.			> 819
5	Usun Apau Plateau			748

Sources: 1. Lee *et al.* 2002; 2. Chai and Teo 2000; 3. Pearce 2005; 4. Yahud *et al.* 2003

\* vascular plants

The Park is particularly rich in orchid species. The orchid family is, in fact, the best-represented family in the *PPTNP BRAHMS Database* with **151** species including 26 *Eria* spp., 23 *Dendrochilum* spp., 16 *Bulbophyllum* spp., 14 *Dendrobium* spp. and 13 *Coelogyne* spp.). The great variety of orchids at Pulong Tau National Park is of scientific interest and conservation importance for Sarawak and more species are likely to be discovered there. The ease with which many orchid species can be observed as one walks through the forest, especially at higher altitudes, and the huge variety of sizes, shapes and colours these plants and their flowers exhibit, makes this group very important resource to be conserved for the ecotourism industry.

The Ericaceae (and in particular the Rhododendrons) is another family that is well-represented at the Park. The Rhododendrons are of great

horticultural importance worldwide for their large, brightly coloured (or sometimes white) flowers. Of the 44 Ericaceae species represented at the Park, 19 are *Rhododendron* species and these have potential as ornamental species. Some of the *Diplycosia* and *Vaccinium* also have attractive flowers and/or fruits.

The ginger family (Zingiberaceae) is another economically important group of plants, both globally and locally. From this family come spices (ginger, galangal, turmeric, langkuas, cardamom etc.), ornamental species (*Alpinia*, *Zingiber* etc.) and locally used medicines, vegetables and fibres. While 30 Zingiberaceae species have been recorded at the Park, there is still much to be learnt of this group in Borneo and new species continue to be described. The local species include potential ornamentals and a well-known medicinal herb.

Another significant group represented at the Park is the pitcher plant (Nepenthaceae) family. Nine species are known to occur in the Park and ecotourists visiting G. Murud to see these plants were encountered during the Project fieldwork. The palms (Arecaceae) are represented by 22 species and include a number of rattans that produce canes used in handicrafts, as well as ornamental species. During 2005 palm enthusiasts from overseas were known to have visited the Park. The Gesneriaceae is represented at the Park by 14 species including ornamentals such as *Aeschynanthus* spp, *Henckeleia* spp. and potential ornamentals such as species of *Agalmyla* (climbers with scarlet flowers).

The Park's ferns and fern allies (about 41 species and eight additional genera not identified to species and otherwise unrepresented) are as yet rather poorly known, and probably under-collected.

The park's botanical richness can be attributed to the variety of vegetation types that occur there, which in turn relate to the wide altitudinal range (530 - 2424 m), variety of soils and varied topography with exposed peaks and ridges, steep and gentle slopes, levees and floodplains.

#### Endemic species, new records and new species

Conclusions on endemism rely on recent taxonomic revisions. Endemism assessed for the families so far revised for the Tree Flora of Sabah and Sarawak Project, the Euphorbiaceae (Airy Shaw 1975), *Diplycosia* and *Vaccinium* (Sleumer, 1967), the ferns (Parris and Latiff 1997), the *Nepenthes* (Clarke 1997) and the rattans (Dransfield 1992) revealed that the Park is home to at least 89 endemic species (83 noted in

the ***Checklist of the Plants of Pulong Tau National Park*** (Appendix 3a) and six noted in ***Plant Species Reported from Pulong Tau National Park Not Represented in the ITTO Checklist*** (Appendix 4)). Endemic species are well represented in the genera *Diplycosia* and *Vaccinium* as well as in the Araucariaceae, Arecaceae, Fagaceae, Moraceae, Myristicaceae and Nepenthaceae. In addition there are 13 endemic varieties. Four fern species and one variety are reported as endemic to G. Murud (Parris and Latiff 1997), as is *Nepenthes murudensis*.

New records for Sarawak include *Actinodaphne sulcata* var. *longipetiolata*, *Agathis lenticula*, *Melicope sororia*, *Microtropis* cf. *keningauensis* and *M. wallichiana*.

Undescribed species undoubtedly exist among the Park's 114 morphospecies.

#### Current underestimation of the Park's botanical richness

The numbers of species reported for the Park can be considered an underestimate because:

- (a) Some areas of the Park and some of its vegetation types have not yet been collected. Notably the Mixed Dipterocarp Forest at the Park's W boundary and the locations Sg Lobang, Pa Tik, Long Labid and Long Aar are not represented by records in SAR BRAHMS database.
- (b) Sixty-six specimens representing 42 species determined only to aff. (akin to) status may represent additional species.
- (c) Newly available data for the Park provided by the Project Forest Ecologist suggest that there are a further 342 named species in addition to those listed in the ***Checklist of the Plants of Pulong Tau National Park***. Only 25% of the species listed in the Project ecological data were listed in the ***Checklist***, probably chiefly because ecological studies record all species, whether fertile or not, whereas in general collecting sterile collections are avoided. The ecological data give a clear picture of the Park's tree flora as is evident from the many tree species listed, belonging to the Annonaceae, Burseraceae, Clusiaceae, Dipterocarpaceae, Ebenaceae, Euphorbiaceae, Lauraceae, Meliaceae, Myrtaceae, Rubiaceae, Sapotaceae and other families.

While more than 1,300 records of specimens believed to be from the Park area were extracted from the *BRAHMS* Database at SAR only 840 records were eventually included in the *PPTNP BRAHMS Database* and further species may be represented by those not included. Records were not included when:

- (a) Specimens could not be located at SAR.
- (b) Taxonomic literature needed to confirm or re-determine specimens was not available at SAR or does not exist (there are no recent taxonomic revisions for the region of the Acanthaceae, Annonaceae, Araliaceae, Begoniaceae, Elaeocarpaceae, Escalloniaceae, Euphorbiaceae, Lauraceae, Melastomataceae, Myrsinaceae, many Orchid genera, Piperaceae, Rubiaceae, *Ternstroemia*, Urticaceae and some fern taxa)
- (c) Identification by matching was inconclusive because there were no reliably identified specimens for comparison.
- (d) Specimen collection data was not clear as to whether specimens had been collected from within the Park.

A large majority of the inserted SAR collections (>500) were from Murud locations and more than 50 were from Belaban locations, also at the N of the Park. Only about 130 collections were from the S of the Park (about 80 from Tama Abu locations and about 50 from Menalio locations). About 500 specimens collected under the Project in the Menalio/Tama Abu area, has improved the representation of the flora of this part of the Park while about 500 additional collections were made from the N of the Park.

#### **4.2 Ethnobotanical Uses of Plants in Pulong Tau National Park**

Members of the Kelabit, Lun Bawang and Penan communities adjacent to Pulong Tau National Park know of a wide variety of uses for a large number of species growing within the Park.

As expected, the older informants knew more of the plants and their uses.

Mr Uda Abeng (Lai) a Penan aged 60 years and one of four Penan informants for the Project fieldwork was particularly well-informed.

Penan vernacular names were noted for 392 specimen records and Kelabit vernacular names for 246 records in the Menalio/Tama Abu



area. In the Murud area one Penan informant became seriously ill and had to return home after about only one week in the field. Here Penan vernacular names were noted for 97 records and Lun Bawang names for 167 records.

### **4.3 Vegetation Types, Structure and Species Composition**

Pulong Tau National Park rises from about 530 m in the W (S of Pa Tik) to 2424 m at the summit of G. Murud, the highest point in Sarawak. Most of the Park lies above 1200 m.

The five major vegetation types identified in Pulong Tau National Park occupy environments characterized by different combinations of substrate, topography and altitude. Four of the vegetation types are typically found at higher altitudes and the only lowland forest type in Pulong Tau National Park is Mixed Dipterocarp Forest (so far insufficiently studied).

The five vegetation types differ from one another in structure (canopy height, tree size, proportions of trees, shrubs, herbs, lianas/climbers and epiphytes). Short-stature Upper Montane Forest has proportionately many more shrubs than either Upland kerangas or Lower Montane Forest on Clay or Clay-loam Soil while herbs are very poorly represented in Upland Kerangas forest.

The five vegetation types differ from one another in species composition. Individual species tend to be restricted to particular vegetation types. Thus dipterocarps are typical of Mixed Dipterocarp Forest, scarce in Lower Montane Forest on Clay or Clay-loam Soil, and absent from the other vegetation types in the Park while Ericaceae species tend to be restricted to Upper Montane Forest. Upper Montane Forest is extremely species-rich, with 160 species/morphospecies recorded, including 31 orchid species.

Vegetation types tend to vary matrix-fashion, based of the interaction of environmental factors. Human activities (extraction, burning, hunting) also affect the vegetation that develops.

There are no consistently-used names for higher altitude forest types in Sarawak. In the Park area collectors have described the vegetation variously as Lower and Upper Montane Forest, Mossy Forest, Sub-Montane Forest and Montane Forest, Upper Mixed Dipterocarp Forest and Hill Mixed Dipterocarp Forest.

T.C. Whitmore (1984), in a classification of forest types for the region, distinguished the upland forest types Tropical Lower Montane rain forest and Tropical Upper Montane rain forest chiefly on structure and physiognomy. Whitmore notes that in the former Fagaceae and Lauraceae are important at its upper level; in the latter the Coniferae, Ericaceae and Myrtaceae are important.

P.S. Ashton (1995), who has carried out ecological studies in the State, takes soils and substrates into consideration in distinguishing forest types. He notes “On shallow soils, which increase on the ridges with the altitude, a distinct short-stature ridge forest is widespread between 800 and 1,200 m, where *Shorea flaviflora*, *Vatica umbonata* and *V. dulitensis* are characteristic of dipterocarps and *Engelhardia* spp. are common”. He also mentions “short stature kerangas” at 800 – 1200 m on exposed sandstone, an “ill-defined transition on clay-rich soils to oak-laurel dominated “lower montane forest ...” ” on slopes at about 1300 m, and “ “Upper Montane” ericaceous elfin forest ... [which] retains many *kerangas* species such as *Eugenia* [*Syzygium*] *bankense* and *Calophyllum nodosum*.” He notes “Myrtaceae, Theaceae, and Podocarpaceae, and to some extent Ericaceae;” as being *kerangas* families particularly well-represented in the upper montane forest. Ashton notes the short stature *kerangas* “... grades imperceptibly and continuously on sandstone substrates into “upper montane” ericaceous elfin forest;”.

To analyse the vegetation types and describe the vegetation structure and species composition in Pulong Tau National Park as objectively as possible and to avoid circular arguments, records of collections in the ***PPTNP BRAHMS Database*** from particular forest types were selected using objective attributes such as soil types and morphological features (river levees, summits).

Altitude was found to be an unsatisfactory determinant for vegetation types – for example the Upper Montane (Short -Ericaceous Scrub) that occurs at the summit of G. Murud at 2424 m is similar to that which occurs on a summit of the Tama Abu Range at 1800 m. Altitude was, however, used to discriminate records of specimens from Upper Montane Forest from those from vegetation at lower altitudes.

Selection based on rather few attributes resulted in many records being missed, namely those without data for attributes on which a selection was being made.

The results of the analyses are only as strong as the specimen data is accurate, representative and complete. However, the analyses can be

repeated or new ones developed by extracting the relevant records from the **PPTNP BRAHMS Database**.

Below are some issues that need to be taken into consideration in the classification of the vegetation types that occur at the Park into the five basic categories:

- (a) Mixed Dipterocarp Forest was not sampled or observed during the Project fieldwork (which covered areas >1000 m) and only 47 records in the **PPTNP BRAHMS Database** have altitudes recorded as <1000 m.
- (b) The Lower Montane Forest on Clay or Clay-loam Soil and Upland Kerangas are very broad categories as, in order to be as objective as possible, records were selected on rather few criteria. From observations, these vegetation types are found over a broad altitudinal range.

The term 'oak-laurel forest', often used for Lower Montane Forest, does not seem appropriate as only one *Lithocarpus* and five Lauraceae species are represented in the Lower Montane Forest on Clay or Clay-loam soil. Furthermore the oaks and laurels are not confined to any particular zone in the Park. The small numbers of oak specimens in the **PPTNP BRAHMS Database** may be because fertile material of Fagaceae (which fruit seasonally) was missed as no collections have been made in the Park in January, February, July and December and only five during June.

- (c) Upland Kerangas refers to vegetation on infertile white sand, but is not restricted to forest on organic, white-sand podzols as podzolisation was not investigated when specimens were collected.
- (d) The Rheophytic and Riparian Vegetation and Alluvial Vegetation (Emperan) are well-defined facies of Lower Montane Forest.
- (e) The Upper Montane (Tall = Mossy) forest, which was determined on altitude and peat soils with mossy vegetation, seems to merge into the mossy facies of Lower Montane Forest. Whitmore (1984) points out that lower montane forest can also have a mossy facies. The term 'peat' has been used very loosely and includes 'mor' humus with still-recognizable leaf fragments.

- (f) The Upper Montane (Short = Ericaceous Scrub) is a well-defined and valid category that can be well-described in terms of its structure, physiognomy and species composition from the floristic data available in the *PPTNP BRAHMS Database*. This is helped by the fact that this vegetation type occurs chiefly at or near summits (often noted in collection data) and has been very well-collected, not only because it occurs at the summit of G. Murud, a popular collection destination, but also because it comprises short-stature vegetation, all of which is easily observed and easily reached for collection.

The Ericaceous Scrub includes a number of species restricted to high altitudes.

The term Ericaceous Scrub well describes the summit vegetation which includes eight *Diplycosia* species, ten *Rhododendron* species and three *Vaccinium* species.

#### Relating the main vegetation formations with the soil types

Detailed soil surveys in several locations in Pulong Tau National Park carried out by Consultant Geomorphologist, Mr P.C. Sia, showed that a variety of soil types occur in the Park.

Kerangas and developing Kerangas soils were found in the S of the Park in the Menalio area but not in the N around G. Murud. This is consistent with the fact that all but 11 of the 134 records from Upland Kerangas from the *PPTNP BRAHMS Database* were from the Menalio area and the Tama Abu Range.

Individual specimen collections could not be related to detailed soil parameters as the Forest Botanist and Mr Sia visited the Park on different occasions. Soils were observed to vary over very short distances. Some locations visited by the Forest Botanist were not visited by the Geomorphologist and *vice versa*. Thus, no specimens were collected from a basin of distinctive, wet Kerangas soils W of Long Rapung to the N of Park. Furthermore where plant collectors have described soils, the terms used tend not to be consistent and the term 'clay' in particular seems to have been used rather uncritically.

#### **4.4 Species with Economic Potential**

Many species with economic potential of various types inhabit Pulong Tau National Park.

Of the timber species, *Agathis* is the most important.

*Boesenbergia stenophylla* has long been marketed outside the area and this and the flavour enhancer, *Arcangelisia flava*, (both of which are brought into cultivation locally) would surely repay investigation of their active components.

Many species from the Park could be investigated for their horticultural potential. There is a huge variety of orchids, some with highly decorative flowers, and considerable movement of orchids in and around the Park suggests that there is a demand for these plants. Most of the Park's 19 *Rhododendron* species have large, brightly coloured flowers. The nine *Nepenthes* (pitcher plant) species already attract interest from tourists who visit G. Murud especially to see them. The palms, *Huperzia* and *Begonia* species also have potential as ornamentas. Visitors are known to have visited the Tama Abu Range to see the palms.

One stimulus to start developing the non-timber forest products would be to survey the current interest in these species by recording which species have been introduced into gardens around the local settlements, whether there is currently a market for them and the prices that they fetch.

#### **4.5 The Park's Ecotourism Potential**

The relatively easy access to the Park for the visitor who is already in NE Sarawak, and the fairly unchallenging terrain and well-trodden trails, even to the summit of Sarawak's highest mountain, make the Park a good destination for the adventurous backpacker and the ageing baby-boomer alike.

G. Murud is already a popular ecotourist destination as is indicated by the steady flow of tourists departing Ba' Kelalan. The scenery is varied and picturesque (especially at Kebun Batu, where there are large sandstone boulders, open scrub and scattered gnarled *Dacrydium xanthandrum* and *Leptospermum flavescens* trees), the terrain is open and easily traversed, there is a variety of vegetation types including attractive elfin forest and ericaceous summit scrub and the flora is species-rich with numerous orchids, a variety of attractive and easily observed *Rhododendron* species and five *Nepenthes* species. A number of the species are restricted to these higher altitudes and there are biologically interesting parasites

(*Balanophora*) and hemi-parasites (*Helixanthera*, *Macrosolen*) as well as herbs with attractive flowers such as *Pentaphragma* and *Gentiana borneensis*.

The Tama Abu Range is also already part of the ecotourist experience as more adventurous tourists are traversing the Park with local guides, camping on the way. The many orchids and pitcher plants found in the mossy forest to the E of the Tama Abu summits can be developed as another 'tourist attraction' with interpretation, both by knowledgeable guides and through leaflets and guide books. Fishing at Long Menalio could become part of the package if the river were managed carefully.

The logging operations to the E of the Park have provided better access to the Park in the form of the private Samling logging road which brings one almost to the Pa Dapur near Pa Berang, not far from Long Menalio. Undesirable side effects of the logging operations are likely to be polluted rivers, unauthorised access to and hunting and fishing in the Park and marring of the currently unspoilt surrounding forest. Edge effect, due to forest clearance, may affect the Park's vegetation. Thus, current tourist experiences are likely to change unless care is taken to preserve the Park in as unspoilt a form as possible. The local communities, being stakeholders in the Park and the benefits it can bring, are the appropriate people to carry out custodian duties for the Park.

## 5. Conclusions

- (a) Specimen records clearly indicate the Park's flora to be rich. Orchids are particularly well-represented, as are other attractive species such as Rhododendrons and pitcher plants. Some of the high altitude plants are probably not found elsewhere in Sarawak. A variety of plants with unusual lifestyles (parasites, hemi-parasites, saprophytes and insectivorous plants) can all be seen at the Park. They range from tiny orchids to giant *Agathis* trees.

Pulong Tau National Park supports at least five broad vegetation types. These vary both in structure and in floristic composition. Each has its own interesting features. The Mixed Dipterocarp Forest has an abundance of large dipterocarp trees; the Lower Montane Forest has areas where *Agathis* timber trees are large enough and dense enough to be proposed as potential genebanks; the Upland Kerangas Forest has a rich epiphyte flora including many attractive orchids; the Upper Montane (Tall) Forest includes a facies with crooked trees with moss-draped trunks and roots and peat underfoot; the Upper Montane (Short = Ericaceous Scrub) vegetation is low, shrubby, open and colourful with abundant flowering and flushes of new leaves.

- (b) The Park's summit flora and Upper Montane (Short = Ericaceous Scrub) vegetation has been fairly well investigated and is described with confidence. The other vegetation types are less fully described, partly because tree species are not well-represented among herbarium collections from the Park. In particular, the lowland Mixed Dipterocarp Forest to the W has not even been visited for collection yet.
- (c) The Park is home to many species that have potential for economic development. The Government should take the lead in investigating and developing these, while encouraging the local community, as stakeholders, to become involved.
- (d) Just as the Park is a great asset to the local communities, so the local community members are a great asset to the Park. As primary stakeholders they are the most appropriate people to take care of, and develop its resources. They are also in the best position to interpret the Park to ecotourists. However, urgent steps need to be taken to stem the loss of local knowledge and restore it to the local community.

- (e) The Park's carrying capacity needs to be determined and steps need to be taken to ensure that it is not exceeded. Stakeholders (especially logging operators whose operations can have a major impact on the area) need to be brought on board so that Pulong Tau National Park can be managed in the best possible way as a State, community and scientific asset both now and in the future.



## 6. Recommendations

### 6.1 Guidelines for the Conservation Management of Pulong Tau National Park

- (a) Address environmental issues related to the Church Camp and the route to the Church Camp and the summit of G. Murud.
- (b) Locate sites of special botanical interest and propose them for protection and eventual inclusion in Park extensions. The site where *Boesenbergia stenophylla* (kebuo apad) grows near Pa Menalio needs urgent protection. *Rafflesia* has been reported to occur at Sg Mekong, E of Long Rapung near the international border and *Rafflesia pricei* was reported by Beaman (1998) 'about 45 minutes walking distance from Long Rapung' (probably not within the Park). These sites could be proposed for special protection.
- (c) Establish a National Park presence at entry points to the Park to, *inter alia*, control what is taken into or out of the Park.
- (d) Enforce the Wild Life Protection Ordinance 1998, in particular with respect to Totally Protected and Protected Plants, especially with regard to the collection of pitcher plants, rhododendrons and wild orchids.
- (e) Raise awareness among local community members so that they know what is not permitted to be taken from the Park and can play a role as Park custodians, for example by reporting illegal activities and damage to the Park.
- (f) Involve members of the local communities in park guiding. Permit visitors to visit certain Park destinations only if accompanied by a local guide. Such destinations would include fragile areas such as G. Murud, Kebun Batu, Tama Abu summits and all routes traversing the Park.

### 6.2 Studies and Activities Recommended as Follow-up Action

#### (a) Address environmental issues in the Park

##### *Action:*

- (i) Replace the Church Camp with a facility that all visitors to G. Murud can use and that the local community, who

established the Church Camp in the first place, can manage for their benefit. The new facility would blend with the environment and incorporate safety features.

- (ii) Upgrade the route to the Church Camp (including the Plank Walk and other parts of the trails) to cater for increasing numbers of visitors. Use materials from outside the Park to improve the trail where it traverses steep slopes, easily eroded peat and other fragile environments.
- (iii) Actively rehabilitate areas damaged by extraction of timber and firewood by clearing the *Racemobambos* and replanting the local trees. Establish a tree nursery on site for this purpose and involve visitors in conservation by providing *Agathis* and other seedlings for them to replant along the Plank Walk.

**(b) Add to the knowledge of the Park's flora and vegetation**

***Action:***

- (i) Collect plants in areas which have so far not been collected, including the low altitude Mixed Dipterocarp forest at the W margin of the park (Long Lobang and S of Pa Tik, Long Aar and Long Labid etc.).
- (ii) Obtain additional taxonomic literature and resources to update herbarium collections with respect to recent taxonomic revisions such as those done for the *Tree Flora of Sabah and Sarawak Project*.
- (iii) Obtain further species determinations by exchange of duplicates of selected Park specimens with herbaria at which taxonomists are actively studying those particular groups.

**(c) Raise awareness of the Park and its importance among the local population, visitors and State decision-makers**

***Action:***

- (i) Adopt an icon/flagship species for the Park (e.g. a *Rhododendron*, orchid or pitcher plant).
- (ii) Display Project posters at all entry points, schools and communities around the Park.

- (iii) Involve State agencies and local populations in developing genebanks within the Park to conserve fauna and flora as a potential source for future initiatives such as herb and rattan plantations, enrichment planting, fish culture etc.

**(d) Empower local communities to use their traditional knowledge**

*Action:*

- (i) As a matter of urgency, work out with the local communities and State agencies how they (the local communities) are to establish their rights over their intellectual property.
- (ii) Encourage communities to record their knowledge about all aspects of the Park, including its history, traditional trails, plants, animals, fish, fungi, environmental management, folklore, etc. This knowledge could help the broader local community understand and manage the Park better and local guides interpret it more effectively.
- (iii) Institute schemes to help the most knowledgeable Penan, Kelabit and Lun Bawang local informants, who are now elderly, benefit financially while sharing their knowledge with younger community members interested in park guiding and interpretation and helping make a comprehensive record of their ethnobotanical knowledge.

One approach to documenting this knowledge would be to employ a graduate from one of the local communities, qualified in a relevant discipline. The graduate would lead a team of local informants to record the knowledge they possess, applying scientific discipline to the task. Such a study could be an initiative under Phase II of the Project.

**(e) Upgrade Park facilities and services**

*Action:*

- (i) Develop basic facilities (e.g. shelter, water supply, toilets, cooking area, refuse pit, generator and wiring) at strategic points:
  - The Penan camp on the traditional route across the Tama Abu Range

- On the Plank Walk to G. Murud
  - At the Church Camp, where night temperatures can drop to 13° C
  - At Long Belaban
  - Outside the Park at Pa Rebadta
- (ii) Mark trails, especially those to G. Murud
- (iii) Encourage local tourist guides to cooperate to establish rates, share assignments, train interested parties and share resource materials.
- (iv) Develop posters and locally hosted websites showing routes to and in the park, locations of historical, cultural and biological features, contacts for tourist services, calendar of events etc.
- (f) Set up Joint Ventures to sustainably produce and market traditional forest products and local plants**

***Action:***

- (i) Investigate the types and amounts of organisms and products currently being extracted from the Park, (include orchids planted in local gardens).

A local graduate, appropriately qualified, could head a team to survey which species are currently in demand and establish gardens or plantations of these species to sustainably supply material for testing and investigation by the relevant authorities and for sale.

Species to be targeted would include Protected Plants (orchids, pitcher plants, Rhododendrons, ekor tupai (*Huperzia*)), other ornamentals and useful species including palms and *Pandanus* species.

- (ii) Source Joint Venture partners.
- (iii) Test popular or high value forest products for active ingredients, carry out market research and product development, investigate how to market plantlets under permit at exit points around the Park and elsewhere and develop marketing strategies; assist the local communities

to apply for patents and exercise their intellectual property rights.

Species to be targeted would include *Arcangelisia* and *Boesenbergia* spp.

**(g) Market timber and fuelwood species seedlings raised from sustainable sources**

***Action:***

- (i) As a condition of any future timber license issued, require licensees to replant areas they extract with locally-sourced timber species.
- (ii) Establish genebanks for timber species, involve local community members in their establishment and in monitoring and raising and marketing seedlings from genebank seed.
- (iii) Encourage local community members to plant the fast-growing, locally preferred fuelwood species 'aru' (*Gymnostoma sumatranum*), which is now in short supply around settlements.

**(h) Develop the local handicraft and souvenir industry**

***Action:***

- (i) Set up a commercial handicraft enterprise in which local master-craftsmen and women, technical advisors and interested local community members work together to develop, produce and market products based on local traditional designs.
- (ii) Involve interested local community members in propagating raw materials for handicrafts, including rattans, *Licuala*, *Pandanus*, Cyperaceae etc.
- (iii) Assist local communities to produce and sell souvenirs, including postcards, calendars, posters and digital images of attractive species from the Park

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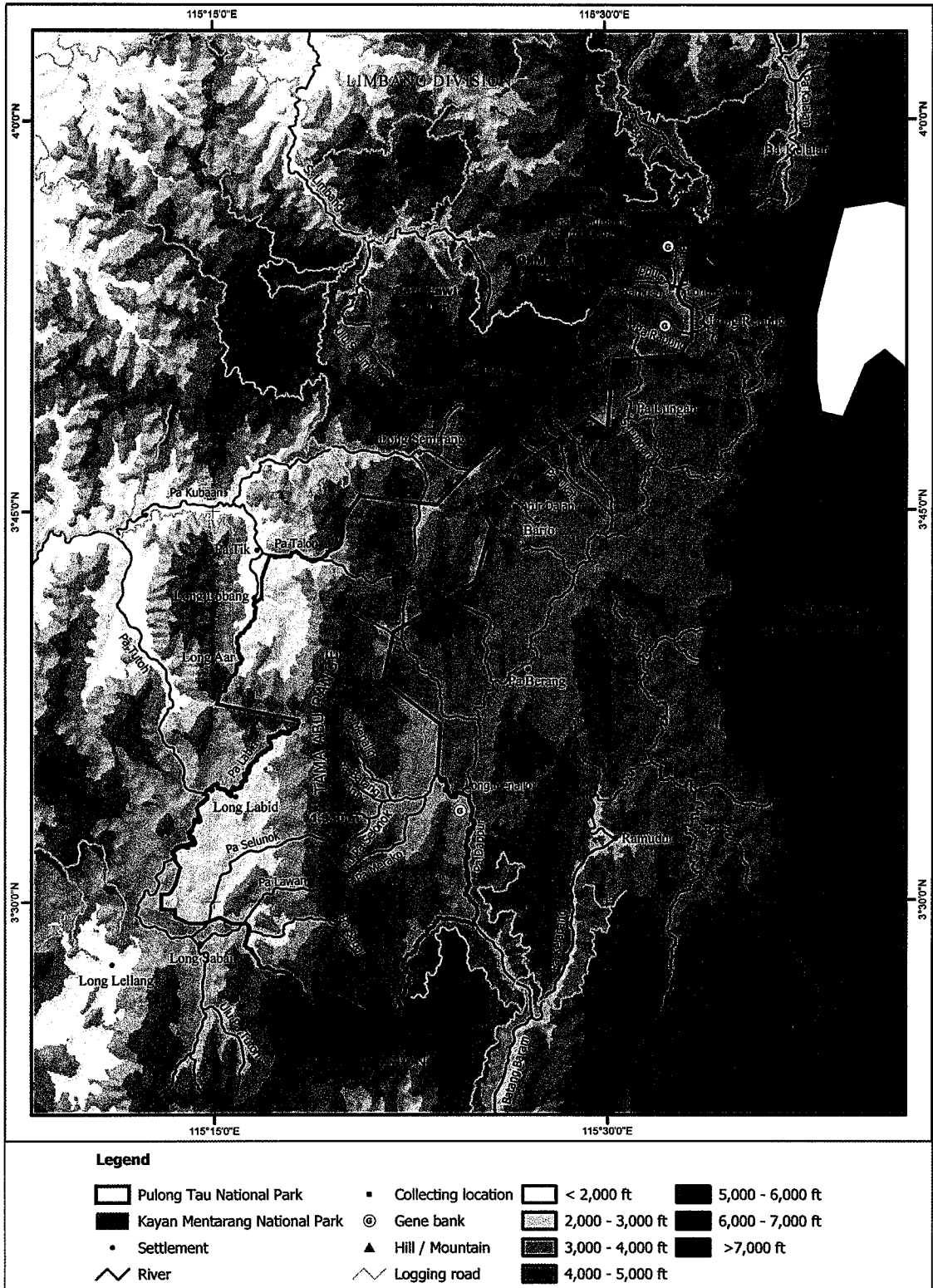


## Appendices

### Appendix 1: Collection Trips to the Pulong Tau National Park Area

Date	Collector	Locations
1914	J.C. Moulton, Curator of the Sarawak Museum	Unsuccessful expedition to G.Murud
1922	Eric Mjoberg (Swedish zoologist-ethnographer)	Expedition to summit of G. Murud
1967	J.A.R. Anderson, Ilias Paie, Sarawak Forest Dept. (SFD)	Ulu Sg Belaban, G. Murud, Ba' Kelalan
1967	B.L. Burt and A.M. Martin, Royal Botanic Gardens Edinburgh	Ba' Kelalan to G. Murud
1970	H.P. Nooteboom, Rijksherbarium, Leiden, and P.P.K. Chai, SFD	Kelabit Highlands, G. Murud
1982	Yii Puan Ching, SFD	'Gunung Murud National Park'
1985	Dayang Awa and Bernard Lee, SFD	Pa' Dappur, Sungai Menalio, Tama Abu Range
1991	Rena George, Rantai Jawa <i>et al.</i> SFD	G. Murud
1995	J.H. Beaman, Royal Botanical Gardens Kew	UNIMAS Expedition to summit of G. Murud
1999	Julaihi Abdullah and Jemree Sabli, SFD	Lepo Bunga, G. Murud
2002	Axel Poulsen, Royal Botanic Gardens, Edinburgh	Between Ba'' Kelalan and G. Murud

## Appendix 2: Map of Pulong Tau National Park and Surroundings



## Appendix 3a: Checklist of the Plants of Pulong Tau National Park

Note: Descriptions of plants and habitats from field notes have been merged when there is more than one specimen.

Only the first collector's name is given.

Collections listed under a genus name given without 'sp.' may represent different species.

### Angiosperms – Dicotyledons

#### ACANTHACEAE

Genus unknown

Pa Selonok, 1150 m, Pearce, K.G. S 94864.

*Borneacanthus* sp.

Herb 0.5 m tall. On peat soil in open, disturbed forest. G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96042.

*Cosmianthemum* PTNP 1

Herb to 40 cm tall. On 30 cm peat over fine alluvial sand at pathside with *Dacrycarpus* and *Gymnostoma* regenerating and in alluvial forest. Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95005; Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95876.

*Cosmianthemum subglabrum* Brem.

Woody herb. Kerangas forest, 950 m, Awa, D. S 51024.

*Hemigraphis* sp.

Herb about 40 cm tall. Alluvial forest. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95858.

*Rungia* PTNP 1

Herb. On clay in oak-laurel-*Syzygium* forest and at edge of open, cleared area in alluvial forest. On hill NW of Bario, 1550 m, Pearce, K.G. S 95136; Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95867.

*Strobilanthes* sp.

Lepo Bunga, 1750 m, Julaihi, L. S 70804; Hill NW of Arur Dalan, 1320 m, Pearce, K.G. S 95292.

*Strobilanthes* cf. *maingayi* C.B. Clarke

Herb less than 50 cm tall. Alluvial forest. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95834.

## AMARANTHACEAE

Genus unknown

Herb 0.5 m tall. Alluvial forest. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95835.

## ANACARDIACEAE

*Gluta aptera* (King) Ding Hou

Tree 25 m tall, 20 cm diam. On peat at least 15 cm deep at ridge top, canopy to 25 m. Pa Selunok, ulu Pa Menalio, 1220 m, Pearce, K.G. S 93443.

*Rhus borneensis* Stapf

Shrub or treelet to 2 m tall. On sandstone rocks with damp patches in 3 m tall vegetation, in summit vegetation and in mossy forest. G. Murud, 2300 m, Yii, P.C. S 44488; 2200 m, S 44612; Summit, 2400 m, Julaihi, L. S 80118; G. Murud, below Kebun Batu, 2400 m, Pearce, K.G. S 95412.

## ANNONACEAE

*Alphonsea*

Treelet to 2.5 m. tall and 1.5 cm diam. On yellow sandy clay in *Agathis*-dominated, mossy forest. Lepo Bunga, 1750 m, Julaihi, L. S 70826;

*Alphonsea?*

N of Long Belaban up ridge, 1440 m, Pearce, K.G. S 95809.

*Artabotrys* sp.

NW of Long Belaban, 1320 m, Pearce, K.G. S 95489.

*Artabotrys rosea* Boerl.

Climber to 10 m high, 15 cm diam. Kerangas forest. 950 m, Awa, D. S 51016.

*Artabotrys suaveolens* (Blume) Blume

Climber to about 17 m tall. On sandy soil on levee above river and on peat soil in pole forest with *Agathis*. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93479; Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1190 m, Pearce, K.G. S 95226.

*Fissistigma manubriatum* (J.D. Hook. and Thompson) Merr.

Climber about 4 m long. On peat soil over tree roots with grey sand beneath. S of Pa Menalio, 1220 m, Pearce, K.G. S 93457.

*Friesodielsia* cf. *biglandulosa* (Blume) Steenis

Woody climber 1.5 m long. On clay covered with 5 cm layer of humus in forest with canopy about 30 m. NW of Long Belaban, 1260 m, Pearce, K.G. S 95487.

*Goniothalamus calcareus* Mat-Salleh

Tree 5 m tall, 5 cm diam. Lepo Bunga, 1130 m, Julaihi, L. S 80176.

*Goniothalamus fasciculatus* Boerl.

Tree 7 m tall, 15 cm diam. On alluvial soil on levee behind river. Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94847.

*Goniothalamus ridleyi* King

Tree about 6 m tall, 15 cm diam. On loam in undisturbed, fairly open forest with canopy 30+ m and *Tristaniopsis* and Fagaceae present. 0.5 km E of Long Belaban going more or less E, 1330 m, Pearce, K.G. S 95961.

*Goniothalamus tapisoides* Mat-Salleh

Tree to 9 m tall, 8 cm diam. On yellow sandy clay in *Agathis*-dominated mossy forest. Lepo Bunga, 1750 m, Julaihi, L. S 70825.

*Goniothalamus umbrosus* J. Sinc.

Tree 3 m tall, 2 cm diam. On peaty humus over tree roots with sandy soil 50 cm beneath in open forest, canopy about 12 m tall. On ridge N of Pa Menalio, 1190 m, Pearce, K.G. S 93490.

*Polyalthia motleyana* (Hook.f.) Airy Shaw var. *glabrescens* Airy Shaw

Treelet to 1 m tall. On yellow sandy clay in *Agathis*-dominated mossy forest. Lepo Bunga, 1750 m, Julaihi, L. S 70858.

*Polyalthia sumatrana* (Miq.) Kurz

Tree to about 14 m tall, 10 cm diam. On peat soil over tree roots with grey sand beneath. S of Pa Menalio, 1220 m, Pearce, K.G. S 93460; On ridge of Menalio, Pa Dapur, 1100 m, Lim, M.T. S 95102.

## APIACEAE

*Hydrocotyle javanica* Thunb.

G. Murud N.P., Yii, P.C. S 44423.

*Sanicula europaea* Linn.

Herb about 50 cm tall. Hill NW of Arur Dalan, 1240 m, Pearce, K.G. S 95290.

## APOCYNACEAE

### *Alyxia angustifolia* Ridl.

Climber 2.5 m, < 1 cm diam. On peaty humus over tree roots, sandy soil 50 cm beneath, in open canopy forest about 12 m tall. On ridge N of Pa Menalio, 1190 m, Pearce, K.G. S 93489.

### *Alyxia oleifolia* King and Gamble

Climber to 1 m. Summit forest. 2<sup>nd</sup> summit, 2240 m, Julaihi, L. S 80140.

### *Alyxia* cf. *oleifolia* King and Gamble

Climber. On peat soil in open, disturbed forest. G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96061.

### *Alyxia palawanensis* F. Markgraf

Herb. On clay covered with 5 cm layer of humus. In forest with canopy about 30 m. NW of Long Belaban, 1320 m, Pearce, K.G. S 95494.

### *Anodendron?*

S of Pa Dapur/Pa Menalio confluence, 1370 m, Pearce, K.G. S 95068.

### *Willughbeia coriacea* Wall.

Climber. Primary forest. Apad Batu Buli, 1650 m, Nootboom, H.P. 2185.

## AQUIFOLIACEAE

### *Ilex* sp.

Nearly at G. Murud summit, 2430 m, Pearce, K.G. S 95394.

### *Ilex cissoidea* Loes.

Tree 5 m tall, 25 cm diam. Primary forest. G. Murud East, Belapan river - Dapo river, Kelabit Highland, 1100 m, Nootboom, H.P. 1824.

### *Ilex glomerata* King

Treelet 4 m tall, 2.5 cm diam. On 30 cm peaty layer over fine alluvial sand at pathside in forest with regenerating *Dacrycarpus* and *Gymnostoma*. Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95002.

### *Ilex havilandii* Loes.

Dwarf shrub, shrub, treelet or climber to about 3 m tall, 2.5 cm diam. On sandstone cliff and on peat soil over roots with white sandstone boulders at exposed summit in ericaceous scrub 1 - 1.5 m tall with scattered *Dacrydium* and *Leptospermum* to 4.5 m

and on hillslope and in mossy forest. G. Murud, N side, 2134 m, Burtt, B.L. B 5468; G. Murud, 2200 m, Nootboom, H.P. 2037; G. Murud, Ulu Pahdapur, 2362 m, Ilias, P. S 26533; Proposed G. Murud N.P., 2250 m, S 44425, 2200 m, S 44618; Tama Abu Range, 1750 m, Awa, D. S 51144, S 51166; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94908; False Summit on route to Church Camp, 2215 m, Pearce, K.G. S 95466.

*Ilex havilandii* Loes. var. *hirsuticalyx* Argent  
Summit ridge, 2150 m, Julaihi, L. S 80028.

*Ilex spicata* Blume

Shrub 50 cm. On nearly bare sandstone on gentle slope with open vegetation and scattered shrubs. G. Murud, 2200 m, Nootboom, H.P. 2020.

*Ilex spicata* Blume var. *harmsiana* (Loes.) S. Andrews

Treelet about 3 m tall. On rocks in mossy forest with some big *Agathis* trees. G. Murud, 2134 m, Ilias, P. S 26453; 2300 m, Yii, P.C. S 44489; On ridge, S part of upper Pa Menalio, 1240 m, Lim, M.T. S 95124.

*Ilex triflora* Blume

Shrub about 30 cm tall. Summit vegetation. Summit, 2400 m, Julaihi, L. S 80110.

## ARALIACEAE

*Arthrophyllum* PTNP 1

Epiphyte 1.5 m long, 1.5 cm diam. 3 m up tree. On peat over mossy tree roots in open mossy forest 15 - 25 m tall. S of Pa Dapur/Pa Menalio confluence, 1370 m, Pearce, K.G. S 95066.

*Arthrophyllum collinum* W.R. Philipson

Climber, shrub, epiphytic climbing shrub or terrestrial treelet to 2 m tall. On exposed summit with exposed peat soil and white sandstone boulders surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and on nearly bare sandstone on gentle N slope with low shrubby vegetation. G. Murud, 2200 m, Nootboom, H.P. 2048; G. Murud, 2420 m, Anderson, J.A.R. S 26473; G. Murud, 2250 m, Rena, G. S 63315; Summit ridge, G. Murud, 2150 m, Julaihi, L. S 80027; G. Murud, below Kebun Batu, 2400 m, Pearce, K.G. S 95410; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95443.

*Dendropanax borneensis* (Philipson) Merrill

Treelet 3 m tall, 8 cm diam. On ridge and on hillside. G. Murud, Sg. Belaban, 1783 m, Ilias, P. S 26367; Sg. Belaban, path to G. Murud, 1829 m, Ilias, P. S 26370, 2256 m, S 26500.

*Schefflera* PTNP 1

Climber 2.5 m tall. Disturbed forest about 4 m tall with scattered trees to about 22 m and abundant *Racemobambos*. New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95312.

*Schefflera avenis* (Miq.) Harms

Climber. Mossy forest. G. Murud, Rena, G. S 63336.

*Schefflera bipalmatifolia* Merr.

Epiphyte and treelet 2 m tall. Along stream bank in primary forest. Apad Batu Buli, 1750 m, Nooteboom, H.P. 2215; Proposed G. Murud N.P., 1300 m, Yii, P.C. S 44672.

*Schefflera bracteata* Frodin

Treelet 2 m tall. On ridge. Tama Abu Range, 1550 m, Awa, D. S 51115.

*Schefflera cephalotes* Harms.

Epiphyte fallen from tree. Pole forest about 20 - 25 m tall on 12 cm peat over clay. W of summit SW of Long Rapung, 1340 m, Pearce, K.G. S 96003.

*Schefflera denticulata* Frodin (*ined.*)

Epiphyte. On peat in mossy forest with broken canopy about 15 - 20 m tall. Camp 4, Ilias, P. S 26432; New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95354.

*Schefflera elliptica* Harms.

Epiphyte 6 m up tree. On yellow sandy clay in *Agathis*-dominated mossy forest. Lepo Bunga, 1750 m, Julaihi, L. S 70882.

*Schefflera glaucophylla* Frodin (*ined.*)

On large sandstone rocks below peak in vegetation about 4 m tall and on thick peat and tree roots in dry ridge forest. About 0.5 km SW of N 3° 33.5', E 115° 23.9', 1400 m, Pearce, K.G. S 95240.

*Schefflera mangiferifolia* Frodin

Treelet 1.5 m tall and epiphyte on tree 5 m high. On yellow sandy clay in mossy forest with *Agathis* dominant, also on a ridge. Tama Abu Range, 1550 m, Awa, D. S 51120; G. Murud, 1710 m, Rena, G. S 60338; Lepo Bunga, 1750 m, Julaihi, L. S 70809.

*Schefflera mjobergii* Merr.

Terrestrial treelet to 3 m tall, climber to 2.6 m high on tree and epiphyte 2.6 m tall on tree, lithophyte 1 m tall and shrub. On exposed summit with exposed peat soil and white sandstone boulders surrounded by ericaceous scrub 1 - 2 (4) m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and on yellow sandy clay in *Agathis*-dominated



mossy forest and near river and on a ridge. G. Murud, 2042 m, Ilias, P. S 26386; G. Murud, ulu Sg. Dapur, 2103 m, Ilias, P. S 26467; G. Murud East, path to the top, 1800 m, Nootboom, H.P. 1961; Proposed G. Murud N.P., 2300 m, Yii, P.C. S 44487; Tama Abu Range, 1550 m, Awa, D. S 51145, 1750 m, S 51148; G. Murud, 2400 m, Julaihi, L. S 70894; G. Murud summit, 2400 m, Julaihi, L. S 80120; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94905; G. Murud summit, 2433 m, Pearce, K.G. S 95366, S 95375; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95446.

*Schefflera* cf. *remotiserrata* Merr.

Climber and scrambler 1.5 m long. On exposed summit with exposed peat soil and white sandstone boulders surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and at edge of swampy, cleared area in about 3 m tall scrub with *Racemobambos* and scattered taller trees and on clay covered with 5 cm humus layer in forest about 30 m tall. On trail from Church Camp to G. Murud, 2090 m, S 95179, S 95180; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95444; NW of Long Belaban, 1260 m, Pearce, K.G. S 95479.

*Schefflera* aff. *remotiserrata* Merr.

Epiphyte on tree 3.5 m high and shrub 1 m tall. On peat over roots in scrubby summit vegetation about 4 m tall and on nearly bare sandstone on gentle slope with low shrubby vegetation. G. Murud, 2200 m, Nootboom, H.P. 2052; Helipad, near Church. G. Murud summit ridge, 2100 m, Julaihi, L. S 80080; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94915.

*Schefflera siffiana* Frodin (*ined.*)

Climber 2 m tall. On peat soil over tree roots with grey sand beneath. S of Pa Menalio, 1220 m, Pearce, K.G. S 93468.

*Schefflera trineura* Frodin (*ined.*)

Woody climber 9 m tall, shrub and creeper. On sandstone cliff and on peat and peaty humus over roots with sandy soil 50 cm beneath in scrubby summit vegetation about 4 m tall and in open canopy mossy forest about 12 m tall. G. Murud East, path to the top, 1800 m, Nootboom, H.P. 1958; Proposed G. Murud N.P., 2200 m, Yii, P.C. S 44619; On ridge N of Pa Menalio, 1190 m, Pearce, K.G. S 93493; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94912.

## ASCLEPIADACEAE

*Dischidia benegalensis* Colebr.

Herbaceous climber. On peat soil in pole forest with *Agathis*. Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1300 m, Pearce, K.G. S 95224.

### *Hoya*

Climber 3 m long. On exposed sandstone rocks criss-crossed by roots covered with moss and peat in open vegetation with scattered, crooked trees to about 12 m tall and on peat in open, disturbed forest. New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95337; By Plank Walk at top of trail from Lepo Bunga to Church Camp, G. Murud, 2130 m, Pearce, K.G. S 96043.

## ASTERACEAE

### *Bidens* sp.

Waterlogged ground. Near Church, summit ridge, 2100 m, Julaihi, L. S 80065.

### *Vernonia arborea* Buch.-Ham.

Treelet about 4 m tall. Forest with some big *Agathis* trees. On ridge, S part of upper Pa Menalio, 1240 m, Lim, M.T. S 95126.

### *Vernonia phanerophlebia* Merr. var. *dulitensis*

Shrub or treelet about 3 m tall. Among network of tree roots in open, dry scrubby forest about 4 m tall and on gentle slope with scattered shrubs and on swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos*. Route from Ba' Kalalan to G. Murud, ridge from above Camp 4, 1951 m, Burt, B.L. B 5422; G. Murud, 2200 m, Nootboom, H.P. 2017; Ilias, P. S 26461; Tama Abu Range near summit, 1800 m, Pearce, K.G. S 94984; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95166.

## BALANOPHORACEAE

### *Balanophora papuana* Schlechter

Parasite at base of tree. On a summit and in forest with broken canopy 10 - 15 m tall. G. Murud, 2200 m, Nootboom, H.P. 2034; Tama Abu Range, 1750 m, Awa, D. S 51128; Summit ridge, 2050 m, Julaihi, L. S 80061; New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95328.

## BALSAMINACEAE

### *Impatiens platypetala* Lindl.

Herb. Alluvial forest about 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95855.

## BEGONIACEAE

### *Begonia*

Route from Ba' Kelalan to G. Murud Camp 3, 1646 m, Burt, B.L. B 5295; Belapan River - Dapo River, Nootboom, H.P. 1841A; Sg. Menalio, route to Tama Abu Range, 950 m, Awa, D. S 51028.

### *Begonia* PTNP 1 aff. *baramensis*

Herb 25 cm tall. Mossy forest. From ulu Pa Selonok W towards Tama Abu Range, 1740 m, Pearce, K.G. S 94890.

### *Begonia* PTNP 2

Herb about 70 cm tall. On clay in shady area by path in oak-laurel-*Syzygium* forest. On hill NW of Bario, 1500 m, Pearce, K.G. S 95145.

### *Begonia* PTNP 3

Herb 0.5 m tall. On loam covered by 1-2 cm humus in disturbed forest, c 27 m tall and on sandy loam covered by 2 cm peat in riverine forest about 25 m tall. Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95079; 0.5 km E of Long Belaban going more or less E, 1300 m, Pearce, K.G. S 95964.

### *Begonia* PTNP 4

Herb about 25 cm long rooting at nodes. In temporary stream bed, alluvial forest. Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95288.

### *Begonia* PTNP 5

Herb. Alluvial forest about 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95844.

### *Begonia* PTNP 6

Herb about 50 cm tall from creeping stem. Hill. On clay soil in damp area by trail, in oak-laurel-*Syzygium* forest, 1150 m, Pearce, K.G. S 95289.

### *Begonia chlorocarpa* Irmscher ex Sands

Herb about 70 cm tall. On clay in damp, shady area by stream in oak-laurel-*Syzygium* forest and on flood plain of river. On hill NW of Bario, 1500 m, Pearce, K.G. S 95144; Long Belaban, 1143 m, Pearce, K.G. S 95826.

## BOMBACACEAE

### *Durio acutifolius* (Mast.) Kosterm.

Tree to 4 m tall, 6 cm diam. On yellow sandy clay. G. Murud, 1130 m, Julaihi, L. S 80195.

## BURSERACEAE

*Canarium dichotomum* (Blume) Miq.

Tree about 8 m tall, about 7 cm diam. On loam covered by 1 - 2 cm humus in disturbed forest about 27 m tall. 0.5 km E of Long Belaban going more or less E, 1255 m, Pearce, K.G. S 95957.

## CAPPARACEAE

*Capparis buwaldae* M. Jacobs

Climber to 3 m high and epiphyte about 7 m up tree. Near stream in riparian forest and on peat soil in Kerangas forest. Sg. Menalio, Awa, D. S 51073; Going approx. N down slope from N 3° 33.5', E 115° 23.9', Pearce, K.G. S 95265.

## CAPRIFOLIACEAE

*Viburnum hispidulum* Kern

Tree 6 m tall, 8 cm diam. On yellow sandy clay in mossy forest with *Agathis* dominant. Lepo Bunga, 1750 m, Julaihi, L. S 70840.

*Viburnum vernicosum* L.S. Gibbs

Shrub 3 m tall. On peat in shrubby vegetation. G. Murud, around top, Nootboom, H.P. 2061.

## CECROPIACEAE

*Poikilospermum scabrinervium* (Barg.-Petr.) Merr.

Epiphyte 3 m up tree. Alluvial forest 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95839.

## CELASTRACEAE

*Celastrus* aff. *monospermoides* Loes.

Woody climber about 4.5 m tall. On peat over mossy tree root in mossy forest 15 - 25 m tall. S of Pa Dapur/Pa Menalio confluence, 1370 m, Pearce, K.G. S 95067.

*Euonymus castaneifolius* Ridley

Tree to 10 m tall, 18 cm diam. On sandy loam covered by 2 cm peat on riverbank in riverine forest about 25 m tall. Belapan river-Dapo river, 1100 m, Nootboom, H.P.

1830; Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94840; Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95081.

*Lophopetalum javanicum* (Zoll.) Turcz.

Tree 27 m tall, 29 cm diam. On ridge. Ulu Belaban to Long Rebata, 1753 m, Ilias, P. S 26523.

*Microtropis* sp.

Treelet 2 m tall. On peat in open, mossy forest, about 25 m tall, with *Racemobambos* abundant. SE of Plank Walk at junction with trail to Long Belaban, 2130 m, Pearce, K.G. S 96069.

*Microtropis* cf. *keningauensis* Kochummen

Tree about 7 m tall. Alluvial forest about 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95865.

*Microtropis* aff. *rigida* Ridl.

Tree about 1 m tall. Scrubby vegetation about 1.5 m tall with scattered *Dacrydium* to 3+ m. G. Murud below Kebun Batu, 2200 m, Pearce, K.G. S 95421.

*Microtropis wallichiana* Wight ex Thwaites

Shrub. On sandstone in open vegetation with low shrubs. G. Murud, 2300 m, Nootboom, H.P. 2043; G. Murud, summit ridge, 2150 m, Julaihi, L. S 80036.

## CHLORANTHACEAE

*Chloranthus officinalis* Blume

Herb about 40 cm long. On loam covered by 1-2 cm humus in disturbed forest about 27 m tall. 0.5 km E of Long Belaban going more or less E, 1230 m, Pearce, K.G. S 95950.

*Sarcandra glabra* (Thunb.) Nakai ssp. *brachystachys* (Blume) Verdc.

Shrub 7 m tall. On clay, canopy about 25 m tall. Just below summit SW of Long Rapung, 1240 m, Pearce, K.G. S 96023.

*Sarcandra glabra* (Thunb.) Nakai ssp. *brachysyachys* (Blume) Verdc. var. *brachystachys*

Shrub 2 m tall. Primary forest. Belapan river - Dapo river, 1100 m, Nootboom, H.P. 1825.

## CLETHRACEAE

### *Clethra canescens* Reinw. ex Blume

Shrub about 3 m tall. On a network of tree roots in open dry scrubby forest about 4 m tall. Tama Abu Range near summit, 1800 m, Pearce, K.G. S 94977.

### *Clethra pachyphylla* Merr.

Tree to 18 m tall, 22 cm diam. On loam covered by 1-2 cm humus in disturbed forest about 27 m tall. G. Murud, 1200 m, Yii, P.C. S 44677; 0.5 km E of Long Belaban going more or less E, 1160 m, Pearce, K.G. S 95944.

## CLUSIACEAE

### *Calophyllum garcinioides* P.F. Stevens

Shrub. On peat over roots. Scrubby summit vegetation about 4 m tall. G. Murud, Sg. Belaban, 1829 m, Ilias, P. S 26372; G. Murud N.P., 2250 m, Yii, P.C. S 44449; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94911.

### *Calophyllum* cf. *garcinioides* P.F. Stevens

Tama Abu Range, 1750 m, Awa, D. S 51160; Lepo Bunga, 1750 m, Julaihi, L. S 70807.

### *Calophyllum nodosum* Vesque

Tree to 12 m tall, 17 cm diam. On 30 cm peaty layer over fine alluvial sand at pathside in forest with regenerating *Dacrycarpus* and *Gymnostoma* and on Kerangas soil in open vegetation to about 7 m and on sandy soil in forest with some big *Agathis* trees and very dense pole-size trees. On ridge of Menalio, Pa Dapur, 1080 m, Lim, M.T. S 95101; 1300 m, S 95105; On ridge, S part of upper Pa Menalio, 1240 m, Lim, M.T. S 95121; Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95024; Summit SW of Long Rapung, 1320 m, Pearce, K.G. S 95990.

### *Calophyllum* cf. *nodosum* Vesque

Treelet to 14 m tall, 17 cm diam. On peat and peaty humus over tree roots with grey sand 50 cm beneath. Canopy open, about 12 m tall. S of Pa Menalio, 1220 m, Pearce, K.G. S 93465; On ridge N of Pa Menalio, 1190 m, Pearce, K.G. S 93487.

### *Calophyllum teysmannii* Miq. var. *inophylloide* (King) P.F. Stevens

Tree 25 m tall, 35 cm diam. On bank behind river. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93428.

*Garcinia* sp.

Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95016.

*Garcinia bancana* (Miq.) Miq.

Route to Tama Abu Range, 950 m, Awa, D. S 51009.

*Garcinia borneensis* Pierre

Tree about 14 m tall, 30 cm diam. On loam covered by 1-2 cm humus in disturbed forest 27 m tall. Belapan river, 1100 m, Nooteboom, H.P. 01891; 0.5 km E of Long Belaban going more or less E, 1255 m, Pearce, K.G. S 95955.

*Garcinia calophyllifolia* Ridl.

Tree to 11 m tall, 18 cm diam. On peat soil over tree roots with grey sand beneath and in forest with some big *Agathis* trees. G. Murud summit ridge, way to 2<sup>nd</sup> summit, 2100 m, Julaihi, L. S 80160; S of Pa Menalio, 1220 m, Pearce, K.G. S 93472; On ridge, S part of upper Pa Menalio, 1240 m, Lim, M.T. S 95120.

*Garcinia* cf. *calophyllifolia* Ridl.

Tree 12 m tall, 10 cm diam. On exposed sandstone rocks criss-crossed by roots covered with moss and peat and in open vegetation with scattered, crooked trees to about 12 m tall. New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95340.

*Garcinia eugenifolia* Wall.

Tree 2 m tall. In disturbed forest about 4 m tall with scattered trees to about 22 m and abundant *Racemobambos*. G. Murud, 2<sup>nd</sup> ridge near Church, 2100 m, Julaihi, L. S 80087; New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95319.

*Garcinia maingayi* Hook.f. ex T. Anders.

Monopodial tree to 20 m tall, 45 cm diam. On sandy loam covered by 2 cm peat in riverine forest and in alluvial forest 30 m tall. Belapan river, 1100 m, Nooteboom, H.P. 1880; G. Murud N.P., 1500 m, Yii, P.C. S 44644; G. Murud 2<sup>nd</sup> ridge near Church, 2100 m, Julaihi, L. S 80083; Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95083; Downstream of Long Belaban, 1150 m, Pearce, K.G. S 95827.

*Garcinia microcarpa* Pierre

Tree to 8 m tall, 12 cm diam. Above riverbank in alluvial forest about 30 m tall. Belapan river - Dapo river, 1100 m, Nooteboom, H.P. 01861; Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95877; Long Rusu along Sg. Dapur up from Long Belaban, 1150 m, Pearce, K.G. S 95879.

*Garcinia myristicaefolia* Pierre

Path to G. Murud, 1707 m, Ilias P. S 26317, S 26322; G. Murud N.P., 2250 m, Yii, P.C. S 44446; Near Church, summit ridge, 2100 m, Julaihi, L. S 80062.

*Garcinia* cf. *parvifolia* Pierre

Tree 12 m tall, 20 cm diam. On bank behind river. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93426.

*Garcinia trianii* Pierre

Tree 12 m tall, 16 cm diam. On loam covered by 1-2 cm humus in disturbed forest 27 m tall. 0.5 km E of Long Belaban going more or less E, 1160 m, Pearce, K.G. S 95953.

*Garcinia* cf. *trianii* Pierre

Treelet 3 m tall. On peat in pole forest with *Agathis*. Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 95215.

## CONVOLVULACEAE

*Erycibe* sp.

NW of Long Belaban, 1320 m, Pearce, K.G. S 95491.

*Erycibe* cf. *glomerata* Blume

Shrub 2 m tall, 2 cm diam. On alluvial soil on levee behind river. Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94855.

## CORNACEAE

*Mastixia rostrata* Blume ssp. *caudatifolia* (Merr.) Matthew

Tree 10 m tall, 11 cm diam. On ridge. Path to G. Murud, Sg. Belaban, 1707 m, Ilias, P. S 26341.

## CRYPTERONIACEAE

*Axinandra* aff. *coriacea* Baill.

Tree about 18 m tall, 35 cm diam. On peaty humus over tree roots with sandy soil 50 cm beneath in open forest about 12 m tall. On ridge N of Pa Menalio, 1190 m, Pearce, K.G. S 93491.

*Crypteronia elegans* J.T. Pereira and K.M. Wong

Tree to about 25 m tall, about 80 cm diam. On yellow sandy clay on riverbank. G. Murud, Lepo Bunga, 1130 m, Julaihi, L. S 80191; Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93425.



## CUNONIACEAE

### *Weinmannia aphanoneura* Airy-Shaw

Tree 5 m tall, 8 cm diam. and shrub. On summit ridge and hillslope. G. Murud, 2378 m, Burt, B.L. B 5487; G. Murud, 2347 m, Ilias, P. S 26481, S 26531.

### *Weinmannia fraxinea* Sm. ex D. Don

Tree 7 m tall, 10 cm diam. On summit. Tama Abu Range, 1750 m, Awa, D. S 51142.

## DAPHNIPHYLLACEAE

### *Daphniphyllum borneense* Stapf

Shrub and small tree 2 m tall. On exposed peat soil and white sandstone boulders surrounded by ericaceous scrub 1-2 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m at summit and on peat over roots in summit forest 4 m tall and in mossy forest. G. Murud N.P., 2300 m, Yii, P.C. S 44479; Tama Abu Range, 1750 m, Awa, D. S 51134; G. Murud 2<sup>nd</sup> summit, 2240 m, Julaihi, L. S 80145, S 80146; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94906, S 94931; G. Murud summit, 2433 m, Pearce, K.G. S 95391; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95440.

### *Daphniphyllum dichotomum* (T.C. Huang) T.C. Huang

Tree 23 m tall, 25 cm diam. On ridge and on hillside. Sg. Belaban, 1707 m, Ilias, P. S 26315, 1783 m, S 26365.

## DIPTEROCARPACEAE

### *Parashorea* cf. *parvifolia* Wyatt-Smith ex P.S. Ashton

Treelet 2 m tall. On humus-covered clay in forest about 30 m tall. N of Long Belaban up ridge, 1440 m, Pearce, K.G. S 95810.

### *Shorea monticola* P.S. Ashton

Tree 27 m tall, 30 cm diam. On ridge. Path to G. Murud, 1707 m, Ilias, P. S 26338.

### *Shorea venulosa* G.H.S. Wood ex Meijer

Tree 17 m tall, about 30 cm diam. On slope in forest. Tinting Menalio, Pa Dapur, 1380 m, Lim, M.T. S 95115.

### *Vatica albiramis* v. Slooten

Tree 19 m tall, 12 cm diam. In forest along river. G. Murud N.P., 1500 m, Yii, P.C. S 44632.

## ELAEOCARPACEAE

### *Elaeocarpus* PTNP 1

Tree 5 m tall, 5 cm diam. On sandy loam covered by 2 cm peat in riverine forest to 25 m. Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95098.

### *Elaeocarpus angustipes* Knuth

Tree 10 m tall, 8 cm diam. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos* and on hillside. G. Murud, ulu Sg. Belaban, (Camp 4), 1371 m, Ilias, P. S 26422; On trail from Church Camp to G. Murud, 2060 m, Pearce, K.G. S 95303.

### *Elaeocarpus balabanii* R. Weibel

Tree 27 m tall, 10 cm diam. On hillside. Ulu Sg. Belaban, 1676 m, Ilias, P. S 26362.

### *Elaeocarpus barbulatus* Knuth

Tree 7 m tall, 15 cm diam. In Kerangas forest. Sg. Menalio, route to Tama Abu Range, 950 m, Awa, D. S 51020.

### *Elaeocarpus clementis* Merr.

Tree 14 m tall, 20 cm diam. On yellow sandy clay in mossy forest with *Agathis* dominant. Lepo Bunga, 1750 m, Julaihi, L. S 70818.

### *Elaeocarpus ferrugineus* (Jack) Steud. ssp. *elliptifolius* (Merr.) M.J.E. Coode

Treelet 3 m tall, 6 cm diam. In swampy scrub at edge of cleared area with vegetation about 3 m tall, scattered taller trees and *Racemobambos*. On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95188.

### *Elaeocarpus ferrugineus* (Jack) Steud. var. *nov.*? M.J.E. Coode

Tree 3.3 m tall, 5 cm diam. Near river. G. Murud, ulu Sg. Dapur, 2042 m, Ilias, P. S 26449.

### *Elaeocarpus glaberrimus* Knuth

Shrub and treelet 3 m tall, 1.7 cm diam. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and in mossy forest on sandstone summit and on rocks and on ridge. G. Murud, 2400 m, Nootboom, H.P. 1988. Nootboom, H.P. 2003; G. Murud, 2134 m, Ilias, P. S 26452, 2179 m, S 26495; G. Murud (nr. Camp 5), 2149 m, Ilias, P. S 26510; Proposed G. Murud N.P., 2250 m, Yii, P.C. S 44427, 2300 m, S 44492; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95457.

*Elaeocarpus hochreutineri* Weibel

Tree 30 m high, 50 cm diam. Primary forest. G. Murud East, Sg. Belapan - Sg. Dapo, Kelabit Highland, 1100 m, Nooteboom, H.P. 1868.

*Elaeocarpus kalabittii* R. Weibel

Shrub and small tree 2 m tall. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m. Tama Abu Range, 1750 m, Awa, D. S 51156; G. Murud, below Kebun Batu, 2200 m, Pearce, K.G. S 95419; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95434.

*Elaeocarpus knuthii* Merr.

Tree 17 m tall, 14 cm diam. On peat over tree roots with grey sand beneath. S of Pa Menalio, 1220 m, Pearce, K.G. S 93451.

*Elaeocarpus lawasii* Weibel

Treelet 4 m tall, 7 cm diam. Near river. 2042 m, Ilias, P. S 26445.

*Elaeocarpus murudensis* Merr.

Shrub to 1 m and treelet 2 m tall, 12 cm diam. On yellow sandy clay and in scrub to 2 m amidst sandstone boulders with peat between and scattered *Dacrydium* to 3+ m and in mossy forest with *Agathis* dominant. G. Murud, Nooteboom, H.P. 1976; Nooteboom, H.P. 2068; Proposed G. Murud N.P., 2300 m, Yii, P.C. S 44471; G. Murud summit, 2410 m, Julaihi, L. S 70898; G. Murud summit, 2433 m, Pearce, K.G. S 95365; G. Murud, below Kebun Batu, 2400 m, Pearce, K.G. S 95417.

*Elaeocarpus nanus* Corner ssp. *congestifolius* (Knuth) M.J.E. Coode

Shrub 2 m tall. In shrubby top vegetation. 2400 m, Nooteboom, H.P. 1986.

*Elaeocarpus* cf. *nanus* Corner ssp. *congestifolius* (Knuth) M.J.E. Coode

Shrub and treelet about 2 m tall. Amidst sandstone boulders with peat between in scrub about 2 m high with scattered *Dacrydium* to 3+ m. G. Murud summit, 2433 m, Pearce, K.G. S 95370; G. Murud, below Kebun Batu, 2400 m, Pearce, K.G. S 95416.

*Elaeocarpus pagonensis* M.J.E. Coode

Treelet 2.5 m tall. On peat soil over roots on small exposed summit with vegetation about 7 m tall. Ridge behind Pa Dapur/Pa Menalio confluence, 1400 m, Pearce, K.G. S 95234.

*Elaeocarpus stipularis* Blume

Tree 7 m tall, 11 cm diam. On yellow sandy clay in mossy forest with *Agathis* dominant. Lepo Bunga, 1750 m, Julaihi, L. S 70883.

## EPACRIDACEAE

*Styphelia malayana* (Jack) Spreng.

Shrub and treelet to 1.3 m tall, about 1 cm diam. In scrubby vegetation about 1.5 m tall with scattered *Dacrydium* to 3+ m and on ridge. N side, 2134 m, Burt, B.L. B 5481; G. Murud, Ba' Kelalan, 2134 m, Ilias, P. S 26516; G. Murud, summit ridge, 2150 m, Julaihi, L. S 80035; Kebun Batu below summit of G. Murud, 2400 m, Pearce, K.G. S 95404.

## ERICACEAE

*Diplycosia* sp.

G. Murud Summit, 2400 m, Julaihi, L. S 80102.

*Diplycosia* PTNP 1

Shrub. On peat over roots in scrubby summit vegetation about 4 m tall. Tama Abu Range summit, 1800 m, Pearce, K.G. S 94921.

*Diplycosia acuminata* Becc.

Epiphyte. Route from Ba' Kelalan to G. Murud, near Camp 4, 1920 m, Burt, B.L. B 5410.

*Diplycosia barbigera* Sleumer

Climber 1.5 m long and epiphyte 3.3 m high on a tree and treelet 2 m tall. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and on ridge. Sg. Belaban, path to G. Murud, 1890 m, Ilias, P. S 26373; Tama Abu Range, 1750 m, Awa, D. S 51133; False Summit on route to Church Camp, 2215 m, Pearce, K.G. S 95468.

*Diplycosia cinnamomifolia* Stapf

Epiphyte about 1 m long, 14 m up tree and shrub 1.5 m tall and tree. On exposed sandstone rocks criss-crossed by roots covered with moss and peat in open vegetation with scattered, crooked trees to about 12 m tall and on peat in open, disturbed forest and in swampy scrub at edge of cleared area with vegetation about 3 m tall and scattered taller trees and *Racemobambos* and on summit. Tama Abu Range, 1750 m, Awa, D. S 51127; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95182; New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95342; G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96029.

*Diplycosia commutata* Sleumer

Epiphyte. On summit. Tama Abu Range, 1750 m, Awa, D. S 51131.

forest 20 m tall with *Agathis* dominant and pole forest and disturbed forest about 4 m tall with scattered taller trees to about 22 m and abundant *Racemobambos* and on clay covered with 5 cm humus layer in forest about 30 m tall and on sandy soil overlying Tertiary sandstone with deep 'mor' layer on ridge summit. Route from Ba' Kelalan to G. Murud, ridge SW of Camp 3, 1829 m, Burtt, B.L. B 5321; G. Murud East, 1800 m, Nooteboom, H.P. 1940; Apad Batu Buli, 1650 m, Nooteboom, H.P. 2200; G. Murud, 2400 m, Nooteboom, H.P. 2006; Path to Kuba'an Pungor Pawan, summit of ridge, 1567 m, Anderson, J.A.R. S 20171; Proposed G. Murud N.P., 2200 m, Yii, P.C. S 44622; Tama Abu Range, 1750 m, Awa, D. S 51176; Lepo Bunga, 1750 m, Julaihi, L. S 70801, S 70854; G. Murud summit ridges, 2200 m, Julaihi, L. S 80001, S 80002; On the way to the summit, Tama Abu Range, 1600 m, Pearce, K.G. S 94971; Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 95212; New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95311; NW of Long Belaban, 1260 m, Pearce, K.G. S 95481; G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96039.

*Rhododendron durionifolium* Becc.

Tree 2 m tall. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and on thick humus on sandstone in shrubby vegetation on ridge. Route from Ba' Kelalan to G. Murud, above Camp 3, 1829 m, Burtt, B.L. B 5264; G. Murud, around the top, 2400 m, Nooteboom, H.P. 1989; G. Murud, 2347 m, Ilias, P. S 26493; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95448.

*Rhododendron durionifolium* Becc. ssp. *durionifolium*

Treelet about 2 m tall and shrub to 1 m tall and epiphyte to 40 cm tall. On yellow sandy clay in mossy forest with *Agathis* dominant and on peat over mossy tree roots in open-canopy mossy forest to 25 m tall and on peaty humus over tree roots with sandy soil 50 cm beneath and in summit forest. G. Murud, 2400 m, Julaihi, L. S 70892; G. Murud 2<sup>nd</sup> summit, 2240 m, Julaihi, L. S 80135; On ridge N of Pa Menalio, 1190 m, Pearce, K.G. S 93484; S of Pa Dapur/Pa Menalio confluence, 1300 m, Pearce, K.G. S 95051.

*Rhododendron exuberans* (Sleumer) G.C.G. Argent

Shrub 60 cm tall and epiphyte on tree trunk 5 m high, stem to 1.5 m tall. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos* and in mossy forest. Route from Ba' Kelalan to G. Murud, above Camp 4, 1951 m, Burtt, B.L. B 5351A; G. Murud, summit ridge, 2100 m, Julaihi, L. S 80056, S 80057; G. Murud summit ridge, way to Murud 2<sup>nd</sup> summit, 2100 m, Julaihi, L. S 80167; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95178.

*Rhododendron himantodes* Sleumer

Shrub to 3 m tall and lithophyte. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1-1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and on peat and a network of tree roots in open dry scrubby forest about 4 m tall and in disturbed forest about 4 m tall with scattered taller trees to about 22 m and abundant *Racemobambos* and on thick humus on sandstone formation in mossy forest. Route from Ba' Kelalan to G. Murud, above Camp 3. Also from ridge SW of Camp 4, 1829 m, Burt, B.L. B 5251; G. Murud, 2134 m, Ilias, P. S 26463; G. Murud N.P., 2250 m, Yii, P.C. S 44443; G. Murud summit ridges, 2200 m, Julaihi, L. S 80003; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94919; Tama Abu Range near summit, 1800 m, Pearce, K.G. S 94978; New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95318; False Summit on route to Church Camp, 2215 m, Pearce, K.G. S 95470.

*Rhododendron lanceolatum* Ridley

Epiphyte on tree about 2 m height. On peat over tree roots in open, mossy forest 15-25 m tall and among very dense pole-size trees and on ridge and on summit. Sg. Belaban, 1707 m, Ilias, P. S 26323; Tama Abu Range, 1750 m, Awa, D. S 51175; S of Pa Dapur/Pa Menalio confluence, 1300 m, Pearce, K.G. S 95052, Lim, M.T. S 95103.

*Rhododendron longiflorum* Lindley

Scrambling treelet and sprawling shrub to 2.5 m long, 2 cm diam. On peat at least 15cm deep over mossy tree roots in open, mossy forest 15 - 25 m tall and at ridge top. Pa Selunok, ulu Pa Menalio, 1220 m, Pearce, K.G. S 93434; S of Pa Dapur/Pa Menalio confluence, 1300 m, Pearce, K.G. S 95058.

*Rhododendron malayanum* Jack var. *malayanum*

Epiphyte. On summit. Tama Abu Range, 1750 m, Awa, D. S 51171.

*Rhododendron micromalayanum* Sleumer

Tree 3.5 m tall and scrambling shrub about 0.5 m tall. On peat and peaty humus over mossy tree roots with sandy soil 50 cm beneath in open mossy forest 15 - 25 m tall. On ridge N of Pa Menalio, 1190 m, Pearce, K.G. S 93485; S of Pa Dapur/Pa Menalio confluence, 1370 m, Pearce, K.G. S 95075.

*Rhododendron* cf. *micromalayanum* Sleumer

Shrub 2 m tall. On Kerangas soil in open vegetation to about 7 m tall. Summit SW of Long Rapung, 1320 m, Pearce, K.G. S 95992.

*Rhododendron niveoflorum* Argent

Treelet 1.7 m tall. On ridge. G. Murud, 2347 m, Ilias, P. S 26492.

*Rhododendron orbiculatum* Ridl.

Shrub to 1.5 m tall and epiphyte 7 m up tree. On peaty soil over roots and large sandstone boulders in open, summit pole forest and in moss-covered shrubby vegetation on ridge; G. Murud, towards the top, 2300 m, Nooteboom, H.P. 1972; Tama Abu Range, 1750 m, Awa, D. S 51174; Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1670 m, Pearce, K.G. S 95201.

*Rhododendron pneumonanthum* Sleumer

Shrub 3.3 m tall. On sandy soil overlying Tertiary sandstone with deep 'mor' layer and in moss-covered shrubby vegetation on ridge and summit. G. Murud, 2400 m, Nooteboom, H.P. 1970; Route from Ba' Kelalan to G. Murud, ridge SW of Camp 4, 2134 m, Burt, B.L. B 5363; Plant received from B.L. Burt, Royal Botanic Garden, Edinburgh. Collected G. Murud, Sarawak, Burt, B.L. B 5380; Path to Kuba'an Pungor Pawan, summit of ridge, 1567 m, Anderson, J.A.R. S 20168.

*Rhododendron robinsonii* Ridl.

Epiphyte. Route from Ba' Kelalan to G. Murud, below Camp 3, 1646 m, Burt, B.L. B 5306.

*Rhododendron stenophyllum* Hook.f. ex Beccari ssp. *angustifolium*

Epiphyte on tree 3 m high. On summit. Tama Abu Range, 1750 m, Awa, D. S 51173; G. Murud summit ridge, 2100 m, Julaihi, L. S 80058.

*Rhododendron suaveolens* Sleumer

Shrub about 1 m tall. On exposed peat and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and on thick humus on sandstone formation in mossy forest. G. Murud summit ridges, 2200 m, Julaihi, L. S 80005; G. Murud summit, 2400 m, Julaihi, L. S 80105; G. Murud summit, 2433 m, Pearce, K.G. S 95358; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95449.

*Rhododendron* cf. *suaveolens* Sleumer

Shrub to 50 cm tall. On thick humus on sandstone formation and in summit vegetation. G. Murud summit ridges, 2200 m, Julaihi, L. S 80004; G. Murud summit, 2400 m, Julaihi, L. S 80113.

*Rhododendron yongii* G.C.G. Argent

Treelet 1 m tall and epiphyte on tree 2 m high. In summit vegetation and on rock and in mossy forest. G. Murud, 2134 m, Ilias, P. S 26462; Tama Abu Range, 1750 m, Awa, D. S 51177; Helipad, near Church, G. Murud summit ridge, 2100 m, Julaihi, L. S 80099; G. Murud summit, 2400 m, Julaihi, L. S 80101; Tama Abu Range on route to summit, 1650 m, Pearce, K.G. S 94992.

*Vaccinium* PTNP 1

Woody climber about 1.2 m tall. On peat in mossy forest about 20 m tall. Tama Abu Range on the way to the summit, 1580 m, Pearce, K.G. S 94967.

*Vaccinium bancanum* Miq. var. *tenuinervium* J.J. Sm.

Shrub about 3.5 m tall, 2 cm diam and small tree and epiphyte. On yellow sandy clay in mossy forest with *Agathis* dominant and in disturbed forest about 4 m tall with scattered taller trees to about 22 m and abundant *Racemobambos* and in riparian forest. Tama Abu Range, ulu Sg. Menalio, 1050 m, Awa, D. S 51091; Lepo Bunga, 1750 m, Julaihi, L. S 70802, S 70803; On ridge, S part of upper Pa Menalio, 1240 m, Lim, M.T. S 95125; New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95322.

*Vaccinium bigibbum* J.J. Sm.

Epiphyte on tree about 7 m high. On ridge. Sg. Belaban (path to G. Murud), 1707 m, Ilias, P. S 26310.

*Vaccinium circidifolium* J.J. Sm.

Shrub about 1 m tall. Among large sandstone rocks below peak in forest about 4 m tall and on thick peat and tree roots in dry ridge forest and in mossy forest with pole-size trees. On steep ridge of Menalio, Pa Dapur, 1370 m, Lim, M.T. S 95111; About 0.5 km SW of N 3° 33.5', E 115° 23.9', 1400 m, Pearce, K.G. S 95239.

*Vaccinium claoxylon* J.J. Sm.

Tree 5 m tall, 12 cm diam. and shrub about 2.5 m tall and epiphyte. On peat over roots and on thick humus on sandstone in scrubby summit vegetation about 4 m tall and on exposed peat soil and between white sandstone boulders surrounded by ericaceous scrub 1-3 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and in swampy scrub at edge of cleared area with vegetation about 3 m tall and scattered taller trees and *Racemobambos* and in mossy forest. Route from Ba' Kelalan to G. Murud, ridge SW from Camp 4, 2134 m, Burt, B.L. B 5362; G. Murud, 2408 m, Burt, B.L. B 5491; G. Murud, 2400 m, Nooteboom, H.P. 1990; G. Murud N.P., 2250 m, Yii, P.C. S 44437; Tama Abu Range, 1750 m, Awa, D. S 51123; G. Murud summit, 2400 m, Julaihi, L. S 80126; 2<sup>nd</sup> summit, 2240 m, Julaihi, L. S 80144; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94920; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95165; G. Murud, nearly at summit, 2430 m, Pearce, K.G. S 95392; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95431.

*Vaccinium* cf. *claoxylon* J.J. Sm.

Climber up to 3.3 m high on a tree and at about 23 m on a Fagaceae tree. On ridge. Sg. Belaban, 1707 m, Ilias, P. S 26326; Path to G. Murud (Camp 4), 2042 m, Ilias, P. S 26393.



*Vaccinium clementis* Merr.

Tree 4 m tall, 2.5 cm diam. and shrub. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1-4 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and on sandy soil overlying Tertiary sandstone with deep 'mor' layer and on thick peat and tree roots in dry ridge forest and in moss forest. Path to Kuba'an Pawan, summit of ridge, 1567 m, Anderson, J.A.R. S 20170; Path to G. Murud (2<sup>nd</sup> summit), 2210 m, Ilias, P. S 26410; Proposed G. Murud N.P., 2250 m, Yii, P.C. S 44436; About 0.5 km SW of N 3° 33.5', E 115° 23.9', 1400 m, Pearce, K.G. S 95258; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95456.

*Vaccinium coriaceum* Hk. f.

Epiphyte 5 m high on tree. On ridge. Path to G. Murud (Camp 4), 2042 m, Ilias, P. S 26398.

*Vaccinium* cf. *dipladenium* Sleumer

Shrub 1 m tall. On peat in open, disturbed forest and in swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos*. Summit ridge, G. Murud, 2150 m, Julaihi, L. S 80026; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95189; By Plank Walk at top of trail from Lepo Bunga to Church Camp, G. Murud, 2130 m, Pearce, K.G. S 96034.

*Vaccinium flagellatifolium* H.F. Copeland

Woody epiphyte about 1 m up trunk. On alluvial soil on levee behind river. Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94852.

*Vaccinium laurifolium* (Blume) Miq.

Tree about 6 m tall, 8 cm diam. On Kerangas soil in open vegetation to about 7 m tall and on peat over tree roots with grey sand beneath. S of Pa Menalio, 1220 m, Pearce, K.G. S 93461; Summit SW of Long Rapung, 1320 m, Pearce, K.G. S 95991.

*Vaccinium pachydermum* Stapf

Treelet 4 m tall, 4 cm diam. and shrub to 3.3 m tall and epiphyte 1 m tall. On exposed peat and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and in mossy forest and on ridge and on summit. Route from Ba' Kelalan to G. Murud, ridge above Camp 4, 1951 m, Burt, B.L. B 5420; Sg. Balaban, path to G. Murud, 1890 m, Ilias, P. S 26378; Path to G. Murud (2<sup>nd</sup> summit), 2210 m, Ilias, P. S 26414; Proposed G. Murud N.P., 2300 m, Yii, P.C. S 44476; Tama Abu Range, 1750 m, Awa, D. S 51135; G. Murud summit, 2433 m, Pearce, K.G. S 95359; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95432.

*Vaccinium simulans* Sleumer var. *letopodium* Sleumer

Fallen tree. On peat soil in open, disturbed forest. G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2020 m, Pearce, K.G. S 96078.

*Vaccinium uroglossum* Sleumer

Epiphyte 3 m up tree and 2.5 m long. On peat over mossy tree roots in mossy forest 10 - 25 m tall and in riverain forest. G. Murud, 1300 m, Rena, G. S 60332; Tama Abu Range on the way to the summit, 1580 m, Pearce, K.G. S 94963; S of Pa Dapur/Pa Menalio confluence, 1370 m, Pearce, K.G. S 95065; New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95326.

## ESCALLONIACEAE

*Polyosma bracteosum* Stapf

Shrub to 1 m tall. On yellow sandy clay in mossy forest with *Agathis* dominant. G. Murud, 2400 m, Julaihi, L. S 70893.

*Polyosma latifolia* Schlechter

Tree about 12 m tall, c 12 cm diam. and shrub. On thick peat and tree roots in dry ridge forest and on large sandstone rocks in forest about 4 m tall and in mossy forest with *Gymnostoma* and forest with some big *Agathis* trees and on peaty soil in open forest with trees to 30 cm diam. Ulu Pa Selonok, 1580 m, Pearce, K.G. S 94880; On ridge, S part of upper Pa Menalio, 1240 m, Lim, M.T. S 95122; About 0.5 km SW of N 3° 33.5', E115° 23.9', 1400 m, Pearce, K.G. S 95238.

*Polyosma* aff. *latifolia* Schlechter

Shrub. Amidst sandstone boulders with peat between, in about 2 m high scrub. G. Murud summit, 2433 m, Pearce, K.G. S 95380.

## EUPHORBIACEAE

*Antidesma*

0.5 km E of Long Belaban going more or less E, 1160 m, Pearce, K.G. S 95938; Just below summit SW of Long Rapung, 1290 m, Pearce, K.G. S 96021.

*Antidesma hosei* Pax and K. Hoffm.

Treelet 8 m tall, 8 cm diam. On bank behind river. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93418.

*Antidesma neurocarpum* Miq.

Shrub 50 cm tall. In open area in oak-laurel-*Syzygium* forest. Hill NW of Arur Dalan, 1320 m, Pearce, K.G. S 95294.

*Antidesma* cf. *neurocarpum* Miq.

Treelet 2.5 m tall, 2 cm diam. On loam in forest 30 m tall. Ridge running upstream SW of Long Rusu, 1350 m, Pearce, K.G. S 95929.

*Antidesma tomentosum* Blume

Treelet to 4 m tall and to 2 cm diam. On loam in forest with trees 30 m tall and on clay in *Tristaniopsis* forest. On ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 93498; Ridge running upstream SW of Long Rusu, 1320 m, Pearce, K.G. S 95923.

*Antidesma tomentosum* Blume var. *tomentosum*

2.5 m tall. On peat in open mossy forest. Trees 25 m tall with abundant *Racemobambos*. SE of Plank Walk at junction with trail to Long Belaban, 2020 m, Pearce, K.G. S 96076.

*Aporusa*?

From ulu Pa Selonok W towards Tama Abu Range, 1770 m, Pearce, K.G. S 94900.

*Baccaurea* cf. *edulis* Merr.

Treelet 5 m tall, about 10 cm diam. On yellow clay soil in forest. On ridge, S part of upper Pa Menalio, 1300 m, Lim, M.T. S 95129.

*Baccaurea* cf. *lanceolata* (Miq.) Muell.-Arg.

Cauliflorous tree to 9 m tall, about 5 cm diam. In alluvial forest 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95841, S 95849.

*Baccaurea membranacea* Pax and K. Hoffm.

Treelet 8 cm diam. On riverbank. Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94844.

*Blumeodendron tockbrai* (Blume) Kurz

Tree 15 m tall, 20 cm diam. On 30 cm peaty layer over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating. Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95022.

*Croton oblongus* Burm. f.

Tree to 7 m tall with trunks to about 12 cm diam. On riverbank and in Kerangas forest. Pa Menalio, Tama Abu Range, 950 m, Awa, D. S 51017; Pa Selonok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93409; Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94837.

*Drypetes iliae* H.K. Airy Shaw

Tree 15 m tall, 25 cm diam. On slope in forest. G. Murud, 1250 m, Rena, G. S 61090.

*Glochidion*

Treelet 2.5 m tall and shrub. On peaty soil over roots and large sandstone boulders and in open, pole-size summit forest. Isolated peak N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 94994; Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 95208.

*Glochidion* cf. *lancisepalum* Merr.

Tree about 10 m tall. In disturbed forest about 4 m tall with scattered taller trees to about 22 m and abundant *Racemobambos*. New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95321.

*Glochidion* aff. *williamsii* C.B. Robinson

Shrub to 1.5 m tall. Forest. G. Murud summit ridge, 2150 m, Julaihi, L. S 80023.

*Gymnanthes borneensis* (Pax and Hoff.) Esser

Broken treelet 4 m tall, 5 cm diam. On peat over tree roots with grey sand beneath in very dense pole forest. S of Pa Menalio, 1220 m, Pearce, K.G. S 93474; On ridge of Menalio, Pa Dapur, 1300 m, Lim, M.T. S 95106.

*Homalanthus* sp.

Lepo Bunga, 1750 m, Julaihi, L. S 70850.

*Homalanthus grandifolius* Ridley

Tree 4 m tall, 15 cm diam. In swampy scrub at edge of cleared area with vegetation about 3 m tall, scattered taller trees and *Racemobambos*. On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95174.

*Macaranga angulata* S.J. Davies

Treelet 5 m tall, 3 cm diam. In mossy forest 20 - 25 m tall. Tama Abu Range summit, 1470 m, Pearce, K.G. S 94956.

*Macaranga depressa* (Muell.Arg.) Muell.Arg. forma *strigosa* Whitmore.

Tree 10 m tall, 6 cm diam. Riparian forest. Tama Abu Range, 1250 m, Awa, D. S 51179.

*Mallotus penangensis* Muell.Arg.

Tree 15 m tall, 20 cm diam. On slope in forest. G. Murud, 1250 m, Rena, G. S 61088.

## FABACEAE

*Bauhinia kockiana* Korth.

Climber about 20 m tall, 3 cm diam. On 30 cm peaty layer over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating. Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95023.

*Desmodium laxum* DC ssp. *leptopus* (A. Gray ex Benth.) Ohashi  
Herb. Above riverbank in disturbed alluvial area, forest about 30 m tall. Long Rusu along Sg. Dapur up from Long Belaban, 1150 m, Pearce, K.G. S 95889.

## FAGACEAE

*Castanopsis clemensii* Soepadmo

Tree 30 m tall, 33 cm diam. In primary forest. G. Murud East (Sg. Belapan - Sg. Dapo), 1100 m, Nooteboom, H.P. 1839; G. Murud N.P., Yii, P.C. S 44680.

*Castanopsis costata* (Blume) A. DC.

Tree 30 m tall, 100 cm diam. Primary forest. Sg. Belapan, 1100 m, Nooteboom, H.P. 1893; Nooteboom, H.P. 2220; 1700 m, Nooteboom, H.P. 2226.

*Castanopsis foxworthyi* Schottky

Tree to 14 m tall, 25 cm diam. In forest. G. Murud, Helipad, near Church, Julaihi, L. S 80097.

*Lithocarpus blumeanus* (Korth.) Rehder

Route to Tama Abu Range, 1050 m, Awa, D. S 51089.

*Lithocarpus echinifer* (Merr.) A. Camus

Tree 27 m tall, 25 cm diam. Riparian forest. Tama Abu Range, ulu Sg. Menalio, 1050 m, Awa, D. S 51088.

*Lithocarpus elegans* (Blume) Hatusima ex Soepadmo

Tree 27 m tall, 30 cm diam. 950 m, Awa, D. S 51081.

*Lithocarpus ewyckii* (Korth.) Rehder

Tree to 33 m tall, 55 cm diam. On peaty layer 30 cm deep over fine alluvial sand at top of steep riverbank in *Agathis* forest with *Dacrycarpus* and *Gymnostoma* regenerating and on yellow sandy clay in mossy forest and at top of ridge. Path from U. Belaban to Long Rebata, 1661 m, Ilias, P. S 26529, S 26539; Lepo Bunga, 1750 m, Julaihi, L. S 70853; Lepo Bunga, Julaihi, L. S 80194, S 80198; Pa Selunok, ulu Pa Menalio, 1220 m, Pearce, K.G. S 93439; Confluence of Pa Dapur and Pa Menalio, behind lodge, at top of valley, 1160 m, Pearce, K.G. S 95041.

*Lithocarpus ferrugineus* Soepadmo

Tree 30 m tall, 40 cm diam. Forest. Sg. Belapan - Sg. Dapo, 1100 m, Nooteboom, H.P. 1844.

*Lithocarpus havilandii* (Stapf) Barnett

Tree 30 m tall, 33 cm diam. Path from ulu Belaban to Long Rebata, Ilias, P. S 25622.

*Lithocarpus luteus* Soepadmo

Tree 33 m tall, 60 cm diam. On ridge. G. Murud, Sg. Belaban, 1707 m, Ilias, P. S 26325, S 26336.

*Lithocarpus meijeri* Soepadmo

Tree to 6 m tall, 15 cm diam. In forest. G. Murud, 2100 m, Julaihi, L. S 80050.

*Lithocarpus nieuwenhuisii* (v. Seemen) A. Camus

Tree 13 m tall, about 20 cm diam. On forest slope and in Kerangas forest. Sg. Menalio, Abu Range, 950 m, Awa, D. S 51022; Tinting Menalio, Pa Dapur, 1380 m, Lim, M.T. S 95116.

*Lithocarpus pulcher* (King) Markg.

Tree 30+ m tall, about 55 cm diam. On loam in fairly open, undisturbed forest 30+ m tall, including *Tristaniopsis* and Fagaceae. 0.5 km E of Long Belaban going more or less E, 1300 m, Pearce, K.G. S 95959.

*Lithocarpus turbinatus* (Stapf) Forman

Tree 14 m tall, 26 cm diam. In forest. G. Murud, Helipad near Church, 2100 m, Julaihi, L. S 80098.

*Quercus kinabaluensis* Soepadmo

Treelet to 2 m tall, 1.7 cm diam. On ridge near summit. G. Murud, Ba' Kelalan, 2149 m, Ilias, P. S 26508, S 26515.

*Quercus valdinervosa* Soepadmo

Tree to 13 m tall, 20 cm diam. On peat in open, disturbed forest on ridge. Sg. Belaban, 1707 m, Ilias, P. S 26330; G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96060.

*Trigonobalanus verticillata* Forman

Tree 30 m tall, 50 cm diam. Primary forest. G. Murud, Sg. Belapan-Sg. Dapo, 1100 m, Nootboom, H.P. 1869.

## FLACOURTIACEAE

*Casearia capitellata* Blume

Treelet 4 m tall, 2.5 cm diam. On peat and on yellow sandy clay in mossy forest 20 m tall with *Agathis* dominant. Lepo Bunga, 1750 m, Julaihi, L. S 70828; G. Murud summit ridge, way to Murud 2<sup>nd</sup> summit, 2100 m, Julaihi, L. S 80162; Tama Abu Range on the way to the summit, 1580 m, Pearce, K.G. S 94958.

*Casearia grewiaefolia* Vent.

Treelet to 2 m tall. On yellow sandy clay in mossy forest with *Agathis* dominant. Lepo Bunga, 1750 m, Julaihi, L. S 70835.

*Flacourtia rukam* Zoll. and Mor.

Treelet 2 m tall, 1.5 cm diam. and spiny shrub 3 m tall. On clay at edge of open, cleared area in oak-laurel-*Syzygium* forest and in alluvial forest. G. Murud, Sg. Belapan - Sg. Dapo, 1100 m, Nootboom, H.P. 1845, Nootboom, H.P. 1886; On hill NW of Bario, 1550 m, Pearce, K.G. S 95142; Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95829.

*Hydnocarpus* cf. *subfalcata* Merr.

Tree 3 m tall, about 3 cm diam. On clay at edge of open, cleared area in oak-laurel-*Syzygium* forest and on peat in pole forest with *Agathis*. On hill NW of Bario, 1550 m, Pearce, K.G. S 95141; Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1300 m, Pearce, K.G. S 95223.

## GENTIANACEAE

*Cotylanthera tenuis* Blume

Saprophyte. On small path in dark, damp place in valley with small stream. Arur Laab behind Arur Dalan village, 1100 m, Poulsen, A.D. S 91195.

*Gentiana borneensis* Hook.f.

Herb. In peat by stream and in wet, shady spots in 3 m tall vegetation with sandstone rocks and in open place on N slope. G. Murud, 2200 m, Nootboom, H.P. 2047; G. Murud, 2134 m, Burt, B.L. B 5457; G. Murud, below Kebun Batu, 2400 m, Pearce, K.G. S 95413.

## GESNERIACEAE

*Aeschynanthus*

1250 m, Rena, G. S 61096; 1130 m, Julaihi, L. S 80185.

*Aeschynanthus* PTNP 1

Climber to about 1 m tall and herbaceous creeper. On clay covered with 5 cm layer of humus at riverside in forest 30 m tall. By Pa Menalio close to its confluence with Pa Dapur, 1160 m, Pearce, K.G. S 95036; NW of Long Belaban, 1320 m, Pearce, K.G. S 95497.

*Aeschynanthus* cf. *angustifolia* (Blume) Steud.

Epiphyte at up to 19 m high. On loam covered by 1-2 cm humus in disturbed forest 27

m tall and in riparian forest. Sg. Menalio, 1050 m, Awa, D. S 51100; 0.5 km E of Long Belaban going more or less E, 1160 m, Pearce, K.G. S 95943.

*Aeschynanthus cf. gibbsiae* S. Moore

Climber creeping on tree. Primary forest. G. Murud, Sg. Belapan, 1100 m, Nootboom, H.P. 1884; G. Murud N.P., 1300 m, Yii, P.C. S 44656.

*Aeschynanthus magnifica* Stapf

Sprawling herb. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos*. On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95157.

*Aeschynanthus parvifolius* R.Br.

Herb about 5 m tall climbing up tree trunk. In open area in oak-laurel-*Syzygium* forest. Hill NW of Arur Dalan, 1320 m, Pearce, K.G. S 95293.

*Aeschynanthus speciosa* Hook.

G. Murud, Camp 3, Sg. Belapan, 1730 m, Burt, B.L. B 5298.

*Aeschynanthus vinaceus* P.J.B. Woods

Creepers rooting at nodes. On peat over mossy tree roots and scrambling on rock in open, mossy forest 15 - 25 m tall. S of Pa Dapur/Pa Menalio confluence, 1300 m, Pearce, K.G. S 95062.

*Agalmyla* sp.

G. Murud N.P., 1600 m, Yii, P.C. S 44415.

*Agalmyla johannis-winkleri* (Kraenzl.) B.L. Burt

Primary forest. Sg. Belapan - Sg. Dapo, 1100 m, Nootboom, H.P. 1858.

*Agalmyla macrocalyx* Hilliard and B.L. Burt

Climber 2 m long and about 4 m up tree. On peat in open, disturbed forest and in swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos*. On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95199; G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96030.

*Agalmyla cf. macrocalyx* Hilliard and B.L. Burt

Climber to about 5 m up tree. On sandy soil with about 5 cm humus above in 18 m tall mossy forest. On way to Tama Abu Range from ulu Pa Selonok, 1720 m, Pearce, K.G. S 94938.

*Agalmyla tuberculata* Hook.f.

Creepers or scramblers to 1 m long. On peat in open, disturbed forest. G. Murud, 2050 m, Julaihi, L. S 80060; G. Murud, near Church Camp, 2200 m, Pearce, K.G. S 95429;



G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96037.

*Cyrtandra* sp.

Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95868.

*Cyrtandra geesinkiana* B.L. Burt

Primary forest. Sg. Belapan - Sg. Dapo, 1100 m, Nootboom, H.P. 1827.

*Cyrtandra* aff. *trisejala* C.B. Clarke

Herb 50 cm and shrublet on fallen trunk. On sandstone along stream bank in primary forest. G. Murud, 1700 m, Nootboom, H.P. 1914. Ba' Kelalan to G. Murud, Camp 4, 1829 m, Burt, B.L. B 5375; G. Murud N.P., 1600 m, Yii, P.C. S 44416.

*Didymocarpus* PTNP 1

Herb about 30 cm tall. On clay by path in oak-laurel-*Syzygium* forest. On hill NW of Bario, 1300 m, Pearce, K.G. S 95147.

*Didymocarpus* cf. *pleuropogon* B.L. Burt

Herb about 60 cm tall. Between mossy rocks and on peaty soil in mossy forest 15 - 20 m tall. New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95348.

*Didymocarpus* aff. *simplex* Kraenzl.

Epiphytic and creeping herb about 15 cm tall. Among moss on exposed sandstone rocks criss-crossed by moss and peat-covered roots in open vegetation with scattered, crooked trees to about 12 m tall and on peat in open, disturbed forest and in mossy forest near summit. Ba' Kelalan, Camps 3 and 4, 2000 m, Burt, B.L. B 5275; Tama Abu Range summit, 1720 m, Pearce, K.G. S 94941; New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95346; G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96052.

*Henckelia murutorum* B.L. Burt

Terrestrial herb. Riparian forest. Tama Abu Range, 950 m, Awa, D. S 51029.

## HYDRANGEACEAE

*Dichroa febrifuga* Lour.

Treelet to about 4 m tall, 2.5 cm diam. Along stream bank and riverbank in forest and in sandy soil with humus about 5 cm above in mossy forest about 18 m tall. Camp 4, 1371 m, Ilias, P. S 26421; G. Murud N.P., 1600 m, Yii, P.C. S 44422; On way to Tama Abu Range from ulu Pa Selonok, 1720 m, Pearce, K.G. S 94940.

## ICACINACEAE

*Stemonorus?*

NW of Long Belaban, 1340 m, Pearce, K.G. S 95492.

## ILLICIACEAE

*Illicium stapfii* Merr.

Shrub or treelet about 5 m tall. On 30 cm peaty layer over fine alluvial sand at pathside at top of steep riverbank in forest with *Dacrycarpus* and *Gymnostoma* regenerating and on peat soil in open, mossy forest, about 25 m tall with abundant *Racemobambos* and on peat soil in pole forest with *Agathis*. Camp 4, 1920 m, Burt, B.L. B 5371; Confluence of Pa Dapur and Pa Menalio, behind lodge, top of steep river bank, 1150 m, Pearce, K.G. S 95027; Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1370 m, Pearce, K.G. S 95220; SE of Plank Walk at junction with trail to Long Belaban, 2130 m, Pearce, K.G. S 96068.

## IXONANTHACEAE

*Ixonanthes reticulata* Jack

Shrub. On thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall. About 0.5 km SW of N3° 33.5', E115° 23.9', 1400 m, Pearce, K.G. S 95237.

## JUGLANDACEAE

*Engelhardtia rigida* Blume

Tree 3.3 m tall, 38 cm diam. On ridge. Sg. Belaban, 1707 m, Ilias, P. S 26316.

*Engelhardtia serrata* Blume

Tree 16 m tall, 40 cm diam. On yellow clay in forest. On ridge, S part of upper Pa Menalio, 1300 m, Lim, M.T. S 95130.

*Engelhardtia* aff. *serrata* Blume

Tree 40 m tall, 65 cm diam. On loam in fairly open, undisturbed forest 30+ m tall including *Tristaniopsis* and Fagaceae. 0.5 km E of Long Belaban going more or less E, 1300 m, Pearce, K.G. S 95960.

## LAURACEAE

*Actinodaphne borneensis* Meisn.

Treelet about 5 m tall. In forest of very dense pole-size trees. On ridge of Menalio, Pa Dapur, 1300 m, Lim, M.T. S 95108.

Pearce, K.G. S 93456; Going N on ridge N of Pa Menalio, 1380 m, Pearce, K.G. S 94815; Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94856; Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95092.

*Litsea cf. magnifica* (Miq.) Gamble

Treelet. On peaty soil in open, mossy forest with *Gymnostoma*. Ulu Pa Selonok, 1580 m, Pearce, K.G. S 94879.

*Litsea sessiliflora* Hook.f. var. *sessiliflora*

Treelet 4 m tall, 6 cm diam. On loam and on clay covered with 5 cm humus layer in forest 30 m tall. NW of Long Belaban, 1320 m, Pearce, K.G. S 95490; Ridge running upstream SW of Long Rusu, 1320 m, Pearce, K.G. S 95924.

*Litsea subumbelliflora* (Blume) Ng

Tree to 7 m tall, 8 cm diam. On ridge and on hillslope and in riparian forest. Ulu Sg. Belaban, 1707 m, Ilias, P. S 26307, 1676 m, S 26359; Tama Abu Range, 1250 m, Awa, D. S 51188.

*Neolitsea* PTNP 1

Treelet 4 m tall, 2 cm diam. In peat over mossy tree roots in open, mossy forest 15 - 25 m tall and on clay covered with 5 cm humus layer in forest about 30 m tall. S of Pa Dapur/Pa Menalio confluence, 1300 m, Pearce, K.G. S 95064; NW of Long Belaban, 1320 m, Pearce, K.G. S 95499.

*Neolitsea* PTNP 2

Tree 1 m tall and shrub. On thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall and in swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos*. On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95177; About 0.5 km SW of N3<sup>0</sup> 33.5', E115<sup>0</sup> 23.9', 1400 m, Pearce, K.G. S 95245.

*Neolitsea* PTNP 3

Shrub. On exposed peat and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 2 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m. G. Murud summit, 2433 m, Pearce, K.G. S 95373; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95442.

*Neolitsea* PTNP 4

Slender shrub about 1.5 m tall. Mossy forest with pole-size trees. On steep ridge of Menalio, Pa Dapur, 1370 m, Lim, M.T. S 95112.

*Neolitsea* PTNP 5

Tree. On exposed peat and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m. False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95460.

*Neolitsea* PTNP 6

Shrub. On exposed peat and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m. False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95437.

*Nothaphoebe sarawacensis* Gamble

Tree about 9 m tall, 12 cm diam. On alluvial soil on levee behind river. Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94851.

*Persea rimosa* (Blume) Zoll. ex Meissn.

Treelet about 10 m tall, 18 cm diam. By riverside in alluvial forest. Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95283.

## LINACEAE

*Indorouchera griffithiana* (Planch.) Hallier f.

Creeping woody climber to 28 m high and about 4 cm diam. Near stream in riparian forest and alluvial forest. Pa Dapur, Awa, D. S 51079; Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95274.

## LOGANIACEAE

*Fagraea cuspidata* Blume

Treelet 5 m tall, 7 cm diam. On loam covered by 1-2 cm humus in disturbed forest 27 m tall and on ridge. Sg. Belaban, G. Murud, Ilias, P. S 26313; 0.5 km E of Long Belaban going more or less E, 1160 m, Pearce, K.G. S 95941.

*Fagraea montana* Wong and Sugau

Tree 10 m tall, 13 cm diam. On clay in forest about 25 m tall. Just below summit SW of Long Rapung, 1360 m, Pearce, K.G. S 96020.

*Fagraea* cf. *oreophila* Wong and Sugau

Tree 2.5 m tall and shrub and epiphyte on tree 1 m tall. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 2 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and on yellow sandy clay in mossy forest with *Agathis* dominant. G. Murud N.P. 2300 m, Yii, P.C. S 44474; G. Murud, 2400 m, Julaihi, L. S 70896; G. Murud summit, 2433 m, Pearce, K.G. S 95364; False Summit on route to Church Camp, 2215 m, Pearce, K.G. S 95469.

*Fagraea renae* Wong and Sugau

Epiphytic shrub on tree 7 m tall. On yellow sandy clay in mossy forest with *Agathis* dominant. Lepo Bunga, 1750 m, Julaihi, L. S 70813.

*Fagraea spicata* Baker

Tree 5 m tall, 6 cm diam. On 12 cm peat over clay in pole-sized forest 20 - 25 m tall. W of summit SW of Long Rapung, 1360 m, Pearce, K.G. S 96014.

*Fagraea stenophylla* Becc. ex Merr.

Treelet about 4 m tall, 3 cm diam. On earth above rocky riverbank at riverside. Confluence of Pa Menalio and Pa Aru, 1200 m, Pearce, K.G. S 94834; By Pa Menalio close to its confluence with Pa Dapur, 1160 m, Pearce, K.G. S 95038.

*Geniostoma rupestre* J.R. Forst. and G. Forst.

Treelet 2 m tall, 2.5 cm diam. On gentle N slope with open, shrubby vegetation on nearly bare sandstone and on ridge. Mount Murud, 2200 m, Nooteboom, H.P. 2051; Path to G. Murud (Camp 4), 2042 m, Ilias, P. S 26397.

## LORANTHACEAE

*Amyema* sp.

On thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall. About 0.5 km SW of N3<sup>0</sup> 33.5', E115<sup>0</sup> 23.9', 1400 m, Pearce, K.G. S 95262.

*Dendrophthoe* cf. *pentandra* (L.) Miq.

Semiparasite. On summit. Tama Abu Range, 1750 m, Awa, D. S 51151.

*Helixanthera coccinea* (Jack) Danser

Epiphyte 22 m up. On peat over tree roots with grey sand beneath. S of Pa Menalio, 1220 m, Pearce, K.G. S 93454.

*Helixanthera cylindrica* (Jack) Danser

Creeper 5 m tall. On peaty soil over roots and large sandstone boulders in open summit pole forest. Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 95210.

*Helixanthera* cf. *cylindrica* (Jack) Danser

Hemi-parasite 1.5 m up tree. In scrubby vegetation about 1.5 m tall with scattered *Dacrydium* to 3+ m. Kebun Batu below summit of G. Murud, 2400 m, Pearce, K.G. S 95403.

*Helixanthera* sp. nov.

Epiphyte up to 3 m and lithophyte. Mossy forest. G. Murud, 1900 m, Nooteboom, H.P. 1965; Proposed G. Murud N.P., 2200 m, Yii, P.C. S 44620.

*Lepeostegeres beccarii* (King) Gamble

Hemi-parasite 2 cm diam. on tree 3 m tall. Forest. Near Church, 2100 m, Julaihi, L. S 80079.

*Macrosolen*

G. Murud, 2400 m, Nootboom, H.P. 2062; G. Murud, 1300 m, Rena, G. S 61099.

*Macrosolen* PTNP 1

Epiphyte 5 m up tree. In peat over mossy tree roots in mossy forest 15 - 25 m tall. S of Pa Dapur/Pa Menalio confluence, 1300 m, Pearce, K.G. S 95050.

*Macrosolen cochinchinensis* (Lour.) Tiegh.

Hemi-parasite and epiphyte to 3 m high on tree and shrub to 1 m. On yellow, sandy clay in mossy forest with *Agathis* dominant and on summit in shrubby top vegetation. Route from Bekalalan to G. Murud, ridge SW from Camp 2, about 2134 m, Burt, B.L. B 5364; G. Murud, 2400 m, Nootboom, H.P. 1977; G. Murud, 2567 m, Ilias, P. S 26494; Proposed G. Murud N.P., 4th Division, 2300 m, Yii, P.C. S 44472, 2200 m, Yii, P.C. S 44614; Tama Abu Range, 1750 m, Awa, D. S 51147; G. Murud, summit, 2400 m, Julaihi, L. S 70889; G. Murud summit ridge, Helipad, near Church, 2100 m, Julaihi, L. S 80086.

**MAGNOLIACEAE**

*Magnolia* sp.

N of Long Belaban up ridge, 1500 m, Pearce, K.G. S 95817.

*Magnolia carsonii* Dandy ex Noot. var. *drymifolia* Nootboom

Tree 22 m tall, 28 cm diam. Riparian forest. Sg. Memalio, route to Tama Abu Range, 950 m, Awa, D. S 51010.

*Magnolia* cf. *carsonii* Dandy ex H.P. Nootboom var. *drymifolia* Nootboom

Tree 2.5 m tall. In disturbed scrubby vegetation 2 - 3 m high between sandstone rocks. G. Murud, below Kebun Batu, 2200 m, Pearce, K.G. S 95426.

*Magnolia maingayi* King

Tree 7 m tall, 7 cm diam. Alluvial forest. Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95279.

**MELASTOMATACEAE**

*Anerinacleistus*

Shrub 1.4 m tall. Alluvial forest. Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95276.

*Anerinacleistus bullatus* J.F. Maxwell

Terrestrial herb. On sandy loam covered by 2 cm peat in riverine forest to 25 m. Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95090.

*Anerinacleistus* aff. *phyllagathioides* (Stapf) J.F. Maxwell

Herb to 50 cm tall. On 30 cm peaty layer over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating and on clay in open forest 20 m tall and on sandy loam covered by 2 cm peat in riverine forest to 25 m tall. Going N on ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 94811; Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95021; Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95084.

*Astronia*

Treelet 7 m tall, 15 cm diam. On riverbank. Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94838.

*Catanthera endertii* (Nayar) Nayar

Epiphyte/climber. On a network of tree roots in open dry scrubby forest about 4 m tall. Tama Abu Range near summit, 1800 m, Pearce, K.G. S 94987.

*Creaghiella setosa* Nayar

Tree 3.5 m tall. On 12 cm peat over clay in pole-sized forest 20 - 25 m tall. W of summit SW of Long Rapung, 1360 m, Pearce, K.G. S 96016.

*Creochiton monticola* (Ridl.) J.F. Veldkamp

Shrubby climber on tree 8 m high. On yellow sandy clay in mossy forest with *Agathis* dominant. Lepo Bunga, 1750 m, Julaihi, L. S 70815.

*Diplectria viminalis* (Jack) Kuntze

Scrambler about 5 m tall, 1 cm diam. On 30 cm peaty layer over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating. Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95004.

*Dissochaeta stellata* G. Clausen

Climber about 4 m tall, about 10 cm diam. On rocks at riverbank. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93412.

*Dissochaeta viminalis* (Jack) Clausen

Climber to 6 m high. Kerangas forest. Route to Tama Abu Range, Sg. Menalio, 950 m, Awa, D. S 51005.

*Medinilla* sp.

0.5 km E of Long Belaban going more or less E, 1300 m, Pearce, K.G. S 95962.

*Medinilla* PTNP 1

Epiphyte to 2 m up tree and 2.5 m above river and to 4 m long, 5 cm diam. Alluvial forest 30 m tall and on 30 cm peaty layer over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating and on Kerangas soil in open vegetation to about 7 m and on peat in open, disturbed forest and at riverbank and in swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos*. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93403; Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95011; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95193; Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95830; Summit SW of Long Rapung, 1320 m, Pearce, K.G. S 95997; G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96031.

*Medinilla* PTNP 2

Shrub. On thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall. About 0.5 km SW of N3° 33.5', E115° 23.9', 1400 m, Pearce, K.G. S 95251.

*Medinilla atroviridis* J.C. Regalado

Epiphyte. At edge of open, cleared area in oak-laurel-*Syzygium* forest with clay soil. On hill NW of Bario, 1550 m, Pearce, K.G. S 95135.

*Medinilla crassifolia* (Reinw. ex Blume) Blume

Woody epiphyte to 2.5 m up tree and scrambler 1.5 m long. On clay covered with 5 cm humus layer in forest about 30 m tall and on loam covered by 1-2 cm humus in disturbed forest 27 m tall and in open, mossy forest. Pa Aru, 1200 m, Pearce, K.G. S 94869; NW of Long Belaban, 1360 m, Pearce, K.G. S 95500; 0.5 km E of Long Belaban going more or less E, 1160 m, Pearce, K.G. S 95939.

*Medinilla homoeandra* (Stapf) Nayar

Epiphyte 50 cm long, 1 m up mossy tree trunk. In disturbed forest about 4 m tall with scattered taller trees to about 22 m and abundant *Racemobambos* and on peat in open, disturbed mossy forest. From ulu Pa Selonok W towards Tama Abu Range, 1740 m, Pearce, K.G. S 94892; New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95315; G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96063.

*Medinilla muricata* Blume

Woody epiphyte about 1 m from ground. In open, mossy forest. Pa Aru, 1200 m, Pearce, K.G. S 94870.

*Medinilla succulenta* (Blume) Blume

Shrub 1 m tall. On peat soil in mossy forest 20 m tall. Tama Abu Range on the way to the summit, 1600 m, Pearce, K.G. S 94975.



*Melastoma sanguineum* Sims

Tree about 2 m tall and shrub 1 m tall. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos* and in vegetation with 3 m tall trees and sandstone rocks with damp patches and in mossy forest. Tama Abu Range on route to summit, 1800 m, Pearce, K.G. S 94993; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95187; G. Murud, below Kebun Batu, 2300 m, Pearce, K.G. S 95408.

*Melastoma cf. sanguineum* Sims

Shrub 2.5 m tall. On peat soil in open, disturbed forest. G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96028.

*Memecylon aff. argenteum* K. Bremer

Tree 5 m tall, 6 cm diam. Riverside. By Pa Menalio close to its confluence with Pa Dapur, 1160 m, Pearce, K.G. S 95037.

*Memecylon scolopacinum* Ridley

Tree 7 m tall. On clay soil in forest about 25 m tall and on alluvial soil on levee behind river. Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94857; Just below summit SW of Long Rapung, 1240 m, Pearce, K.G. S 96022.

*Memecylon aff. scolopacinum* Ridley

Tree 5 m tall, 5 cm diam. Alluvial forest. Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95278.

*Oxyspora aff. beccarii* (Cogn.) J.F. Maxwell

Woody shrub to 4 m tall, 1+ cm diam. On bank behind river and on 30 cm peaty layer over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93429; Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95019.

*Oxyspora?*

Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94860.

*Pachycentria pulverulenta* (Jack) G. Clausen

Shrub 2 m tall. On Kerangas soil in open vegetation to about 7 m tall. Summit SW of Long Rapung, 1320 m, Pearce, K.G. S 95993.

*Phyllagathis* sp.

On rock and near river. G. Murud, ulu PahDapur. 1859 m, Ilias, P. S 26518.

*Phyllagathis dispar* (Cogn.) C. Hansen

Herb. Riverbank. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93480.

*Phyllagathis uniflora* Stapf

Herb about 15 cm tall. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos* and on ridge. Tama Abu Range, 1550 m, Awa, D. S 51110; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95198.

*Pternandra azurea* (Blume) Burk. var. *azurea*

Tree 15 m tall, 15 cm diam. Primary forest. Belapan river - Dapo river, 1100 m, Nooteboom, H.P. 1831.

*Pternandra rostrata* (Cogn.) M.P. Nayar

Tree to 20+ m tall, 21 cm diam. On 30 cm peaty layer over fine alluvial sand at pathside at top of steep riverbank in *Agathis* forest with *Dacrycarpus* and *Gymnostoma* regenerating and on loam in forest 30 m tall and on sandy loam covered by 2 cm peat in riverine forest to 25 m. Confluence of Pa Dapur and Pa Menalio, behind lodge, at top of valley, 1160 m, Pearce, K.G. S 95033; Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95086; Ridge running upstream SW of Long Rusu, 1180 m, Pearce, K.G. S 95907.

*Sonerila* PTNP 1

Herb 6 cm tall. On sandy loam covered by 2 cm peat in riverine forest to 25 m. Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95094.

*Sonerila crassiuscula* Stapf

Epiphytic herb on mossy stump. On peaty soil in open, mossy forest with *Gymnostoma*. Ulu Pa Selonok, 1580 m, Pearce, K.G. S 94883.

*Sonerila* cf. *crassiuscula* Stapf

Shrub and woody herb about 15 cm tall and herb. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos* and on exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and on ground covered with a network of tree roots in open dry scrubby forest about 4 m tall and on peat soil in open, mossy forest 25 m tall with abundant *Racemobambos*. Tama Abu Range near summit, 1800 m, Pearce, K.G. S 94983; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95158; False Summit on route to Church Camp, 2215 m, Pearce, K.G. S 95471; SE of Plank Walk at junction with trail to Long Belaban, 2020 m, Pearce, K.G. S 96075.

*Sonerila gibbsiae* Ridley

Herb 8 cm tall. On sandy loam covered by 2 cm peat in riverine forest to 25 m and in alluvial forest 30 m tall and on clay soil in forest 25 m tall. Along Pa Menalio about 1

km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95095; Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95871.

*Sonerila hirtella* Cogn.

Herb. Riverbank. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93481.

*Sonerila maculata* Roxb.

Terrestrial herb 10 cm tall. On yellow sandy clay in riparian forest. Way to G. Murud, 1130 m, Julaihi, L. S 80183; Route to Tama Abu Range, 950 m, Awa, D. S 51030.

*Sonerila* aff. *minima* Stapf ex Ridley

Herb 6 cm tall. On sandy loam alluvium covered by 2 cm peat in riverine forest 25 m tall. Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1110 m, Pearce, K.G. S 93401.

*Sonerila tenuifolia* Blume

Herb 15 cm tall and semi-woody herb (woody at base) and shrub 50 cm tall and treelet 1 m tall. On 30 cm peaty layer over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating and on peat soil in open, mossy forest about 25 m tall with much *Racemobambos* and in mossy forest on sandstone summit and on ridge and near stream in riparian forest and in vegetation with 3 m tall trees and sandstone rocks with damp patches. G. Murud, N side, 2286 m, Burt, B.L. B 5449; G. Murud, 2400 m, Nooteboom, H.P. 1982; G. Murud, 2347 m, Ilias, P. S 26484; Proposed G. Murud N.P., 2250 m, Yii, P.C. S 44434; Route to Tama Abu Range, 950 m, Awa, D. S 51012; G. Murud, summit ridge, 2150 m, Julaihi, L. S 80043; Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95006; Below Kebun Batu, G. Murud, 2400 m, Pearce, K.G. S 95406; SE of Plank Walk at junction with trail to Long Belaban, 2130 m, Pearce, K.G. S 96065.

*Sonerila* cf. *tenuifolia* Blume

Terrestrial herb 15 cm tall. Mossy forest. Tama Abu Range near summit, 1770 m, Pearce, K.G. S 94901.

## MELIACEAE

*Aglaia exstipulata* (Griffith) W. Theobald ssp. *bruneostellata* Pannell

At edge of open, cleared area in oak-laurel-*Syzygium* forest with clay soil. On hill NW of Bario, 1550 m, Pearce, K.G. S 95137.

*Aglaia* cf. *odoratissima* Blume

Tree 2.5 m tall, 2 cm diam. On loam in forest with trees 30 m tall. Ridge running upstream SW of Long Rusu, 1320 m, Pearce, K.G. S 95918.

*Aglaia stellatopilosa* Pannell

Treelet to 9 m tall, 10 cm diam. On 30 cm peaty layer over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating and on sandy, alluvial soil on levee behind river and on clay covered with 5 cm humus layer in forest about 30 m tall. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93405; Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94849; Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95020; NW of Long Belaban, 1260 m, Pearce, K.G. S 95483.

*Aglaia tomentosa* Teijsm. and Binn.

Tree. On clay on steep hillside in forest 35 m tall. Going approx. N down slope from N3° 33.5', E115° 23.9', Pearce, K.G. S 95267.

*Aglaia tomentosa* Teijsm. and Binn. ssp. *tomentosa*

Treelet 4 m tall, 3 cm diam. On loamy soil on hillside above river in closed forest about 25 m tall. Pa Menalio, 1150 m, Pearce, K.G. S 94866.

*Dysoxylum rugulosum* King

Tree 16 m tall, 14 cm diam. On peat at least 15 cm deep in forest 25 m tall at top of ridge. Pa Selunok, ulu Pa Menalio, 1220 m, Pearce, K.G. S 93438.

## MENISPERMACEAE

*Arcangelisia flava* (L.) Merr.

Climber to 5 m long. On peat soil over tree roots with grey sand beneath and on peaty soil in open, mossy forest with *Gymnostoma*. S of Pa Menalio, 1220 m, Pearce, K.G. S 93478; Ulu Pa Selonok, 1580 m, Pearce, K.G. S 94884.

*Arcangelisia* cf. *flava* (L.) Merr.

Climber about 60 cm tall. On clay covered with 5 cm humus layer in forest about 30 m tall. NW of Long Belaban, 1320 m, Pearce, K.G. S 95488.

*Fibraurea tinctoria* Lour.

Scrambler reaching about 4 m up tree. On alluvial soil in open area in river valley. Pa Menalio/Pa Dapur confluence, 1150 m, Tinjan, K. S 95268.

*Parabaena* cf. *hirsuta* (Becc.) Diels

Climber 4 m long climbing up tree. On loam covered by 1-2 cm humus in disturbed forest 27 m tall. 0.5 km E of Long Belaban going more or less E, 1160 m, Pearce, K.G. S 95946.

*Tinospora*?

On hill NW of Bario, 1550 m, Pearce, K.G. S 95133.

## MORACEAE

### *Artocarpus excelsus* Jarrett

Tree 23 m tall, 25 cm diam. Near river. G. Murud, ulu Belalan, 1707 m, Ilias, P. S 26520.

### *Ficus* sp.

Tama Abu Range, on the way to the summit, 1580 m, Pearce, K.G. S 94966.

### *Ficus aurantiacea* Griff.

Climber 20 m up tree. On sandy loam covered by 2 cm peat in riverine forest to 25 m. Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95091.

### *Ficus borneensis* Kochummen

Treelet about 3 m tall. At edge of river in alluvial forest. Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95281.

### *Ficus deltoidea* Jack var. *angustifolia* (Miq.) Corner

Alluvial area above riverbank in disturbed vegetation about 30 m tall and in primary forest. Gunung Murud East, path to top, 1700 m, Nootboom, H.P. 1916; Long Rusu along Sg. Dapur up from Long Belaban, 1150 m, Pearce, K.G. S 95880.

### *Ficus deltoidea* Jack var. *deltoidea*

Epiphyte on *Lithocarpus*. Along river in forest. G. Murud N. P., 1500 m, Yii, P.C. S 44646.

### *Ficus deltoidea* Jack var. *intermedia* Corner

Tree 5 m tall, 7 cm diam. and climber 7 m tall and shrub 2 m tall and creeping shrublet and epiphyte 1.5 m tall to 5 m high on a tree. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 2 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and in vegetation with 3 m tall trees and sandstone rocks with damp patches and on exposed sandstone rocks criss-crossed by roots covered with moss and peat and in open vegetation with scattered, crooked trees to about 12 m tall and on thick peat layers in shrubby top vegetation and on hillside and on sandy soil overlying Tertiary sandstone with deep 'mor' layer and at and near summit and in mossy forest and on a ridge and on rocks and boulders and in primary forest. G. Murud East, 1800 m, Nootboom, H.P. 1957; G. Murud, 2400 m, Nootboom, H.P. 2001, Nootboom, H.P. 2004, Nootboom, H.P. 2066; Path to Kuba'an Pungor Pawan, summit of ridge, 1432 m, Anderson, J.A.R. S 20178; G. Murud, Sg. Belaban 1783 m, Ilias, P. S 26368; G. Murud, 2042 m, Ilias, P. S 26392; G. Murud, Camp 4, 2042 m, Ilias, P. S 26400; G. Murud, 2<sup>nd</sup> summit, 2210 m, Ilias, P. S 26417; G. Murud, 2134 m, Ilias, P. S 26450; G. Murud, near Camp 5, 2149 m, Ilias, P. S 26514; G. Murud N.P.,

2300 m, Yii, P.C. S 44475; 2200 m, Yii, P.C. S 44601; Tama Abu Range, 1550 m, Awa, D. S 51114, S 51119; 1750 m, Awa, D. S 51157, S 51162; G. Murud, 2250 m, Rena, G. S 63319; G. Murud, summit ridge, 2150 m, Julaihi, L. S 80037; near Church, summit ridge, 2100 m, Julaihi, L. S 80084; trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95343; G. Murud summit, 2433 m, Pearce, K.G. S 95361; G. Murud, below Kebun Batu, 2300 m, Pearce, K.G. S 95407; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95439.

*Ficus deltoidea* Jack var. *motleyana* (Miq.) Corner

Treelet to 2 m tall. On 30 cm peaty layer over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating and on 12 cm peat over clay in pole-sized forest 20 - 25 m tall. Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95013; W of summit SW of Long Rapung, 1340 m, Pearce, K.G. S 96004.

*Ficus* cf. *deltoidea* Jack var. *motleyana* (Miq.) Corner

Terrestrial, 50 cm tall. In forest 10 - 15 m tall. New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95324.

*Ficus deltoidea* Jack var. *recurvata* Kochummen

Epiphyte 2 m up tree. On alluvial soil on levee behind river. Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94853.

*Ficus* aff. *detonsa* Corner

Climber 8 m tall. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos*. On trail from Church Camp to G. Murud, 2060 m, Pearce, K.G. S 95304.

*Ficus disticha* Blume

Climber 25 m tall and epiphyte. On peat soil over tree roots with grey sand beneath and in riparian forest. 1250 m, Awa, D. S 51178; S of Pa Menalio, 1220 m, Pearce, K.G. S 93453.

*Ficus hemsleyana* King

Fig tree 2 m tall. Primary forest. Apa Batu Buli, 1650 m, Nooteboom, H.P. 02182; G. Murud N.P., 1300 m, Yii, P.C. S 44665.

*Ficus macilenta* King

Tree 4.5 m tall, 8 cm diam. On clay in forest about 25 m tall. Just below summit SW of Long Rapung, 1360 m, Pearce, K.G. S 96018.

*Ficus obscura* Blume

Treelet to 2.5 m tall. On yellow, sandy clay in mossy forest with *Agathis* dominant. Lepo Bunga, 1750 m, Julaihi, L. S 70842.

*Ficus oleifolia* King ssp. *intermedia* (Corner) C.C. Berg

Shrub to 1 m tall. On yellow sandy clay in mossy forest with *Agathis* dominant. 2400 m, Julaihi, L. S 70886.

*Ficus oleifolia* King var. *valida* Corner

Tree 2.6 m tall, 2.5 cm diam. and shrub. On peat over roots in scrubby summit vegetation about 4 m tall and in mossy forest and on ridge. G. Murud, Sg. Belaban, 1890 m, Ilias, P. S 26376; G. Murud N.P., 2200 m, Yii, P.C. S 44604; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94922.

*Ficus parietalis* Blume

Fig tree 3 m tall. Riparian forest. Route to Tama Abu Range, 1050 m, Awa, D. S 51092.

*Ficus* cf. *punctata* Thunb.

Epiphyte about 6 m up. Alluvial forest 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95832.

*Ficus recurva* Blume var. *ribesoides* Wall. ex Miq.

Climber. Primary forest. G. Murud, path to the top, 1700 m, Nootboom, H.P. 01929.

*Ficus rubrocupidata* Corner

Climber 4 m tall. On loam in forest 30 m tall. Ridge running upstream SW of Long Rusu, 1350 m, Pearce, K.G. S 95930.

*Ficus schwarzii* Koord.

Cauliflorous tree 15 m tall, 20 cm diam. Primary forest. Belapan river, 1100 m, Nootboom, H.P. 1892.

*Ficus setiflora* Stapf var. *adelpha* Corner

Epiphyte on tree 2.5 m high. Forest. G. Murud summit ridge, Helipad near Church, 2100 m, Julaihi, L. S 80096.

*Ficus setiflora* Stapf var. *puberula* Corner

Tree to 5 m tall, 3.3 cm diam. and climber 1 m tall. On peat soil in open, disturbed forest and on hillslope and in riparian forest. G. Murud, 2012 m, Ilias, P. S 26390; Route to Tama Abu Range, 950 m, Awa, D. S 51006; G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96054.

*Ficus setiflora* Stapf var. *setiflora*

Treelet to 3 m tall, 2 cm diam. On yellow, sandy clay in mossy forest with *Agathis* dominant. Lepo Bunga, 1750 m, Julaihi, L. S 70821.

*Ficus sinuata* Thunb.

Climber about 6 m tall. Alluvial forest 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95864.

*Ficus subulata* Blume

Plant 1 m tall. On peat soil in pole forest with *Agathis*. Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1370 m, Pearce, K.G. S 95219.

*Ficus uniglandulosa* Wall. ex Miq.

Treelet to 2 m tall. On yellow sandy clay on a ridge in mossy forest with *Agathis* dominant. Tama Abu Range, 1550 m, Awa, D. S 51101; Lepo Bunga, 1750 m, Julaihi, L. S 70873.

*Ficus villosa* Blume

Climber on tree about 3 m long. On peaty soil in forest with *Gymnostoma* and *Tristaniopsis* common. On ridge of upper Pa Merako, 1100 m, Lim, M.T. S 95132.

## MYRICACEAE

*Myrica javanica* Blume

Shrub to 2 m tall. On peat over roots in scrubby summit vegetation about 4 m tall. G. Murud, summit ridge, 2150 m, Julaihi, L. S 80033; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94918.

## MYRISTICACEAE

*Horsfieldia endertii* W.J. de Wilde

Tree 14 m tall, 20 cm diam. On a ridge. Tama Abu Range, 1550 m, Awa, D. S 51106.

*Knema* sp.

Going N on ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 94812.

*Knema kunstleri* (King) Warb. ssp. *alpina* (J. Sinclair) W.J. de Wilde

Tree 17 m tall, 7 cm diam. Along river in forest. Proposed G. Murud N.P., 1500 m, Yii, P.C. S 44650.

*Knema* cf. *linguiformis* (J. Sinclair) W.J. de Wilde

Tree 12 m tall, 30 cm diam. On yellow sandy clay in forest. Way to G. Murud, 1130 m, Julaihi, L. S 80193.

*Knema lunduensis* (J. Sinclair) W.J.J.O. de Wilde

Monopodial treelet to 10 m tall, 10 cm diam. On sandy, alluvial soil on levee behind river. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93406; Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94854.



*Embelia spiraeoides* Stapf

G. Murud, 2<sup>nd</sup> summit, Ilias, P. S 26420A; G. Murud, Ilias, P. S 26501; G. Murud, ulu PahDapur, Ilias, P. S 26532.

*Embelia tortuosa* Stapf

Belapan River - Dapo River, Nooteboom, H.P. 1870; G. Murud N.P., Yii, P.C. S 44481.

*Labisia pumila* (Blume) F.-Vill

Terrestrial, semi-woody plant to 30 cm tall and herb about 40 cm tall and epiphyte 60 cm tall. On 30 cm peaty layer over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating and on yellow sandy clay in mossy forest 20 - 25 m tall. G. Murud, Lepo Bunga, 1130 m, Julaihi, L. S 80181; Tama Abu Range summit, 1470 m, Pearce, K.G. S 94950; Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95012.

*Maesa* sp.

Climber on tree 4 m long. Forest. G. Murud N.P., Yii, P.C. S 44419; 1200 m, Yii, P.C. S 44675.

*Maesa ramentacea* Wall.

Sg. Menalio, 950 m, Awa, D. S 51076.

*Rapanea*

Ba' Kelalan to G. Murud, above Camp 4, 2134 m, Burtt, B.L. B 5357; G. Murud, summit ridge, 2378 m, Burtt, B.L. B 5490; G. Murud N.P., 2300 m, S 44468, S 44473, 1200 m, Yii, P.C. S 44681; Tama Abu Range, 1750 m, Awa, D. S 51153, S 51161; G. Murud summit, 2240 m, Julaihi, L. S 80138.

*Rapanea* PTNP 1

Treelet 8 m tall, 5 cm diam. In peat over mossy tree roots in mossy forest 15 - 25 m tall. S of Pa Dapur/Pa Menalio confluence, 1370 m, Pearce, K.G. S 95069.

*Rapanea* PTNP 2

Shrub. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m. False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95445.

*Rapanea* PTNP 3

Tree about 1.5 m tall. Amidst sandstone boulders with peat between in scrub about 2 m high. G. Murud summit, 2433 m, Pearce, K.G. S 95381.

## MYRTACEAE

*Baeckea frutescens* Linn.

Shrub about 1 m tall. Disturbed scrubby vegetation 2 - 3 m high between sandstone rocks. G. Murud, nearly at summit, 2430 m, Pearce, K.G. S 95396.

*Decaspermum fruticosum* Forst.

Treelet 4 m tall. By riverside in alluvial forest. Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95286.

*Leptospermum flavescens* Sm.

Shrub about 3 m tall. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* to 4.5 m and on a network of tree roots in open dry scrubby forest about 4 m tall and amidst sandstone boulders with peat between in scrub about 2 m high. Tama Abu Range near summit, 1800 m, Pearce, K.G. S 94980; G. Murud summit, 2433 m, Pearce, K.G. S 95382; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95458.

*Syzygium alcinae* (Merr.) Merr. and L.M. Perry

Treelet about 10 m tall, 12 cm diam. On peat over tree roots with grey sand beneath and in forest to 25 m tall and at top of ridge. Pa Selunok, ulu Pa Menalio, 1220 m, Pearce, K.G. S 93436; S of Pa Menalio, 1220 m, Pearce, K.G. S 93449.

*Syzygium ampullarium* (Stapf) Merr. and L.M. Perry

Shrub. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and amidst sandstone boulders with peat between in scrub about 2 m high. G. Murud summit, 2433 m, Pearce, K.G. S 95372, S 95387; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95441.

[Also, as *Eugenia ampullaria* Stapf

Treelet 4 m tall and 5 cm diam. and shrub 2 m tall. At summit in shrubby top vegetation and on ridge and in mossy forest. G. Murud to Ba' Kelalan, 2187 m, Burt, B.L. B 5360; G. Murud, 2400 m, Nootboom, H.P. 2012; G. Murud, 2266 m, Ilias, P. S 26406; G. Murud, 2646 m, Anderson, J.A.R. S 26472; G. Murud, 2300 m, Yii, P.C. S 44467.]

*Syzygium cf. bankense* (Hassk.) Merr. and Perry

Shrub about 2 m tall. On thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall and in mossy forest with pole-size trees. On steep ridge of Menalio, Pa Dapur, 1370 m, Lim, M.T. S 95110; About 0.5 km SW of N3° 33.5', E115° 23.9', 1400 m, Pearce, K.G. S 95236.

*Syzygium brachyrachis* Merr. and Perry

Treelet 5 m tall, about 10 cm diam. Above riverbank in alluvial area in disturbed forest about 30 m tall and on riverbank. Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94835; Long Rusu along Sg. Dapur up from Long Belaban, 1150 m, Pearce, K.G. S 95882.

*Syzygium* cf. *castaneum* (Merr.) Merr. and Perry

Small tree. In vegetation with scattered trees up to 17 m tall, undergrowth of *Racemobambos* and shrubs to about 3 m and epiphytes. Foot of False Summit at end of Plank Walk, 2176 m, Pearce, K.G. S 95475.

*Syzygium caudatilimbium* (Merr.) Merr. and Perry

Tree to 17 m tall, 25 cm diam. On 30 cm peaty layer over fine alluvial sand at pathside at top of steep riverbank in *Agathis* forest with *Dacrycarpus* and *Gymnostoma* regenerating and on sandy soil on levee above river and in peat over mossy tree roots in mossy forest 15 - 25 m tall. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93404, S 93421; S of Pa Menalio, 1220 m, Pearce, K.G. S 93458; Confluence of Pa Dapur and Pa Menalio, behind lodge, at top of valley, 1160 m, Pearce, K.G. S 95034; S of Pa Dapur/Pa Menalio confluence, 1370 m, Pearce, K.G. S 95073.

*Syzygium fastigiatum* (Blume) Merr. and L.M. Perry

Tree 17 m tall, 17 cm diam. Forest. G. Murud N.P., 1200 m, Yii, P.C. S 44676.

*Syzygium* cf. *fastigiatum* (Blume) Merr. and Perry

Treelet 8 m tall, 16 cm diam. On riverbank. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93408, 1150 m, S 94842.

*Syzygium foxworthianum* (Ridley) Merr. and Perry

Treelet 10 m tall, 18 cm diam. By riverside and at riverbank in alluvial forest. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93410; Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95284.

*Syzygium griffithii* (Duthie) Merr. and Perry

Tree 20 m tall, 40 cm diam. On sandy loam covered by 2 cm peat in riverine forest to 25 m. Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95088.

*Syzygium kalahiense* Korth.

Tree 6 m tall, 6 cm diam. On peat over tree roots with grey sand beneath and in peat over mossy tree roots in mossy forest 15 - 25 m tall and on peaty humus over tree roots with sandy soil 50 cm beneath in open forest about 12 m tall. S of Pa Menalio, 1220 m, Pearce, K.G. S 93469; On ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 93494; S of Pa Dapur/Pa Menalio confluence, 1370 m, Pearce, K.G. S 95074.

*Syzygium kinabaluensis* (Stapf) Merr. and Perry

Tree 2.5 m tall. Mossy forest on sandstone summit. G. Murud N.P., 2250 m, Yii, P.C. S 44428.

*Syzygium kuchingensis* (Merr.) Merr. and Perry

Tree to 20 m tall, 30 cm diam. On thick peat and tree roots with grey sand beneath and in dry ridge forest and with large sandstone rocks in forest about 4 m tall and in open, mossy forest 15 - 25 m tall with very dense pole-size trees and some big *Agathis* trees and at top of ridge. Pa Selunok, ulu Pa Menalio, 1220 m, Pearce, K.G. S 93437; S of Pa Menalio, 1220 m, Pearce, K.G. S 93455; S of Pa Dapur/Pa Menalio confluence, 1370 m, Pearce, K.G. S 95070; On ridge of Menalio, Pa Dapur, 1300 m, Lim, M.T. S 95104; On ridge, S part of upper Pa Menalio, 1240 m, Lim, M.T. S 95119; About 0.5 km SW of N3° 33.5', E115° 23.9', 1400 m, Pearce, K.G. S 95257.

*Syzygium kunstleri* (King) Bahadur and Gaur

G. Murud, path to the top, Nooteboom, H.P. 1931.

*Syzygium peregrinum* (Blume) Merr. and Perry

Tree to 6 m tall, 10 cm diam. On clay loam covered by humus in forest about 25 m tall and on 30 cm peaty layer over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating and on peat soil in pole forest with *Agathis*. At top of steep bank along Pa Menalio, behind its confluence with Pa Dapur, 1160 m, Pearce, K.G. S 95043; Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1310 m, Pearce, K.G. S 95222.

*Syzygium punctilimum* (Merr.) Merr. and Perry

Tree and shrub. On thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall and in scrubby vegetation about 1.5 m tall with scattered *Dacrydium* to 3+ m. About 0.5 km SW of N3° 33.5', E115° 23.9', 1400 m, Pearce, K.G. S 95261; Kebun Batu below summit of G. Murud, 2400 m, Pearce, K.G. S 95402; Below Kebun Batu, G. Murud, 2200 m, Pearce, K.G. S 95420.

[also, as *Eugenia punctilimba* Merr. G. Murud, ulu Sg. Dapur, Ilias, P. S 26469.]

*Syzygium steenisii* Merr. and Perry

Shrub about 3 m tall. On a network of tree roots in open dry scrubby forest about 4 m tall and on peat over roots in scrubby summit vegetation about 4 m tall. Tama Abu Range, summit, 1800 m, Pearce, K.G. S 94917, S 94986.

*Syzygium* cf. *subrufum* (King) Masam.

Tree 8 m tall, 15 cm diam. On clay covered with 5 cm humus in forest about 30 m tall. NW of Long Belaban, 1320 m, S 95495.

*Tristaniopsis elliptica* (Stapf) P.G. Wilson and J.T. Waterhouse  
G. Murud, Nooteboom, H.P. 2041.

*Tristaniopsis whiteana* (Griff.) P.G. Wilson and J.T. Waterhouse  
Tree 30 m tall, 40 cm diam. Disturbed forest about 4 m tall with scattered taller trees to about 22 m with abundant *Racemobambos* and in peat at least 15 cm deep in forest to 25 m and in primary forest and at top of ridge. Belapan River, 1100 m, Nooteboom, H.P. 1879; Pa Selunok, ulu Pa Menalio, 1220 m, Pearce, K.G. S 93435; New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95308.

*Xanthomyrtus flavida* (Stapf) Diels  
Shrub. Amidst sandstone boulders with peat between in scrub about 2 m high. G. Murud, Nooteboom, H.P. 1997; G. Murud, 2<sup>nd</sup> summit, Ilias, P. S 26409; G. Murud summit, 2433 m, Pearce, K.G. S 95383.

*Xanthomyrtus* cf. *flavida* (Stapf) Diels  
Shrub. On thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall. Anderson, J.A.R. S 26474; Ilias, P. S 26534; About 0.5 km SW of N3° 33.5', E115° 23.9', 1400 m, Pearce, K.G. S 95260.

*Xanthomyrtus moultonii* (Merr.) Merr.  
Shrub or treelet to 3 m. G. Murud, shrubby top vegetation. 2400 m, Nooteboom, H.P. 2000.

## NEPENTHACEAE

*Nepenthes hurrelliana* Cheek and A.L. Lamb  
Climbing to 1 m. Forest. G. Murud, 2200 m, Julaihi, L. S 80020.

*Nepenthes lowii* Hook.f.  
Climber about 2.5 m long and sprawling vine about 1 m long and herb at ground level and on mossy trunk. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos* and in peat over roots in scrubby summit vegetation about 4 m tall and in peat soil in open, disturbed forest and in scrubby vegetation about 1.5 m tall with scattered *Dacrydium* to 3+ m and in mossy forest 15 - 20 m tall and sprawling over rocks. G. Murud, path to the top, Nooteboom, H.P. 1962; G. Murud, near Camp 5, Ilias, P. S 26511, S 26512; G. Murud N.P., Yii, P.C. S 44429; Tama Abu Range, 1750 m, Awa, D. S 51149; G. Murud summit, 2400 m, Julaihi, L. S 80018; Summit ridge, way to 2<sup>nd</sup> summit, 2100 m, Julaihi, L. S 80158; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94909; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95156; New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95347; Kebun Batu below summit of G. Murud, 2200 m, Pearce,

K.G. S 95428; By Plank Walk at top of trail from Lepo Bunga to Church Camp, G. Murud, 2130 m, Pearce, K.G. S 96045.

*Nepenthes muluensis* M. Hotta

Climber about 50 cm long. Elfin forest just below summit. Tama Abu Range, 1750 m, Awa, D. S 51169; G. Murud summit, 2400 m, Julaihi, L. S 80017; Tama Abu Range near summit, 1800 m, Pearce, K.G. S 94989.

*Nepenthes murudensis* Culham ex Jebb and Cheek

Sprawling herb about 1 m tall or climbing to 3.5 m. Amidst sandstone boulders with peat between in scrub about 2 m high and on exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m high and scattered *Dacrydium* and *Leptospermum* to 4.5 m and in scrubby vegetation about 1.5 m tall with scattered *Dacrydium* to 3+ m and on thick humus in mossy forest. G. Murud summit, 2400 m, Julaihi, L. S 80016; 2200 m, S 80021; G. Murud summit, 2433 m, Pearce, K.G. S 95378; G. Murud below Kebun Batu, 2200 m, Pearce, K.G. S 95422; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95452.

*Nepenthes reinwardtiana* Miq.

Climber about 2 m tall and scrambling over mossy stumps. On clay loam covered by humus in forest about 25 m tall, and in mossy forest 20 - 25 m tall. Pa Aru, 1200 m, Pearce, K.G. S 94872; Tama Abu Range summit, 1470 m, Pearce, K.G. S 94949.

*Nepenthes stenophylla* Mast.

Climber about 2 m tall and creeping vine. On thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall and in mossy forest with crooked trees and canopy about 4 m high. Tama Abu Range, 1750 m, Awa, D. S 51141; Summit S of Pa Dapur/Pa Menalio confluence, 1410 m, Rantai, J. S 95076; About 0.5 km SW of N3° 33.5', E115° 23.9', 1400 m, Pearce, K.G. S 95252; Ridge running upstream SW of Long Rusu, 1650 m, Rantai, J. S 95936.

*Nepenthes tentaculata* Hook.f.

Scrambler 1.5 m up mossy trunk and climber 1.5 m tall and herb among moss. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and on thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall and in disturbed forest about 4 m tall with scattered taller trees to about 22 m and abundant *Racemobambos* and on exposed sandstone rocks criss-crossed by roots covered with moss and peat and in open vegetation with scattered, crooked, trees about 12 m tall and in swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos* and on peat soil in open, disturbed, mossy forest and planted in garden. Lepo Bunga, 1750 m, Julaihi, L. S 70881; G. Murud summit ridge, 2150 m, Julaihi, L. S 80024, Helipad, near Church, 2100 m, S 80078;

On way to Tama Abu Range from ulu Pa Selonok, 1800 m, Pearce, K.G. S 94935; On trail from Church Camp to G. Murud, 2090 m, S 95171, S 95190; About 0.5 km SW of N3° 33.5', E115° 23.9', 1400 m, Pearce, K.G. S 95242; New trail to G. Murud just past junction with old trail, 2058 m, S 95306, 2012 m, S 95345; G. Murud summit, 2433 m, S 95388; False Summit on route to Church Camp, 2248 m, S 95453; G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96041, S 96044.

*Nepenthes veitchii* Hook.f.

Herb 20 cm long. Mossy forest 20 - 25 m tall and in swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos*. Lepo Bunga, 1750 m, Julaihi, L. S 70880; Tama Abu Range summit, 1470 m, Pearce, K.G. S 94951; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95181.

## OCHNACEAE

*Campylospermum serratum* (Gaertn.) V. Bittrich and M.C.E. Amaral

Tree to 13 m tall, 13 cm diam. Near stream and at edge of river in alluvial forest and on riverbank and in riparian forest and on peat soil in mossy forest 20 m tall. Pa' Dapur, Sg. Menalio, 950 m, Awa, D. S 51071; Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94845; Tama Abu Range, on the way to the summit, 1600 m, Pearce, K.G. S 94972; Pa Menalio/ Pa Dapur confluence, 1150 m, Pearce, K.G. S 95280.

## OLEACEAE

*Chionanthus curvicaupus* Kiew

Tree about 8 m tall, about 13 cm diam. Alluvial forest 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95866.

*Chionanthus globosus* (Kiew) Kiew

Tree about 24 m tall, 60 cm diam. On bank behind river. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93427.

*Chionanthus macrobotrys* (Merr.) Kiew

Epiphyte 1.5 m high and shrub to 70 cm tall and climber. On thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall and on exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and amidst sandstone boulders with peat between in scrub about 2 m high and in thick humus on sandstone formation in mossy forest and in summit vegetation. G. Murud summit, 2400 m, Julaihi, L. S 80015, S 80127; About 0.5 km SW of N3° 33.5', E115° 23.9', 1400 m,

Pearce, K.G. S 95248; G. Murud summit, 2433 m, Pearce, K.G. S 95362; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95451.

*Chionanthus polygamus* (Roxb.) Kiew

Tree 16 m tall, 15 cm diam. On peat over tree roots with grey sand beneath. S of Pa Menalio, 1220 m, Pearce, K.G. S 93452, S 93459.

*Chionanthus* cf. *rugosus* Kiew

Tree 7 m tall, 6 cm diam. In peat over mossy tree roots in mossy forest 15 - 25 m tall. S of Pa Dapur/Pa Menalio confluence, 1300 m, Pearce, K.G. S 95060.

*Jasminum oreophilum* Kiew

Climber 3.3 m high on a tree. On ridge. Sg. Belaban, 1707 m, Ilias, P. S 26324.

*Olea rubrovenia* (Elmer) Kiew

Tree 5.7 m tall, 6.6 cm diam. On ridge and on hillslope. G. Murud, 2256 m, Ilias, P. S 26497; U. Pah Dapur, 2362 m, Ilias, P. S 26535.

## **PENTAPHRAGMATACEAE**

*Pentaphragma* sp.

G. Murud summit ridge, 2150 m, Julaihi, L. S 80044.

*Pentaphragma* PTNP 1

Creeping herb about 60 cm long. In vegetation with 3 m tall trees and sandstone rocks with damp patches. G. Murud, below Kebun Batu, 2300 m, Pearce, K.G. S 95409.

*Pentaphragma decurrens* Airy Shaw

1 m tall. On sandy clay bank. Route from Ba' Kelalan to G. Murud, SW of Camp 3, 1900 m, Burt, B.L. B 5316.

## **PIPERACEAE**

*Piper* PTNP 1

On clay soil at edge of open, cleared area in oak-laurel-*Syzygium* forest. On hill NW of Bario, 1550 m, Pearce, K.G. S 95139.

*Piper* PTNP 2

Climber 5 m tall. On loam in forest 30 m tall. Ridge running upstream SW of Long Rusu, 1410 m, Pearce, K.G. S 95933.



*Piper* PTNP 3

Erect herb 1.5 m tall. On peat soil in pole forest with *Agathis* and on 12 cm peat over clay in pole-sized forest 20 - 25 m tall. Towards summit about 3 km N of Pa Menalio/ Pa Batang Aru confluence, 1190 m, Pearce, K.G. S 95227; W of summit SW of Long Rapung, 1340 m, Pearce, K.G. S 96005.

*Piper* cf. *kurzii* Ridl.

Erect woody shrub 2.5 m tall, 0.8 cm diam. On 30 cm peaty layer over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating and on ridge. Ba' Kelalan to G. Murud, 1646 m, Burt, B.L. B 5310; Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95007.

*Piper muricatum* Blume

Erect herb to 1.5 m tall. Near the river and in alluvial area above riverbank in disturbed vegetation about 30 m tall. Along ridge running SW, S of tributary of Sg. Rusu, 1160 m, Pearce, K.G. S 95899; Ulu Pa Menalio, 1150 m, Solomon, S. S 94862.

*Piper* cf. *stylosum* Miq.

Creepers 1.5 m tall. On loam in forest 30 m tall. Ridge running upstream SW of Long Rusu, 1320 m, Pearce, K.G. S 95917.

## POLYGALACEAE

*Polygala oreotrephes* B.L. Burt

Herb and shrub to 1 m tall. Exposed sandstone rocks criss-crossed by roots covered with moss and peat and in open vegetation with scattered, crooked trees about 12 m tall and in vegetation with 3 m tall trees and sandstone rocks with damp patches and on shrubby ridge vegetation. G. Murud, 2200 m, Nooteboom, H.P. 1971; G. Murud summit ridges, 2200 m, Julaihi, L. S 80007; New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95335; G. Murud, below Kebun Batu, 2300 m, Pearce, K.G. S 95405.

*Xanthophyllum* sp.

Ridge running upstream SW of Long Rusu, 1320 m, Pearce, K.G. S 95925.

*Xanthophyllum* cf. *macrophyllum* Baker

Tree 13 m, 20 cm diam. On yellow sandy clay in mossy forest. Lepo Bunga, 1750 m, Julaihi, L. S 70816.

## PROTEACEAE

### *Helicia excelsa* (Roxb.) Blume

Tree 12 m tall, 13 cm diam. G. Murud, Sg. Belaban, on ridge. 1707 m, Ilias, P. S 26339.

### *Helicia petiolaris* Benn.

Tree 8 m tall, 10 cm diam. On yellow sandy clay. Way to G. Murud, 1130 m, Julaihi, L. S 80171.

### *Helicia* aff. *petiolaris* Benn.

Treelet about 10 m tall, 15 cm diam. On riverbank. Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94843.

### *Helicia robusta* (Roxb.) R.Br. ex Wall.

Shrub or tree to 10 m tall, 12 cm diam. On and above riverbank in disturbed, alluvial area about 30 m tall and in primary forest. Belapan river - Dapo river, 1100 m, Nooteboom, H.P. 1850, Nooteboom, H.P. 01860; G. Murud N.P., 1200 m, Yii, P.C. S 44688; Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94836; Long Rusu along Sg. Dapur up from Long Belaban, 1150 m, Pearce, K.G. S 95878.

### *Heliciopsis velutina* (Prain) Sleumer

Cauliflorous tree 25 m tall, 30 cm diam. Along river in forest. G. Murud N.P., 1500 m, Yii, P.C. S 44647.

## RHAMNACEAE

### *Rhamnus borneensis* Steenis

Shrub and tree to 3.3 m, 5 cm diam. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and amidst sandstone boulders with peat between in scrub about 2 m high and in disturbed scrubby vegetation 2 - 3 m high between sandstone rocks and on ridge. Ba' Kelalan to G. Murud, ridge SW from Camp 4, 2134 m, Burt, B.L. B 5361; G. Murud, 2134 m, Burt, B.L. B 5461; G. Murud, 2400 m, Nooteboom, H.P. 1996; G. Murud, path to mount, 2195 m, Ilias, P. S 26419; G. Murud, 2347 m, Ilias, P. S 26485; G. Murud summit ridge, 2150 m, Julaihi, L. S 80046; Near Church, summit ridge, 2100 m, Julaihi, L. S 80089; G. Murud summit, 2400 m, Julaihi, L. S 80129; G. Murud top, 2350 m, Yahud, W. S 88302; G. Murud summit, 2433 m, Pearce, K.G. S 95369; G. Murud just below summit, 2400 m, Pearce, K.G. S 95397; False Summit on route to Church Camp, 2215 m, Pearce, K.G. S 95472.

## RHIZOPHORACEAE

*Carallia* sp.

Tama Abu Range, 1750 m, Awa, D. S 51126.

*Carallia* sp. 1 (*sensu* Madani and Wong)

Treelet 10 m tall, 20 cm diam. By riverside in alluvial forest. Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95285.

## ROSACEAE

*Prunus* sp.

On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95167.

*Prunus arborea* (Blume) Kalkm. var. *densa* (King) Kalkm.

Tree 8 m tall, 11 cm diam. On alluvial soil on levee behind river and on peat soil in moderately open Kerangas forest and on yellow clay soil in *Tristaniopsis* forest. On ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 93497; Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94850; On ridge, S part of upper Pa Menalio, 1300 m, Lim, M.T. S 95128; Going approx. N down slope from of N3° 33.5', E115° 23.9', Pearce, K.G. S95263.

*Prunus* cf. *arborea* (Blume) Kalkm. var. *densa* (King) Kalkm.

Tree 3 m tall, 3 cm diam. On Kerangas soil in open vegetation to about 7 m tall. Summit SW of Long Rapung, 1320 m, Pearce, K.G. S 95994.

*Prunus arborea* (Blume) Kalkm. var. *stipulacea* (King) Kalkm.

Treelet 7 m tall, 4 cm diam. On peat over tree roots with grey sand beneath. S of Pa Menalio, 1220 m, Pearce, K.G. S 93470.

*Prunus oocarpa* (Stapf) Kalkman

Shrub to 2.5 m tall, 5 cm diam. and treelet 3 m tall. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and on thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall and in swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos* and amidst sandstone boulders with peat between in scrub about 2 m high and in thick humus on sandstone in shrubby vegetation and in scrubby summit vegetation about 4 m tall and in mossy forest and in primary forest. G. Murud East, path to the top, 1900 m, Nooteboom, H.P. 1951, 1800 m, Nooteboom, H.P. 1953, around the top, 2400 m, Nooteboom, H.P. 1991; Tama Abu Range, 1750 m, Awa, D. S 51129; G. Murud summit, 2400 m, Julaihi, L. S 80103; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94910; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95161; About 0.5 km SW of N3° 33.5', E115° 23.9', 1400 m, Pearce, K.G. S 95244;

G. Murud summit, 2433 m, Pearce, K.G. S 95385; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95433.

*Rubus alpestris* Blume

Scrambling, shrubby vine to 2.5 m long and sprawling shrub about 3 m tall. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos*. G. Murud, Nooteboom, H.P. 1993; G. Murud, Camp 4, Ilias, P. S 26396; G. Murud summit ridge, Helipad, near Church, 2100 m, Julaihi, L. S 80090; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95159.

*Rubus* cf. *moluccanus* L.

Sprawling shrub about 1 m long. Alluvial forest 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95857.

*Rubus rosifolius* J.E. Smith

Scrambling herb to 15 cm tall. Summit forest. G. Murud, 2<sup>nd</sup> summit, near Church, 2100 m, Julaihi, L. S 80156.

## RUBIACEAE

*Acranthera atropella* Stapf

Herb to 1.3 m tall and shrub 0.5 m tall. On riverbank, near the river and in alluvial forest 30 m tall. Ba' Kelalan to G. Murud, 1768 m, Burt, B.L. B 5336; Ulu Pa Menalio, 1150 m, Malik, M. S 94863; Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95850.

*Argostemma*

On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95160; G. Murud by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96048.

*Argostemma* PTNP 1

Epiphytic herb. On peaty soil in open forest and in mossy forest with *Gymnostoma*. Ulu Pa Selonok, 1580 m, Pearce, K.G. S 94882.

*Argostemma hameliaefolium* Wernham

Herb. Above riverbank in disturbed, alluvial vegetation about 30 m tall and in riparian forest. Tama Abu Range, 1250 m, Awa, D. S 51183; Long Rusu along Sg. Dapur up from Long Belaban, 1150 m, Pearce, K.G. S 95891.

*Argostemma* aff. *hameliaefolium* Wernham

Sprawling shrub 1.5 m long and lithophytic herb to 1 m long. On peaty soil over roots and large sandstone boulders in open, summit pole forest and in peat over mossy tree

roots in mossy forest 15 - 25 m tall and on sandstone along river and on sandy loam covered by 2 cm peat in riverine forest to 25 m and in mossy forest near summit and climbing up rock and on riverbank. G. Murud East, path to the top, 1700 m, Nootboom, H.P. 1935; G. Murud N.P., 1200 m, Yii, P.C. S 44674; Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93411; Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94846; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94924; S of Pa Dapur/Pa Menalio confluence, 1300 m, Pearce, K.G. S 95053; Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95093; Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1670 m, Pearce, K.G. S 95202.

*Argostemma moultonii* Ridl.

Creeping herb about 10 cm long. On peat soil in mossy forest 20 m tall and in mossy forest near summit and in alluvial forest 30 m tall and in primary forest. Belapan River - Dapo River, 1100 m, Nootboom, H.P. 1856; Tama Abu Range summit, 1720 m, Pearce, K.G. S 94942; Tama Abu Range, on the way to the summit, 1600 m, Pearce, K.G. S 94976; Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95852.

*Canthium* sp.

Treelet 4+ m tall, 4 cm diam. On 30 cm peaty layer over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating. Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95018.

*Chassalia curviflora* (Wall.) Thwaites

In open area in oak-laurel-*Syzygium* forest. Hill NW of Arur Dalan, 1320 m, Pearce, K.G. S 95299.

*Diplospora abnormis* Valet. *apud* H. Winkler

Tree 1 m tall and shrub to 1.5 m tall. On peat soil in open, disturbed forest and in mossy forest and on hillside. Ba' Kelalan to G. Murud, below Camp 4, 1829 m, Burt, B.L. B 5373; G. Murud, ulu Sg. Belaban Camp 4, 1371 m, Ilias, P. S 26426; G. Murud summit ridge, way to 2<sup>nd</sup> summit, 2100 m, Julaihi, L. S 80161; G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96056.

*Geophila* sp.

Creeping herb. Alluvial forest 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95836.

*Hedyotis costata* (Roxb.) Kurz

Creeping herb with upright shoots 2 cm tall. On sandy loam covered by 2 cm peat in riverine forest to 25 m. Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95097.

*Hedyotis pulchella* Stapf

Herb to 30 cm tall. On peat soil in open, mossy forest about 25 m tall with abundant *Racemobambos* and in summit vegetation and on forest slopes. Ba' Kelalan to G. Murud, 1646 m, Burt, B.L. B 5291; G. Murud summit, 2400 m, Julaihi, L. S 80133; G. Murud summit ridge, way to 2<sup>nd</sup> summit, 2100 m, Julaihi, L. S 80166; SE of Plank Walk at junction with trail to Long Belaban, 2020 m, Pearce, K.G. S 96074.

*Hedyotis?* PTNP 1

Treelet 1.3 m tall and suffruticose plant about 50 cm high. On yellow, sandy clay in mossy forest with *Agathis* dominant and on bare sandstone on gentle slope with open, shrubby vegetation and in mossy forest. G. Murud, Nootboom, H.P. 2021; G. Murud, 2134 m, Ilias, P. S 26465; G. Murud summit, 2400 m, Julaihi, L. S 70890.

*Ixora cf. barberae* Brem.

Treelet 6.5 m tall, 2.5 cm diam. On peat at least 15 cm deep in forest to 25 m and at top of ridge. Pa Selunok, ulu Pa Menalio, 1190 m, Pearce, K.G. S 93433.

*Ixora hallierii* Brem.

On thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall. About 0.5 km SW of N3<sup>o</sup> 33.5', E115<sup>o</sup> 23.9', 1400 m, Pearce, K.G. S 95259.

*Ixora mjoebergii* Merr.

Treelet 4 m tall, 3.3 cm diam. and shrub 1.5 m tall. In forest along river. Belapan river - Dapo river, 1100 m, Nootboom, H.P. 1838; G. Murud N.P., 1500 m, Yii, P.C. S 44643.

*Ixora otophora* Brem.

Treelet to 2 m tall, about 1.5 cm diam. On loam in forest to 30 m tall. Going N on ridge N of Pa Menalio, 1380 m, Pearce, K.G. S 94818; Ridge running upstream SW of Long Rusu, 1250 m, Pearce, K.G. S 95911.

*Lasianthus*

Shrub about 1 m tall. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos*. On hill NW of Bario, 1550 m, Pearce, K.G. S 95143; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95164. W of summit SW of Long Rapung, 1340 m, Pearce, K.G. S 96006.

*Lasianthus* sp. 7 (*sensu* SAR)

Tree about 5 m tall. On 30 cm peaty layer over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating. Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95015.

*Lasianthus cf. inaequalis* Blume

Shrub. On peat soil in pole forest with *Agathis*. Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 95216.

*Lasianthus cf. pilosus* Wight

Creeper. On loam in forest 30 m tall. Ridge running upstream SW of Long Rusu, 1250 m, Pearce, K.G. S 95910.

*Lucinaea*

Lepo Bunga, 1750 m, Julaihi, L. S 70817, S 70875; G. Murud, summit ridge, Helipad, near Church, 2100 m, Julaihi, L. S 80081.

*Lucinaea* PTNP 1

Treelet. On peat over roots in scrubby summit vegetation about 4 m tall. Tama Abu Range summit, 1800 m, Pearce, K.G. S 94907.

*Lucinaea* PTNP 2

Epiphyte 3 m up tree. On exposed sandstone rocks criss-crossed by roots covered with moss and peat and in open vegetation with scattered, crooked trees to about 12 m tall. New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95332.

*Lucinaea montana* Korth.

Climber 1 m tall. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos*. On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95173.

*Lucinaea pentacme* Stapf

Climber. Tama Abu Range, on summit. 1750 m, Awa, D. S 51138.

*Mycetia* PTNP 1

Woody herb. Alluvial forest 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95863.

*Myrmecodia cf. tuberosa* Jack

Epiphyte on branch. On thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall. About 0.5m SW of N3° 33.5', E115° 23.9', 1400 m, Pearce, K.G. S 95247.

*Neonauclea excelsa* (Blume) Merr.

Treelet 10 m tall, 12 cm diam. On riverbank. Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94841.

*Oldenlandia santubongensis* W.W. Sm.

Herb. On thin layer of peat over clay in forest to 26 m tall. W of summit SW of Long Rapung, 1320 m, Pearce, K.G. S 96000.

*Ophiorrhiza* sp.

Ba' Kelalan to G. Murud, below Camp 3, 1646 m, Burtt, B.L. B 5296.

*Pavetta* PTNP 1

Treelet 3 m tall, 2 cm diam. On loamy soil on hillside above river in closed vegetation about 25 m tall. 1150 m, Pearce, K.G. S 94868.

*Pavetta* PTNP 2

Herb. Alluvial forest 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95840.

*Pavetta sarawacensis* Brem.

Tree 2 m tall. On peaty soil over roots and large sandstone boulders and in open, summit pole forest. Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1670 m, Pearce, K.G. S 95203.

*Pavetta* cf. *sarawacensis* Brem.

Treelet to 3 m tall. On yellow sandy clay soil and on slope in forest. G. Murud, 1250 m, Rena, G. S 61087; Way to G. Murud, 1130 m, Julaihi, L. S 80184, S 80196.

*Pleiocarpidia borneensis* (Miq.) Brem.

Treelet 6 m tall, 6 cm diam. On sandy loam covered by 2 cm peat in riverine forest to 25 m tall. Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95080.

*Porterandia anisophyllea* (Jack ex Roxb.) Ridl.

Treelet 6 m tall, 6 cm diam. On loam soil with 1-2 cm humus above in disturbed forest 27 m tall. 0.5 km E of Long Belaban going more or less E, 1160 m, Pearce, K.G. S 95947.

*Porterandia sessiliflora* Ridley

Tree 5 m tall, 12 cm diam. Mossy forest. From ulu Pa Selonok W towards Tama Abu Range, 1740 m, Pearce, K.G. S 94899.

*Praravinia hexamera* Brem.

Treelet 2.5 m tall, 2 cm diam. On clay soil in open forest about 20 m tall. Going N on ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 94809.

*Praravinia parviflora* Brem

Treelet 2.5 m tall, 3 cm diam. On loam in forest 30 m tall. Ridge running upstream SW of Long Rusu, 1320 m, Pearce, K.G. S 95922.



*Psychotria* PTNP 1

Climber about 2 m long and shrub 50 cm tall and scrambling herb to 10 cm tall. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and on peat over roots in scrubby summit vegetation about 4 m tall and on peat soil in open, disturbed forest. G. Murud summit ridge, Helipad, near Church, 2100 m, Julaihi, L. S 80082; Tama Abu Range summit, 1800 m, Rantai, J. S 94902; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95436; G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96049.

*Psychotria* PTNP 2

Shrub to 1 m tall. Scrubby vegetation about 1.5 m tall with scattered *Dacrydium* to 3+ m and summit vegetation. G. Murud summit, 2400 m, Julaihi, L. S 80121, S 80131; Kebun Batu below summit of G. Murud, 2400 m, Pearce, K.G. S 95401.

*Psychotria densiflora* Humb. and Bonpl. ex Roem. and Schult.

Climber up to 2 m high on a tree and epiphyte on dead trunk and shrub. Shrubby top vegetation and on ridge and in mossy forest. G. Murud, 2400 m, Nooteboom, H.P. 1979; G. Murud, 2<sup>nd</sup> summit, 2210 m, Ilias, P. S 26413; 2300 m, G. Murud N.P., Yii, P.C. S 44465.

*Psychotria* cf. *elegans* Ridl.

Shrub. On thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall. About 0.5 km SW of N3<sup>o</sup> 33.5', E115<sup>o</sup> 23.9', 1400 m, Pearce, K.G. S 95243.

*Psychotria* cf. *gyrulosa* Stapf

Semi-woody scrambler about 60 cm long. On 30 cm peaty layer over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating and scrambling over forest floor. Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95008.

*Psychotria* aff. *pachyphylla* Ridl.

Climber on tree about 3 m height. On yellow clay soil in forest. On ridge, S part of upper Pa Menalio, 1300 m, Lim, M.T. S 95127.

*Psychotria* cf. *robusta* Blume

Shrub about 0.5 m tall. Mossy forest. From ulu Pa Selonok W towards Tama Abu Range, 1580 m, Pearce, K.G. S 94885.

*Timonius* sp.

G. Murud summit, 2400 m, Julaihi, L. S 70897; G. Murud summit ridge, Helipad, near Church, 2100 m, Julaihi, L. S 80076.

*Timonius flavescens* (Jack) Baker

Tree about 4 m tall, 7 cm diam. On peaty soil in mossy forests 15 - 20 m tall. New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95351.

*Timonius* cf. *flavescens* (Jack) Baker

Treelet 8 m tall, 5 cm diam. On bank behind river. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93431.

*Uncaria* cf. *gambier* Roxb.

On clay soil at edge of open, cleared area in oak-laurel-*Syzygium* forest. On hill NW of Bario, 1550 m, Pearce, K.G. S 95138.

*Urophyllum arboreum* (Reinw.) Hook.f.

Treelet 4 m. On clay soil at edge of open, cleared area in oak-laurel-*Syzygium* forest and in primary forest. Belapan River - Dapo River, 1100 m, Nooteboom, H.P. 1848; On hill NW of Bario, 1550 m, Pearce, K.G. S 95134.

*Urophyllum* cf. *arboreum* (Reinw.) Korth.

Tree 2 m tall. On loam in forest 30 m tall and on peat soil in open, disturbed forest. Ridge running upstream SW of Long Rusu, 1250 m, Pearce, K.G. S 95913; G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96059.

## RUTACEAE

*Melicope* sp.

G. Murud, 2134 m, Burt, B.L. B 5458; G. Murud N.P., 2300 m, Yii, P.C. S 44458.

*Melicope* PTNP 1

Tree 1.5 m tall, 4 cm diam. In vegetation with 3 m tall trees and sandstone rocks with damp patches. G. Murud, below Kebun Batu, 2400 m, Pearce, K.G. S 95411.

*Melicope* cf. PTNP 1

Tree 20 m tall, 15 cm diam. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos*. On trail from Church Camp to G. Murud, 2060 m, Pearce, K.G. S 95302.

*Melicope* cf. *clemensiae* T.G. Hartley

Tree 5 m tall, 7 cm diam. Forest with some big *Agathis* trees and open area with resam (*Gleichenia*) and on 12 cm peat over clay in pole-sized forest 20 - 25 m tall. At top of steep bank along Pa Menalio, behind its confluence with Pa Dapur, 1080 m, Rantai, J. S 95046; On ridge, S part of upper Pa Menalio, 1240 m, Lim, M.T. S 95117; W of summit SW of Long Rapung, 1360 m, Pearce, K.G. S 96017.

*Melicope lunu-ankenda* (Gaertn.) T. G. Hartley

Tree to 17 m tall, 14 cm diam. On peat over tree roots with grey sand beneath and in mossy forest with *Agathis* dominant and on peat soil in moderately open Kerangas forest and on yellow sandy clay and in primary forest. Belapan River - Dapo River, 1100 m, Nootboom, H.P. 1836; G. Murud, 1710 m, Rena, G. S 60348; Lepo Bunga, 1750 m, Julaihi, L. S 70872; S of Pa Menalio, 1220 m, Pearce, K.G. S 93450; Going approx. N down slope from of N3° 33.5', E115° 23.9', Pearce, K.G. S 95264.

*Melicope sororia* T.G. Hartley (*ex lit.*)

Small tree. On exposed sandstone rocks criss-crossed by roots covered with moss and peat and in open vegetation with scattered, crooked trees to about 12 m tall. New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95331.

*Tetractomia tetrandra* (Roxb.) Merr.

Tree to 4 m tall, 8 cm diam. On yellow sandy clay in forest. Lepo Bunga, 1130 m, Julaihi, L. S 80197.

## SABIACEAE

*Meliosma simplicifolia* (Roxb.) Walp.

Tree 1.5 m tall. On 30 cm peaty layer over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating and on peat soil in pole forest with *Agathis* and in Kerangas forest. Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150m, Pearce, K.G. S 95017; Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 95214; Ulu Pa Menalio, 1100 m, Rantai, J. S 94824.

*Meliosma sumatrana* (Jack) Walp.

Tree 4 m tall, 6 cm diam. On sandy loam covered by 2 cm peat in riverine forest to 25 m. Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95096.

*Sabia limoniacea* Wall. *ex* Hook.f.

Climber. Primary forest. Belapan River - Dapo River, 1100 m, Nootboom, H.P. 1849.

## SANTALACEAE

*Dendrotrophe buxifolia* (Blume) Miq.

Shrub. On thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall. About 0.5 km SW of N3° 33.5', E115° 23.9', 1400 m, Pearce, K.G. S 95249.

*Dufrenoya papillosa* Stauffer

Semi-parasite. Primary forest. Belapan River, 1100 m, Nooteboom, H.P. 1896.

## SAPINDACEAE

*Allophyllus* sp.

Treelet 1.7 m tall, 1 cm diam. On loam covered by 1-2 cm humus in disturbed forest 27 m tall. 0.5 km E of Long Belaban going more or less E, 1255 m, Pearce, K.G. S 95958.

*Guioa bijuga* (Hiern) Radlk.

Small tree about 3.5 m tall. On yellow clay soil. On ridge, S part of upper Pa Menalio, 1300 m, Lim, M.T. S 95131.

## SAURAUACEAE

*Saurauia amoena* Stapf

Treelet to 4.5 m tall, 5 cm diam. Alluvial forest 30 m tall and on sandy soil with about 5 cm humus above in mossy forest about 18 m tall. On way to Tama Abu Range from ulu Pa Selonok, 1720 m, Pearce, K.G. S 94939; Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95845.

*Saurauia glabra* Merr.

Tree 4.5 m tall, 6 cm diam. On loam in disturbed forest 30 m tall. Ridge running upstream SW of Long Rusu, 1410 m, Pearce, K.G. S 95934.

*Saurauia* cf. *glabra* Merr.

Treelet 5 m tall, 2.5 cm diam. On riverbank. Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94839.

*Saurauia heterophylla* Merr.

Cauliflorous treelet about 6 m tall. Primary forest. Belapan River, 1100 m, Nooteboom, H.P. 1894.

*Saurauia ridleyi* Merr.

Treelet 3.5 m tall, 4 cm diam. Alluvial forest 30 m tall and on loam soil with 1-2 cm humus above in disturbed forest 27 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95869; 0.5 km E of Long Belaban going more or less E, 1160 m, Pearce, K.G. S 95940.

*Saurauia cf. ridleyi* Merr.

Cauliflorous treelet 3 m tall, 5 cm diam. On sandy loam covered by 2 cm peat in riverine forest to 25 m tall. Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95077, S 95078.

## SCHIZANDRACEAE

*Kadsura* sp.

Climber to 2.5 m long. Above riverbank in disturbed, alluvial forest about 30 m tall. Close to Pa Menalio/Pa Dapur confluence, 1150 m, Noh, B. S 93447; Long Rusu along Sg. Dapur up from Long Belaban, 1150 m, Pearce, S 95886.

## SIMAROUBACEAE

*Eurycoma longifolia* Jack

Tree 3 m tall. Riparian forest. Route to Tama Abu Range, 950 m, Awa, D. S 51025.

## STAPHYLEACEAE

*Turpinia sphaerocarpa* Hassk. var. *sphaerocarpa*

Tree 25 m tall, 70 cm diam. Alluvial forest 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95874.

## SYMPLOCACEAE

*Symplocos adenophylla* Wall. ex G. Don

Tree to 13 m tall, 22 cm diam. On exposed sandstone rocks criss-crossed by roots covered with moss and peat and in open vegetation with scattered, crooked trees to about 12 m tall and on yellow, sandy clay in mossy forest with *Agathis* dominant and on clay covered with 5 cm humus layer in forest about 30 m tall and on hillside and on ridge. Ulu Sg. Belaban, 1707 m, Ilias, P. S 26306, Ilias, P. S 26352; Camp 4, 1371 m, Ilias, P. S 26434; Lepo Bunga, 1750 m, Julaihi, L. S 70827, S 70831; G. Murud, 1710 m, Rena, G. S 60357; New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95333; N of Long Belaban up ridge, 1500 m, Pearce, K.G. S 95815.

*Symplocos anomala* Brand

Tree 23 m tall, 17 cm diam. Hillside. G. Murud, ulu Sg. Belaban, 1676 m, Ilias, P. S 26357.

*Symplocos fasciculata* Zoll.

Tree 10 m tall, 25 cm diam. Riverbank and Kerangas forest. Route to Tama Abu Range, 950 m, Awa, D. S 51015; Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93407.

*Symplocos henschelii* (Moritz) Benth. ex C.B. Clarke ssp. *henschelii* var. *henschelii*

Shrub about 1.5 m tall. On alluvial soil on levee behind river and in open area in oak-laurel-*Syzygium* forest. Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94861; Hill NW of Arur Dalan, 1320 m, Pearce, K.G. S 95300.

*Symplocos henschelii* (Moritz) Benth. ex C.B. Clarke var. *maingayi* (Benth. ex C.B. Clarke) Noot.

G. Murud East, path to the top, Nootboom, H.P. 1932; G. Murud, ulu Sg. Belaban, Ilias, P. S 26351.

*Symplocos laeteviridis* Stapf var. *basirotonda* Noot.

Shrub 1.5 m tall and treelet to 2 m tall, 1.5 cm diam. On sandy soil with thick humus and in primary forest and on ridge. Belapan River - Dapo River, 1100 m, Nootboom, H.P. 1864; G. Murud, 1100 m, Nootboom, H.P. 1901; Path to G. Murud, 1707 m, Ilias, P. S 26302; G. Murud, 1710 m, Rena, G. S 60355.

*Symplocos laeteviridis* Stapf var. *laeteviridis*

Tree 2 m tall, about 3 cm diam. On loamy soil in open forest about 20 m tall. Going N on ridge N of Pa Menalio, 1380 m, Pearce, K.G. S 94821.

*Symplocos laeteviridis* Stapf var. *mjobergii* Noot.

Tree 10 m tall, 15 cm diam. Hillside, primary forest. G. Murud East, 1500 m, Nootboom, H.P. 1909; G. Murud, ulu Sg. Belaban, Camp 4, 1371 m, Ilias, P. S 26429.

*Symplocos laeteviridis* Stapf var. *pauciflora* Noot.

Tree to 7 m tall, 8 cm diam. and shrub. On hillside and on ridge and in forest. Ba' Kelalan to G. Murud, near Camp 4, 1920 m, Burt, B.L. B 5389; Sg. Belaban, Ilias, P. S 26334; G. Murud, Ilias, P. S 26391; Tama Abu Range, 1550 m, Awa, D. S 51105; G. Murud, 1710 m, Rena, G. S 60347.

*Symplocos laeteviridis* Stapf var. *velutinos*a Noot.

Treelet 2 m tall. Tama Abu Range, on ridge. 1550 m, Awa, D. S 51104.

*Symplocos pendula* Wight var. *hirtistylis* (C.B. Clarke) Noot.

Tree 8 m tall, 15 cm diam. and shrub about 2 m tall. On yellow, sandy clay in mossy forest with *Agathis* dominant and amidst sandstone boulders with peat between in scrub about 2 m high and in Kerangas forest and on the summit of one of the peaks. G. Murud, 2300 m, Nootboom, H.P. 2058; Route to Tama Abu Range, 950 m, Awa, D. S 51023; Tama Abu Range, 1750 m, Awa, D. S 51152; G. Murud summit, 2400 m, Julaihi, L. S 70888; G. Murud summit, 2433 m, Pearce, K.G. S 95384.

*Symplocos tricoccata* Noot.

Tree to 4 m tall, 3 cm diam. On yellow, sandy clay in mossy forest with *Agathis* dominant and on ridge. Path to G. Murud, 1707 m, Ilias, P. S 26305; G. Murud, 1710 m, Rena, G. S 60366; Lepo Bunga, 1750 m, Julaihi, L. S 70856.

## TETRAMERISTACEAE

*Tetramerista glabra* Miq.

Tree 10 m tall, 14 cm diam. On yellow sandy clay in mossy forest with *Agathis* dominant. Lepo Bunga, 1750 m, Julaihi, L. S 70844.

## THEACEAE

*Adinandra* sp.

Belapan river, 1100 m, Nooteboom, H.P. 01898; G. Murud N.P., Yii, P.C. S 44611; G. Murud, 2<sup>nd</sup> summit, 2240 m, Julaihi, L. S 80143.

*Adinandra* PTNP 1

Shrub 5 m tall, 8 cm diam. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos*. On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95186.

*Adinandra clemensiae* Kobuski

Tree 17 m tall, 20 cm diam. Forest. G. Murud, 1710 m, Rena, G. S 60339; G. Murud N.P., 1600 m, Yii, P.C. S 44499.

*Adinandra cordifolia* Ridl.

Tree 13 m tall, 20 cm diam. Riverbank. G. Murud, ulu Sg. Belaban, Camp 4, Ilias, P. S 26430.

*Adinandra cordifolia* Ridl. var. *cordifolia*

Tree 1.5 m tall. Disturbed scrubby vegetation 2 - 3 m high between sandstone rocks. Nearly at G. Murud summit, 2430 m, Pearce, K.G. S 95395.

*Adinandra* aff. *nunokensis* Kobuski

Treelet about 8 cm tall. Mossy forest 20 - 25 m tall. Tama Abu Range summit, 1470 m, Pearce, K.G. S 94943.

*Adinandra verrucosa* Stapf

Tree 7 m tall, 15 cm diam. G. Murud, on slope in forest. 1250 m, Rena, G. S 61091.

*Eurya acuminata* DC.

Tree 10 m tall, 5 cm diam. On loam covered by 1-2 cm humus in disturbed forest 27 m tall and along river and near stream in riparian forest. G. Murud N.P., 1500 m, Yii, P.C. S 44640; Pa' Dapur, Sg. Menalio, 950 m, Awa, D. S 51078; 0.5 km E of Long Belaban going more or less E, 1160 m, Pearce, K.G. S 95945.

*Eurya nitida* Korth.

Treelike to 6 m tall, 5 cm diam. On 30 cm peaty layer over fine alluvial sand at pathside at top of steep riverbank in *Agathis* forest with *Dacrycarpus* and *Gymnostoma* regenerating and on peaty soil in open in mossy forest with *Gymnostoma*. Ulu Pa Selonok, 1580 m, Pearce, K.G. S 94881; Confluence of Pa Dapur and Pa Menalio, behind lodge, at top of valley. 1160 m, Pearce, K.G. S 95039.

*Gordonia havilandii* Burkill

Tree 5 m tall, about 7 cm diam. Sg. Belaban, on ridge. 1707 m, Ilias, P. S 26319.

*Gordonia* cf. *imbricata* King

Treelike 2 m tall, 2.5 cm diam. On exposed sandstone rocks criss-crossed by roots covered with moss and peat and in open vegetation with scattered, crooked trees to about 12 m tall. New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95356.

*Pyrenaria serrata* Blume var. *masocarpa* (Korth.) H. Keng

Tree to 20 m. On loam in forest 30 m tall and on loamy soil in open forest to about 20 m and in sandy Kerangas forest and in primary forest. Belapan river - Dapo river, 1100 m, Nootboom, H.P. 01859; G. Murud N.P., 1300 m, Yii, P.C. S 44659; Behind Pa Menalio, 1100 m, Rantai, J. S 93486; Going N on ridge N of Pa Menalio, 1380 m, Pearce, K.G. S 94816; Ridge running upstream SW of Long Rusu, 1180 m, Pearce, K.G. S 95901, 1350 m, S 95928.

*Schima brevifolia* Baill. ex Stapf

Shrub about 3 m tall. On a network of tree roots in open dry scrubby forest about 4 m tall and on a lower summit. G. Murud, N side, 2134 m, Burtt, B.L. B 5469; G. Murud, 2250 m, Rena, G. S 63327; G. Murud summit ridge, 2150 m, Julaihi, L. S 80040; Tama Abu Range near summit, 1800 m, Pearce, K.G. S 94982.

*Ternstroemia* sp.

G. Murud, 2400 m, Nootboom, H.P. 1980; Route to Tama Abu Range, 1150 m, Awa, D. S 51090.

*Ternstroemia* PTNP 1

Treelike 4 m tall, 5 cm diam. and shrub. On thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall and on Kerangas soil in open vegetation to about 7 m tall and in forest with some big *Agathis* trees. On ridge, S part



of upper Pa Menalio, 1240 m, Lim, M.T. S 95123; About 0.5 km SW of N3<sup>0</sup> 33.5', E115<sup>0</sup> 23.9', 1400 m, Pearce, K.G. S 95241; Summit SW of Long Rapung, 1320 m, Pearce, K.G. S 95996.

*Ternstroemia* PTNP 2

Treelet to 10 m tall, 15 cm diam. and shrub. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and on exposed sandstone rocks criss-crossed by roots covered with moss and peat and amidst sandstone boulders with peat between in scrub about 2 m high and on peat over roots in scrubby summit vegetation about 4 m tall and in open vegetation with scattered, crooked trees to about 12 m tall and in scrubby vegetation about 1.5 m tall with scattered *Dacrydium* to 3+ m. Tama Abu Range summit, 1800 m, Lim, M.T. S 94904; New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95355; G. Murud summit, 2433 m, Pearce, K.G. S 95386; Below Kebun Batu, G. Murud, 2200 m, Pearce, K.G. S 95418; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95438.

*Ternstroemia* PTNP 3

Tree 8 m tall, 8 cm diam. Mossy forest 20 - 25 m tall. Tama Abu Range summit, 1470 m, Pearce, K.G. S 94955.

*Ternstroemia* PTNP 4

Shrub about 3 m tall. On a network of tree roots in open dry scrubby forest about 4 m tall. Tama Abu Range near summit, 1800 m, Pearce, K.G. S 94979.

*Ternstroemia beccarii* Stapf ex Ridl.

Shrub about 2 m tall. On thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall and in pole-size, mossy forest. On steep ridge of Menalio, Pa Dapur, 1370 m, Lim, M.T. S 95109; About 0.5 km SW of N3<sup>0</sup>. 33.5', E115<sup>0</sup> 23.9', 1400 m, Pearce, K.G. S 95246.

*Ternstroemia* cf. *coriacea*

Shrub 2 m tall. Mossy forest. G. Murud, Rena, G. S 63337.

*Ternstroemia* aff. *coriacea* King

Tree 12 m tall, 35 cm diam. Forest on ridge. Path to G. Murud, 1707 m, Ilias, P. S 26309; G. Murud, summit ridge, Helipad, near Church, 2100 m, Julaihi, L. S 80092.

## THYMELAEACEAE

*Wikstroemia indica* (L.) C.A. Mey.

Tree to 2.5 m tall, 3 cm diam. On sandstone in open vegetation with low shrubs. G. Murud, N from the top, 2300 m, Nooteboom, H.P. 2038, Nooteboom, H.P. 2040; G. Murud, Ilias, P. S 26459; G. Murud summit ridge, 2150 m, Julaihi, L. S 80030.

*Wikstroemia ovata* C. A. Mey.

Tree 3 m tall and shrub. Forest. Ba' Kelalan to G. Murud, below Camp 4, 1829 m, Burt, B.L. B 5374; G. Murud N.P., 1600 m, Yii, P.C. S 44420.

## TILIACEAE

*Grewia stylocarpa* Warb. ex Perkins

Tree to 10 m tall, 16 cm diam. By riverside in alluvial forest and on loam covered by 1-2 cm humus in disturbed forest 27 m tall. Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95282; 0.5 km E of Long Belaban going more or less E, 1255 m, Pearce, K.G. S 95956.

*Microcos* cf. *antidesmifolia* (King) Burret

Treelet 9 m tall, 10 cm diam. On clay soil in open forest about 20 m tall. Going N on ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 94813.

## TRIGONIACEAE

*Trigoniastrum hypoleucum* Miq.

Tree 16 m tall, 18 cm diam. On peat over tree roots with grey sand beneath and on bank behind river. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93424; S of Pa Menalio, 1220 m, Pearce, K.G. S 93462.

## ULMACEAE

*Gironniera parvifolia* Planch.

Tree 8 m tall, 12 cm diam. On 30 cm peaty layer over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating. Route to Tama Abu Range, 950 m, Awa, D. S 51011; Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95010.

*Gironniera subaequalis* Planch.

Treelet 8 m tall, 18 cm diam. On 12 cm peat over clay in pole-sized forest 20 - 25 m tall. W of summit SW of Long Rapung, 1340 m, Pearce, K.G. S 96012.

## URTICACEAE

*Elatostema* PTNP 1

Herb about 30 cm long. On peat soil in open, disturbed forest and on peaty soil in mossy forest 15 - 20 m tall. New trail to G. Murud just past junction with old trail, 2012 m,

Pearce, K.G. S 95352; G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96040.

*Elatostema* cf. *integrifolium* (D. Don) Wedd.

Herb to 10 cm tall. Forest. G. Murud summit ridge, Helipad, near Church, 2100 m, Julaihi, L. S 80100.

*Elatostema penibukanensis* L.S. Gibbs

Epiphytic herb 25 cm long. Mossy forest. From ulu Pa Selonok W towards Tama Abu Range, 1740 m, Pearce, K.G. S 94898.

*Pilea*

Herb about 50 cm tall. Alluvial forest 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95853.

## VERBENACEAE

*Vitex gamosepala* Griff.

Treelet 5 m tall, about 6 cm diam. Alluvial forest. Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95277.

## VISCACEAE

*Ginalloa* sp.

Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 95211.

*Ginalloa arnottiana* Korth.

Hemi-parasitic shrub. On bank behind river Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93432.

## VITACEAE

*Ampelocissus ochracea* Merrill

Climber to 3 m long. Forest. Lepo Bunga, Julaihi, L. S 80170.

*Cayratia* cf. *geniculata* (Blume) Gagnep.

Scrambling herb. Open area in oak-laurel-*Syzygium* forest. Hill, 1240 m, Pearce, K.G. S 95291.

*Pterisanthes polita* (Miq.) Lawson

Climber 4.5 m tall. On 30 cm peaty layer over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating. At top of steep bank along Pa Menalio, behind its confluence with Pa Dapur, 1160 m, Pearce, K.G. S 95044.

*Tetrastigma dichotomum* (Blume) Planch.

Climber to 1 m long. Forest. G. Murud summit ridge, Helipad, near Church, 2100 m, Julaihi, L. S 80094.

*Tetrastigma diepenhorstii* (Miq.) Latiff

Creeper about 1 m long. On clay covered with 5 cm humus layer in forest about 30 m tall. NW of Long Belaban, 1260 m, Pearce, K.G. S 95482.

## WINTERACEAE

*Drimys piperita* Hook.f.

Shrub to 1.5 m tall and treelet 70 cm tall. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and on exposed sandstone rocks criss-crossed by roots covered with moss and peat and in open vegetation with scattered, crooked trees to about 12 m tall and on 30 cm peaty layer over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating and in summit vegetation. G. Murud summit, 2400 m, Julaihi, L. S 80104; Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95003; New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95339; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95450.

## Angiosperms - Monocotyledons

### AGAVACEAE

*Dracaena* PTNP 1

Treelet 5 m tall. On bank behind river. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93430.

### ARACEAE

*Aglaeonema nebulosum* N.E. Brown

Herb 35 cm tall. On loam in forest with trees 30 m tall. Ridge running upstream SW of Long Rusu, 1300 m, Pearce, K.G. S 95916.

*Anadendrum* sp. 1

Herb. Alluvial area above riverbank in disturbed vegetation. Along ridge running SW, S of tributary of Sg. Rusu, 1160 m, Pearce, K.G. S 95896.

*Anadendrum* sp. 2

Epiphyte 1.5 m up tree. On loam in forest with trees 30 m tall. Ridge running upstream SW of Long Rusu, 1320 m, Pearce, K.G. S 95919.

*Aridarum* cf. *caulescens* M. Hotta

Herb. Alluvial area above riverbank in disturbed vegetation. Long Rusu along Sg. Dapur up from Long Belaban, 1150 m, Pearce, K.G. S 95888.

*Homalomena* sp.

Herb about 40 cm tall. Alluvial area above riverbank in disturbed vegetation. Along ridge running SW, S of tributary of Sg. Rusu, 1160 m, Pearce, K.G. S 95900.

*Homalomena sagittifolia* Jungh. ex Schott.

Primary forest. Belapan river-Dapo river, 1100 m, Nooteboom, H.P. 1841.

*Piptospatha havilandii* Engl.

G. Murud N.P., Yii, P.C. S 44417.

*Piptospatha* cf. *maduensis* Bogner and A. Hay

Herb about 25 cm tall. On rock in river and on clay soil by stream in oak-laurel-*Syzygium* forest and in alluvial area above riverbank in disturbed vegetation. On hill NW of Bario, 1300 m, Pearce, K.G. S 95148; Long Rusu along Sg. Dapur up from Long Belaban, 1150 m, Pearce, K.G. S 95887.

*Schismatoglottis calyptrata* (Roxb.) Zoll. and Moritzi

Herb about 1 m tall. On clay soil by path in oak-laurel-*Syzygium* forest. G. Murud N.P., 1600 m, Yii, P.C. S 44418; On hill NW of Bario, 1300 m, Pearce, K.G. S 95149.

*Schismatoglottis venusta* A. Hay

Herb 35 cm tall. On clay soil by stream in oak-laurel-*Syzygium* forest and in alluvial forest. On hill NW of Bario, 1300 m, Pearce, K.G. S 95146; Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95851, S 95860.

*Scindapsus coriaceus* Engl.

Climber to 2.5 m high. G. Murud summit ridge, 2150 m, Julaihi, L. S 80039.

*Scindapsus crassipes* Engl.

Herb 60 cm tall. On damp sandstone boulder and loam in forest with trees 30 m tall. Ridge running upstream SW of Long Rusu, 1250 m, Pearce, K.G. S 95914.

## ARECACEAE

### *Areca kinabaluensis* Furtado

Solitary palm 6 m to crown shaft, 3 cm diam. On bank behind river. Tama Abu Range, 1250 m, Awa, D. S 51193; Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93414.

### *Areca klingkangensis* J. Dransf.

Palm 1.5 m tall, 0.5 m to base of crown shaft. On clay covered with 5 cm humus in forest about 30 m tall. NW of Long Belaban, 1320 m, Pearce, K.G. S 95496.

### *Areca minuta* Scheff.

Clustering palm 1.3 m tall, 90 cm to top of crown-shaft and solitary palm 1.5 m to base of crown-shaft. On peat soil over tree roots with grey sand beneath. S of Pa Menalio, 1220 m, Pearce, K.G. S 93448, S 93466.

### *Areca triandra* Roxb.

Solitary palm 1 m to base of crown shaft. On clay covered with 5 cm humus layer in forest about 30 m tall. NW of Long Belaban, 1260 m, Pearce, K.G. S 95478.

### *Calamus* PTNP 1

Solitary rattan 3.5 m tall. Alluvial forest. Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95275.

### *Calamus conirostris* Becc.

Sessile, clustered rattan 5 m tall and solitary rattan 4 m tall. On sandy loam covered by 2 cm peat in riverine forest about 25 m tall and in alluvial forest and in riparian forest. Tama Abu Range, Sg. Menalio, 950 m, Awa, D. S 51046; Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95100; Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95272.

### *Calamus convallium* J. Dransf.

Clustered climbing rattan to 30 m long. On loam in forest about 30 m tall. G. Murud N.P., 1300 m, Yii, P.C. S 44663; Ridge running upstream SW of Long Rusu, 1350 m, Pearce, K.G. S 95932.

### *Calamus flabellatus* Becc.

Clustering rattan 8 m long and solitary rattan 5.5 m long. On yellow sandy clay soil and in riparian forest and on peat soil in mossy forest about 20 m tall and on peat soil in pole forest with *Agathis*. Tama Abu Range, 1250 m, Awa, D. S 51199; Lepo Bunga, 1130 m, Julaihi, L. S 80172; Tama Abu Range, on the way to the summit, 1580 m, Pearce, K.G. S 94969; Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 95218.

*Calamus gibbsianus* Becc.

Solitary climber to 4 m long. In shrubby top vegetation and on thick humus on sandstone formation in mossy forest and on ridge and in peat over roots amidst sandstone boulders in scrubby summit vegetation to 4 m tall. G. Murud, 2400 m, Nooteboom, H.P. 1998; G. Murud, 2347 m, Ilias, P. S 26491; G. Murud N.P., 2300 m, Yii, P.C. S 44494; G. Murud, 2400 m, Julaihi, L. S 80019; G. Murud, Helipad near Church, 2100 m, Julaihi, L. S 80074; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94923; G. Murud summit, 2433 m, Pearce, K.G. S 95389.

*Calamus cf. gibbsianus* Becc.

Solitary rattan 1.5 m tall. On peat in open, disturbed forest. G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96062.

*Calamus javensis* Blume

Clustering climber to 10 m tall. On yellow sandy clay soil in forest and on peat in pole forest with *Agathis*. Lepo Bunga, 1130 m, Julaihi, L. S 80173; Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 95213.

*Calamus pogonacanthus* Becc. ex Winkler

Clustered juvenile rattan 5 m tall. Alluvial forest. Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95271.

*Calamus aff. semoi* Becc.

Climber to 6 m high. Riparian forest. Tama Abu Range, 1250 m, Awa, D. S 51198.

*Calamus tenompokensis* Furtado

Stemless rattan 1.5 m tall. Forest. G. Murud N.P., 1300 m, Yii, P.C. S 44664.

*Calamus aff. tenompokensis* Furtado

Solitary sessile rattan about 70 cm tall. Above riverbank in disturbed alluvial forest about 30 m tall. Long Rusu along Sg. Dapur up from Long Belaban, 1150 m, Pearce, K.G. S 95893.

*Daemonorops asteracanthus* Becc.

Solitary rattan to 4 m tall. On peat soil over tree roots with grey sand beneath in elfin forest just below summit and on a ridge. Tama Abu Range, 1550 m, Awa, D. S 51121; S of Pa Menalio, 1220 m, Pearce, K.G. S 93471; Tama Abu Range near summit, 1800 m, Pearce, K.G. S 94991.

*Daemonorops longipes* (Griff.) Mart.

Climber to 7 m high. Riparian forest. Tama Abu Range, 1250 m, Awa, D. S 51197.

*Daemonorops longistipes* Burret

Solitary, sessile rattan to 5 m tall. On yellow sandy clay soil in forest and on 30 cm peat

over fine alluvial sand at pathside in *Agathis* forest with regenerating *Dacrycarpus* and *Gymnostoma* and on peat in mossy forest about 20 m tall and on loam covered by 1-2 cm humus at top of steep riverbank in disturbed forest about 27 m tall and on humus-covered clay in forest about 30 m tall. Pa' Dapur, Sg. Menalio, 950 m, Awa, D. S 51087; Tama Abu Range, 1250 m, Awa, D. S 51195; Lepo Bunga, 1130 m, Julaihi, L. S 80187; Tama Abu Range, on the way to the summit, 1580 m, Pearce, K.G. S 94970; Confluence of Pa Dapur and Pa Menalio, behind lodge, at top of valley, 1160 m, Pearce, K.G. S 95040; N of Long Belaban up ridge, 1360 m, Pearce, K.G. S 95801; 0.5 km E of Long Belaban going more or less E, 1160 m, Pearce, K.G. S 95937.

*Licuala collina* L.G. Saw

Solitary palm. On humus-covered clay in forest about 30 m tall. Tama Abu Range, 1250 m, Awa, D. S 51191; N of Long Belaban up ridge, 1360 m, Pearce, K.G. S 95802.

*Pinanga angustisecta* Becc.

Tama Abu Range, 1250 m, Awa, D. S 51190.

*Pinanga* cf. *aristata* (Burr.) Dransf.

Palm 1.5 m to crown shaft. Mossy forest. From ulu Pa Selonok W towards Tama Abu Range, 1740 m, Pearce, K.G. S 94897.

*Pinanga* aff. *brevipes* Becc.

Riparian forest. Tama Abu Range, 1250 m, Awa, D. S 51194.

*Pinanga capitata* Becc. ex Gibbs var. *capitata*

Solitary palm to 3.5 m tall. On yellow sandy clay in mossy forest with *Agathis* dominant and on a ridge. G. Murud N.P., 2250 m, Yii, P.C. S 44442; Tama Abu Range, 1550 m, Awa, D. S 51116; Lepo Bunga, 1750 m, Julaihi, L. S 70877; G. Murud, 2150 m, Julaihi, L. S 80047; G. Murud summit ridge, Helipad, near Church, 2100 m, Julaihi, L. S 80073, S 80091.

*Pinanga* cf. *capitata* Becc. ex Gibbs var. *capitata*

Clustered and solitary palm 3 m tall. Between sandstone rocks and on peat soil over roots in open, disturbed scrubby summit vegetation 2 - 4 m high and in about 3 m tall scrub at edge of swampy, cleared area with *Racemobambos* and scattered taller trees. Tama Abu Range summit, 1800 m, Pearce, K.G. S 94914; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95163; G. Murud, below Kebun Batu, 2200 m, Pearce, K.G. S 95425; G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96038.

*Pinanga lepidota* Rendle

Clustered and solitary palm to 1.2 m tall. On yellow sandy clay soil in forest and on peat over mossy tree roots in open, mossy forest about 15 - 25 m tall and on 12 cm peat over clay in pole forest 20 - 25 m tall. Lepo Bunga, 1130 m, Julaihi, L. S 80182; S of



Pa Dapur/Pa Menalio confluence, 1300 m, Pearce, K.G. S 95063; W of summit SW of Long Rapung, 1340 m, Pearce, K.G. S 96001.

*Retispatha dumetosa* J. Dransf.

Non-climbing rattan to 4 m tall. Riparian forest. Tama Abu Range, 1250 m, Awa, D. S 51200.

*Salacca vermicularis* Becc.

Clustering palm. Riparian Forest. Tama Abu Range, 1250 m, Awa, D. S 51189.

## BURMANNIACEAE

*Burmannia longifolia* Becc.

Epiphytic herb about 30 cm tall. At trail side on exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and on peat soil over roots in mossy forest near summit and on small exposed summit, canopy about 7 m tall. Tama Abu Range summit, 1800 m, Pearce, K.G. S 94925; Ridge behind Pa Dapur/Pa Menalio confluence, 1400 m, Pearce, K.G. S 95233; False Summit on route to Church Camp, 2215 m, Pearce, K.G. S 95464.

## COMMELINACEAE

*Amischolotype* sp.

Herb. In open area in oak-laurel-*Syzygium* forest. Hill NW of Arur Dalan, 1320 m, Pearce, K.G. S 95298.

## CYPERACEAE

*Carex* cf. *cruciata* Wahlenb.

Herb about 1.5 m tall. On sandy soil covered by about 5 cm humus in mossy forest 18 m tall and on peat soil, in open, mossy forest about 25 m tall with abundant *Racemobambos*. On way to Tama Abu Range from ulu Pa Selonok, 1720 m, Pearce, K.G. S 94937; SE of Plank Walk at junction with trail to Long Belaban, 2130 m, Pearce, K.G. S 96066.

*Carex dietrichiae* Boeck.

On peat in shrubby vegetation. G. Murud, around the top, 2400 m, Nootboom, H.P. 2030.

*Gahnia javanica* Zoll. and Moritzi ex Moritzi

Open place on mountain top. G. Murud, 2400 m, Nootboom, H.P. 1981.

*Oreobolus kuekenthalii* v. Steenis ex Kukenth.

In peat on sandstone in shrubby vegetation. G. Murud, around the top, 2400 m, Nootboom, H.P. 2023.

## HANGUANACEAE

*Hanguana* sp.

Herb 1.5 m tall. On sandy loam covered by 2 cm peat in riverine forest to 25 m. Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95099.

## HYPOXIDACEAE

*Curculigo* sp.

Herb about 1 m tall. Alluvial forest 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95856.

## IRIDACEAE

*Patersonia lowii* Stapf

Herb. Among rocks and in damp places in scrubby vegetation about 1.5 m tall with scattered *Dacrydium* trees to 3+ m. G. Murud, N side, 2256 m, Burt, B.L. B 5455; G. Murud, below Kebun Batu, 2400 m, Pearce, K.G. S 95415.

## LILIACEAE

*Dianella ensata* (Thunberg) R.J. Henderson

Herb about 80 cm tall. On peaty layer 30 cm over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating and in scrubby vegetation about 1.5 m tall with scattered *Dacrydium* to 3+ m. Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95009; G. Murud, below Kebun Batu, 2200 m, Pearce, K.G. S 95424.

*Ophiopogon* cf. *caulescens* (Blume) Baker

Epiphyte about 0.5 m up tree. On loam in forest 30 m tall. Ridge running upstream SW of Long Rusu, 1250 m, Pearce, K.G. S 95912.

## MARANTACEAE

*Phrynium capitatum* Willd.

Herb 80 cm tall. Alluvial forest 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95848.

## ORCHIDACEAE

### Genus unknown

Ulu Pa Menalio, 1100 m, Rantai, J. S 94828; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95194; Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95875.

### *Agrostophyllum cyathiforme* J.J. Sm.

Epiphyte. On ridge. Tama Abu Range, 1550 m, Awa, D. S 51111.

### *Agrostophyllum* aff. *cyathiforme* J.J. Sm.

Terrestrial herb 70 cm tall. Mossy forest. From ulu Pa Selonok W towards Tama Abu Range, 1740 m, Pearce, K.G. S 94895.

### *Agrostophyllum laterale* J.J. Sm.

Epiphyte about 40 cm long. By riverside in alluvial forest and in riparian forest and near a stream. Sg. Menalio, Pa Dapur, 950 m, Bernard, L.M.H. S 51065; Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95287.

### *Agrostophyllum* cf. *majus* Hook.f.

Terrestrial herb about 60 cm long. On peaty soil over roots and large sandstone boulders in open, pole-size summit forest. Isolated peak N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 94995.

### *Agrostophyllum stipulatum* (Griff.) Schltr.

Epiphyte 2 m up mossy tree. Above riverbank in disturbed, alluvial area with trees about 30 m tall. Long Rusu along Sg. Dapur up from Long Belaban, 1150 m, Pearce, K.G. S 95890.

### *Anoectochilus* sp.

On ground by riverbank in *Agathis* forest. From Pa Menalio on the way to Tama Abu Range, Solomon, S. S 94822.

### *Appendicula* sp.

New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95338.

### *Appendicula calcarata* Ridl.

Epiphyte. Riparian Forest. Tama Abu Range, 1250 m, Awa, D. S 51186.

### *Appendicula congesta* Ridl.

Epiphyte near tree base. Mossy forest near summit. Route from Ba' Kalalan to G. Murud, Burt, B.L. B 5233; Lepo Bunga, 1750 m, Julaihi, L. S 70884; G. Murud, 1730 m, Rena, G. S 60386; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94933.

*Appendicula cornuta* Blume

Epiphyte. On ridge. Tama Abu Range, 1550 m, Awa, D. S 51107.

*Appendicula foliosa* Ames and C. Schweinf.

Epiphyte about 2.5 m tall and terrestrial plant. On sandstone and in mossy forest near summit. Proposed G. Murud N.P., 1600 m, Yii, P.C. S 44421; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94932.

*Appendicula* aff. *foliosa* Ames and C. Schweinf.

Mossy sub-montane forest. Lepo Bunga, 1750 m, Julaihi, L. S 70861.

*Appendicula longirostrata* Ames and C. Schweinf.

Epiphyte in moss. Route from Ba' Kelalan to G. Murud, ridge above Camp 4, 1951 m, Burt, B.L. B 5434.

*Appendicula pendula* Blume

Terrestrial plant. Forest. Proposed G. Murud N.P., 1600 m, Yii, P.C. S 44401.

*Appendicula torta* Blume

Epiphyte on mossy branch 3 m up. Above riverbank in disturbed alluvial area with canopy about 30 m tall and on clay covered with humus in forest about 30 m and in riparian forest. Tama Abu Range, 1250 m, Awa, D. S 51187; N of Long Belaban up ridge, 1500 m, Pearce, K.G. S 95820; Long Rusu along Sg. Dapur up from Long Belaban, 1150 m, Pearce, K.G. S 95883.

*Appendicula undulata* Blume var. *undulata*

Epiphyte. Riparian forest. Sg. Menalio, 1050 m, Awa, D. S 51098.

*Appendicula* aff. *undulata* Blume

Lithophyte. On loam in forest 30 m tall. Ridge running upstream SW of Long Rusu, 1320 m, Pearce, K.G. S 95920.

*Appendicula* cf. *xytriophora* Rchb.f.

Epiphyte at base of tree. On clay in *Tristaniopsis* forest. On ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 93500.

*Ascidieria longifolia* (Hk.f.) Seidenf.

Epiphyte 40 cm tall. On fallen branch and to 4 m up tree trunk. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos* and on yellow sandy clay in mossy forest with *Agathis* dominant and clay with rocks along stream at steep hillside and on peat over tree roots with grey sand beneath and in peat soil in open, mossy forest about 25 m tall with abundant *Racemobambos* and on dead wood. G. Batu Buli, 1500 m, Julaihi, L. S 75245; Lepo Bunga, 1750 m, Julaihi, L. S 70867; S of Pa Menalio, 1280 m, Pearce, K.G. S 93477; On trail from Church

Camp to G. Murud, 2090 m, Pearce, K.G. S 95155; SE of Plank Walk at junction with trail to Long Belaban, 2020 m, Pearce, K.G. S 96079.

*Bromheadia* cf. *cecieliae* Kruizinga

Epiphyte on fallen branch. On peat over tree roots with grey sand beneath. On ridge S of Pa Menalio, 1300 m, Rantai, J. S 93483.

*Bromheadia crassiflora* J. J. Sm.

Terrestrial orchid to 1 m tall and lithophyte about 1 m tall. In scrubby vegetation about 1.5 m tall with scattered *Dacrydium* to 3+ m and on thick humus on sandstone formation in mossy forest. G. Murud, 2134 m, Burt, B.L. B 5463A; G. Murud N.P., 2300 m, Yii, P.C. S 44482; G. Murud summit, 2400 m, L. S 80013; summit ridge, 2150 m, Julaihi, L. S 80053; Murud, below Kebun Batu, 2400 m, Pearce, K.G. S 95414.

*Bulbophyllum*

Lepo Bunga, 1750 m, Julaihi, L. S 70862; G. Murud, 2<sup>nd</sup> summit, 2240 m, Julaihi, L. S 80148; 1130 m, S 80178; Tama Abu Range, 1250 m, Awa, D. S 51184; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95192; 0.5 km E of Long Belaban going more or less E, 1255 m, Pearce, K.G. S 95954.

*Bulbophyllum* PTNP 1

Epiphyte 8 m up tree. On peat soil in open, mossy forest about 25 m tall with abundant *Racemobambos*. SE of Plank Walk at junction with trail to Long Belaban, 2020 m, Pearce, K.G. S 96077.

*Bulbophyllum* PTNP 2

Epiphyte. Kerangas forest. Ulu Pa Menalio, 1100 m, Rantai, J. S 94829.

*Bulbophyllum* PTNP 3

Epiphyte. On thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall. About 0.5 km SW of N3° 33.5', E115° 23.9', 1400 m, Pearce, K.G. S 95254.

*Bulbophyllum* PTNP 4

Epiphyte. Mossy forest 20 - 25 m tall. Tama Abu Range on the way to the summit, 1580 m, Pearce, K.G. S 94960.

*Bulbophyllum* PTNP 5

Epiphyte 3.5 m up tree. On 12 cm peat over clay in pole-sized forest 20 - 25 m tall. W of summit SW of Long Rapung, 1360 m, Pearce, K.G. S 96015.

*Bulbophyllum* aff. *acuminatum* (Ridl.) Ridl.

Epiphyte. On peaty soil over roots and large sandstone boulders and in open, summit pole forest. Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1670 m, Pearce, K.G. S 95204.

*Bulbophyllum* aff. *anguliferum* Ames and C. Schweinf.

Orchid on tree trunk. On summit. Tama Abu Range, 1750 m, Awa, D. S 51168.

*Bulbophyllum* aff. *auratum* (Lindl.) Rchb.f.

Epiphyte to 1.5 m up tree and on broken branch. In open, summit pole forest and on peaty humus over tree roots with sandy soil 50 cm beneath in open forest about 12 m tall and in mossy forest 20 - 25 m tall and on peaty soil over roots and large sandstone boulders and on clay covered with 5 cm humus layer in forest about 30 m tall. On ridge N of Pa Menalio, 1190 m, Pearce, K.G. S 93492; Tama Abu Range summit, 1470 m, Pearce, K.G. S 94945; Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 95207; N of Long Belaban up ridge, 1360 m, Pearce, K.G. S 95824.

*Bulbophyllum cornutum* (Blume) Rchb.f.

Epiphyte 2 m up tree. On peaty soil over roots and large sandstone boulders in open, pole-size summit forest and in mossy forest 20 - 25 m tall. Tama Abu Range summit, 1470 m, Pearce, K.G. S 94947; Isolated peak N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 94996.

*Bulbophyllum dearei* Rchb. f.

Epiphyte 60 cm up stump. On peat soil in mossy forest 20 m tall. Lepo Bunga, 1750 m, Julaihi, L. S 70865; Tama Abu Range, on the way to the summit, 1580 m, Pearce, K.G. S 94957.

*Bulbophyllum disjunctum* Ames and C. Schweinf.

Epiphyte on tree 2 m high. Forest. G. Murud, Julaihi, L. S 80136.

*Bulbophyllum elongatum* (Blume) Hassk.

Mossy sub-montane forest. Lepo Bunga, 1750 m, Julaihi, L. S 70851.

*Bulbophyllum flavescens* (Blume) Lindl.

Epiphyte on fallen branch. On peat over tree roots with grey sand beneath and in mossy and riparian forest. Sg. Menalio, Pa Dapur, 1050 m, Awa, D. S 51095; Lepo Bunga, 1750 m, Julaihi, L. S 70864; S of Pa Menalio, 1220 m, Pearce, K.G. S 93476.

*Bulbophyllum* cf. *malleolabrum* Carr

Epiphyte 0.5 m up trunk. On peat soil in mossy forest 20 m tall. Tama Abu Range on the way to the summit, 1580 m, Pearce, K.G. S 94964.

*Bulbophyllum* aff. *montense* Ridl.

Epiphyte. Kerangas forest. Ulu Pa Menalio, 1100 m, Rantai, J. S 94832.

*Bulbophyllum obtusum* (Blume) Lindl.

Epiphyte. On summit. Tama Abu Range, 1750 m, Awa, D. S 51125.

*Bulbophyllum* cf. *obtusum* (Blume) Lindl.

Epiphyte. Riparian forest. Sg. Menalio, route to Tama Abu Range, 950 m, Awa, D. S 51039.

*Bulbophyllum* cf. *reticulatum* Bateman

Epiphyte 4 m high. Riparian forest. Sg. Menalio, Pa Dapur, 950 m, Bernard, L.M.H. S 51064.

*Bulbophyllum sopoetanense* Schltr.

Epiphyte. Route from Ba' Kelalan to G. Murud near Camp 4, 1920 m, Burt, B.L. B 5404.

*Bulbophyllum* cf. *stormii* J.J. Sm.

Epiphyte 1.5 m up tree. Mossy forest 20 - 25 m tall. Tama Abu Range summit, 1470 m, Pearce, K.G. S 94948.

*Bulbophyllum teres* Carr

Epiphyte on tree trunk 2 m high. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and on mossy branch on peaty soil in mossy forest 15 - 20 m tall and in summit forest. G. Murud, Julaihi, L. S 80142; New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95350; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95454.

*Bulbophyllum* aff. *teres* Carr

Route from Ba' Kelalan to G. Murud, above Camp 3, Burt, B.L. B 5262.

*Calanthe* sp.

Sg. Menalio, route to Tama Abu Range, 950 m, Awa, D. S 51037.

*Calanthe* PTNP 1

Terrestrial herb about 1 m tall. Alluvial forest 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95862.

*Calanthe* cf. *otuhanica* C. L. Chan and T. J. Barkman

Terrestrial, about 1 m tall. In disturbed forest about 4 m tall with scattered taller trees to about 22 m. *Racemobambos* abundant. G. Murud summit ridge, Helipad, near Church, 2100 m, Julaihi, L. S 80071; New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95307.

*Calanthe pulchra* (Blume) Lindl.

Epiphyte 60 cm tall. In open, mossy forest. Pa Aru, 1200 m, Pearce, K.G. S 94876.

*Calanthe* cf. *pulchra* (Blume) Lindl.

Terrestrial plant 30 cm tall. Riverain forest. G. Murud, 1300 m, Rena, G. S 60326.

*Calanthe* cf. *speciosa* (Blume) Lindl.

Lower edge of mossy forest. Route from Ba' Kelalan to G. Murud, near Camp 3, 1768 m, Burt, B.L. B 5271.

*Calanthe* aff. *speciosa* (Blume) Lindl.

G. Murud, 1800 m, Nootboom, H.P. 1969.

*Calanthe sylvatica* Lindl.

Terrestrial herb to 25 cm tall. In alluvial forest 30 m tall and in riverain forest. Proposed G. Murud N.P., 1300 m, Yii, P.C. S 44667; G. Murud, 1300 m, Rena, G. S 60330; Downstream of Long Belaban, 1150 m, Pearce, K.G. S 95828.

*Calanthe tenuis* Ames and C. Schweinf.

On wet mossy ground. Route from Ba' Kelalan to G. Murud, ridge above Camp 4, 1951 m, Burt, B.L. B 5352, 1829 m, B 5368.

*Calanthe* aff. *tenuis* Ames and C. Schweinf.

Herb about 90 cm tall. In forest with scattered trees up to 17 m tall with undergrowth of *Racemobambos*, epiphytes and shrubs to about 3 m. Foot of False Summit at end of Plank Walk, 2176 m, Pearce, K.G. S 95476.

*Ceratostylis*

Sg. Menalio, route to Tama Abu Range, 950 m, Awa, D. S 51042; Ulu Pa Menalio, 1100 m, Rantai, J. S 94831.

*Ceratostylis* PTNP 1

Epiphyte 2 m up on tree. On peaty soil in mossy forest 15 - 20 m tall. New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95353.

*Ceratostylis subulata* Blume

Epiphyte 2 m up tree. On peat soil in pole forest with *Agathis*. Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 95205.

*Chelonistele*

G. Murud, 2370 m, Rena, G. S 63305; Lepo Bunga, 1130 m, Julaihi, L. S 80180.

*Chelonistele* PTNP 1

Lithophyte. In disturbed scrubby vegetation 2 - 3 m high between sandstone rocks. G. Murud, just below summit, 2400 m, Pearce, K.G. S 95399.



*Chelonistele* PTNP 2

Epiphyte 2 m up tree. In disturbed forest about 4 m tall with scattered taller trees to about 22 m, *Racemobambos* abundant and in peat soil in open, disturbed forest. New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95320; G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96046.

*Chelonistele brevilamellata* (J. J. S.) Carr

Epiphyte. Tama Abu Range on a ridge, 1550 m, Awa, D. S 51103.

*Chelonistele* cf. *sulphurea* (Blume) Pfitzer var. *sulphurea*

Herb. On peat soil over roots on small exposed summit with vegetation about 7 m high. Ridge behind Pa Dapur/Pa Menalio confluence, 1400 m, Pearce, K.G. S 95235.

*Coelogyne* sp.

G. Murud, 1250 m, Rena, G. S 61083.

*Coelogyne* PTNP 2

Epiphyte to 1 m up tree and about 34 cm tall. On peaty layer 30 cm over fine alluvial sand at pathside in *Agathis* forest with *Dacrycarpus* and *Gymnostoma* regenerating and on peat at least 15 cm deep in forest to 25 m and on top of ridge and at top of steep riverbank. Pa Selunok, ulu Pa Menalio, 1220 m, Pearce, K.G. S 93441; Confluence of Pa Dapur and Pa Menalio, behind lodge, at top of valley, 1160 m, Pearce, K.G. S 95029.

*Coelogyne* aff. *asperata* Lindl.

Epiphyte on tree trunk 3 m high. Forest. G. Murud summit ridge, 2150 m, Julaihi, L. S 80049.

*Coelogyne compressicaulis* Ames and C. Schweinf.

Epiphyte. Riparian forest. Sg. Menalio, route to Tama Abu Range, 950 m, Awa, D. S 51033.

*Coelogyne craticulaelabris* Carr

Terrestrial plant 60 - 130 cm. Among rocks and low scrub and amidst sandstone boulders with peat between in scrub about 2 m high and on thick humus on sandstone formation in mossy forest. G. Murud, N side, 2256 m, Burt, B.L. B 5454; G. Murud summit ridges, 2200 m, Julaihi, L. S 80006; G. Murud summit, 2433 m, Pearce, K.G. S 95377.

*Coelogyne cuprea* H. Wendl. and Kraenzl. var. *planiscapa* J. J. Wood and C. L. Chan

Epiphyte. Riparian forest. Sg. Menalio, route to Tama Abu Range, 950 m, Awa, D. S 51035.

*Coelogyne* cf. *exaltata* Ridl.

Epiphyte on tree to 6 m high. On yellow sandy clay in forest. G. Murud summit ridge,

Helipad, near Church, 2100 m, Julaihi, L. S 80068; Lepo Bunga, 1130 m, Julaihi, L. S 80177.

*Coelogyne* cf. *gibbifera* J. J. Sm.

Epiphyte. Riparian forest. Sg. Menalio, route to Tama Abu Range, 950 m, Awa, D. S 51034.

*Coelogyne hirtella* J.J. Sm.

Epiphyte 5 m up tree. On peat over tree roots with grey sand beneath and in open vegetation on sandstone at summit. G. Murud, 2200 m, Nooteboom, H.P. 2019; S of Pa Menalio, 1220 m, Pearce, K.G. S 93463.

*Coelogyne longibulbosa* Ames and C. Schweinf.

Epiphyte. Riparian Forest. Sg. Menalio, Pa Dapur, 1050 m, Awa, D. S 51094.

*Coelogyne moultonii* J.J. Sm.

On mossy rock. Route from Ba' Kalalan to G. Murud above Camp 3, 1829 m, Burt, B.L. B 5258.

*Coelogyne planiscapa* Carr

Epiphyte on tree 4 m high and terrestrial plant 60 cm tall. On exposed sandstone rocks criss-crossed by roots covered with moss and peat and in open vegetation with scattered, crooked trees to about 12 m tall and on yellow, sandy clay in mossy forest with *Agathis* dominant. Lepo Bunga, 1750 m, Julaihi, L. S 70843; G. Murud Church Camp, 2090 m, Pearce, K.G. S 95168; New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95334.

*Coelogyne pulverula* Teijsm. and Binn.

Epiphyte about 1 m up tree. On peaty layer 30 cm over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating. Confluence of Pa Dapur and Pa Menalio, behind lodge, 1080 m, Dennis S 95048.

*Coelogyne radioferens* Ames and C. Schweinf.

Epiphyte to 2.5 m up tree trunk and on dead wood and plant 60 cm tall. In disturbed scrubby vegetation 2 - 3 m high between sandstone rocks and in disturbed forest about 4 m tall with scattered taller trees to about 22 m and abundant *Racemobambos* and in swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos* and near river and in mossy forest and on ridge. Route from Ba' Kalalan to G. Murud, near Camps 3 and 4, 2000 m, Burt, B.L. 5274; G. Murud, ulu Pahdapur, 1859 m, Ilias, P. S 26519; Tama Abu Range, 1550 m, Awa, D. S 51112; G. Murud summit ridge, way to 2<sup>nd</sup> summit, 2100 m, Julaihi, L. S 80157; From ulu Pa Selonok W towards Tama Abu Range, 1580 m, Pearce, K.G. S 94887; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95183; New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95305; G. Murud, just below summit, 2400 m, Pearce, K.G. S 95398.

*Coelogyne swaniana* Rolfe

Epiphyte about 1 m up tree. On loam in forest 30 m tall. Route to Tama Abu Range, ulu Sg. Menalio, 1050 m, Awa, D. S 51093; Ridge running upstream SW of Long Rusu, 1180 m, Pearce, K.G. S 95904.

*Coelogyne* aff. *vermicularis* J. J. Sm.

Epiphyte to 3 m up on mossy branch and on tree. On sandy loam covered by 2 cm peat in riverine forest to 25 m tall and above riverbank in alluvial area with disturbed vegetation about 30 m tall and in mossy forest. Lepo Bunga, 1750 m, Julaihi, L. S 70852; Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95082; Along ridge running SW, S of tributary of Sg. Rusu, 1160 m, Pearce, K.G. S 95894.

*Cryptostylis* sp.

Terrestrial, beside rock. On yellow sandy clay in mossy forest with *Agathis* dominant. Lepo Bunga, 1750 m, Julaihi, L. S 70860.

*Cymbidium elongatum* J.J. Wood, D. Du Pui and P.S. Shim

Epiphyte with trailing stem. Between sandstone rocks in disturbed scrubby vegetation 2 - 3 m high. Route from Ba' Kalalan to G. Murud, ridge above Camp 4, Burt, B.L. B 5428; G. Murud, 2134 m, Burt, B.L. B 5460; G. Murud, just below summit, 2400 m, Pearce, K.G. S 95400.

*Cystorchis variegata* Blume

Terrestrial plant. Riparian Forest. Sg. Menalio, route to Tama Abu Range, 950 m, Awa, D. S 51032.

*Cystorchis*?

Tama Abu Range summit, 1800 m, Pearce, K.G. S 94929; SE of Plank Walk at junction with trail to Long Belaban, 2020 m, Lim, M.T. S 96083.

*Dendrobium* PTNP 1

Epiphyte 1.5 m up tree. On Kerangas soil in open vegetation to about 7 m tall and on clay covered with humus in forest about 30 m tall. N of Long Belaban up ridge, 1440 m, Pearce, K.G. S 95812; Summit SW of Long Rapung, 1320 m, Pearce, K.G. S 95995.

*Dendrobium* PTNP 2

Epiphyte 15+ m up in tree. On peat at least 15 cm deep in forest to 25 m tall and on ridge summit. Pa Selunok, ulu Pa Menalio, 1220 m, Pearce, K.G. S 93444.

*Dendrobium* PTNP 3

Epiphyte 1 m up tree. In loamy soil in open forest about 20 m tall. Going N on ridge N of Pa Menalio, 1380 m, Pearce, K.G. S 94820.

*Dendrobium* PTNP 4

Terrestrial herb. On clay covered with 5 cm humus layer in forest about 30 m tall. N of Long Belaban up ridge, 1500 m, Pearce, K.G. S 95819.

*Dendrobium* PTNP 5

Herb 70 cm tall. On loam in forest 30 m tall. Ridge running upstream SW of Long Rusu, 1180 m, Pearce, K.G. S 95908.

*Dendrobium alabense* J.J. Wood

G. Murud, N side, 2134 m, Burt, B.L. B 5480.

*Dendrobium bifarium* Lindl. ex Hook.f.

Epiphyte. In peat over mossy tree roots in mossy forest 15 - 25 m tall and on a ridge in Kerangas forest. S of Pa Dapur/Pa Menalio confluence, 1370 m, Pearce, K.G. S 95071; Route to Tama Abu Range, Sg. Menalio, 1000 m, Awa, D. S 51049.

*Dendrobium cinnabarinum* Rchb.f.

Epiphyte about 4 m up tree. On clay-loam in closed forest. Pa Aru, 1330 m, Pearce, K.G. S 94877.

*Dendrobium cumulatum* Lindl.

Epiphyte 2.3 m up tree, 50 cm long. On loam in forest 30 m tall and in mossy forest 20 - 25 m tall. Tama Abu Range summit, 1470 m, Pearce, K.G. S 94952; Ridge running upstream SW of Long Rusu, 1350 m, Pearce, K.G. S 95931.

*Dendrobium indivisum* (Blume) Miq.

Epiphyte about 1 m from ground. In loamy soil in open forest about 20 m tall. Going N on ridge N of Pa Menalio, 1380 m, Pearce, K.G. S 94819.

*Dendrobium lancilobum* J.J. Wood

Epiphyte 10 m up tree. On sandy loam covered by 2 cm peat in riverine forest to 25 m and in riparian forest and on rocky riverside. Sg. Menalio, route to Tama Abu Range, 950 m, Awa, D. S 51038; Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95089; Pa Menalio/Pa Dapur confluence, 1150 m, Lim, M.T. S 95270.

*Dendrobium* cf. *oblongum* Ames and C. Schweinf.

Epiphyte about 1 m long. On peat soil in mossy forest 20 m tall. Tama Abu Range on the way to the summit, 1600 m, Pearce, K.G. S 94974.

*Dendrobium piranha* C.L. Chan and P.J. Cribb

On gentle slope with open shrubby vegetation on nearly bare sandstone. G. Murud, 2200 m, Nooteboom, H.P. 2032.

*Dendrobium* aff. *sandsii* J.J. Wood and C.L. Chan

Epiphyte on tree 2 m high. Forest. G. Murud, summit ridge, Helipad, near Church, 2100 m, Julaihi, L. S.80054, S 80069.

*Dendrobium uniflorum* Griff.

Epiphyte 3.5 m up tree. On clay soil in forest about 25 m tall. Just below summit SW of Long Rapung, 1360 m, Pearce, K.G. S 96019.

*Dendrochilum* PTNP 1

Epiphyte. On clay covered with 5 cm humus layer in forest about 30 m tall. NW of Long Belaban, 1260 m, Pearce, K.G. S 95480.

*Dendrochilum* PTNP 1 (aff. *exasperatum* Ames)

Terrestrial herb about 25 cm tall. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos*. On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95153.

*Dendrochilum* PTNP 2

Lepo Bunga, 1750 m, Julaihi, L. S 70885; G. Murud summit, 2400 m, Julaihi, L. S 80008.

*Dendrochilum* PTNP 3

Epiphyte. On clay covered with 5 cm humus layer in forest about 30 m tall. N of Long Belaban up ridge, 1440 m, Pearce, K.G. S 95813.

*Dendrochilum* PTNP 4

Epiphyte. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos*. On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95191.

*Dendrochilum* PTNP 5

Epiphyte 2 m up tree. Kerangas forest. Ulu Pa Menalio, 1100 m, Rantai, J. S 94823.

*Dendrochilum* PTNP 6

Epiphyte on tree trunk 3 m high. G. Murud summit ridge, Helipad, near Church, 2100 m, Julaihi, L. S 80066.

*Dendrochilum* PTNP 7

Epiphyte on fallen branch. On peat over roots in scrubby summit vegetation about 4 m tall and on 12 cm peat over clay in pole-sized forest 20 - 25 m tall. Tama Abu Range summit, 1800 m, Pearce, K.G. S 94928; W of summit SW of Long Rapung, 1340 m, Pearce, K.G. S 96008.

*Dendrochilum crassilabium* J.J. Wood

Epiphyte. Kerangas forest. Ulu Pa Menalio, 1100 m, Rantai, J. S 94833.

*Dendrochilum galbanum* J.J. Wood

Epiphyte about 1 m. Amidst sandstone boulders with peat between in scrub about 2 m high and on wood. G. Murud summit, 2433 m, Pearce, K.G. S 95374.

*Dendrochilum geesinkii* J.J. Wood

Fallen epiphyte. On loam in forest 30 m tall. Ridge running upstream SW of Long Rusu, 1250 m, Pearce, K.G. S 95915.

*Dendrochilum gibbsiae* Rolfe

Epiphyte on tree 16 m tall. Along stream on clay with rocks on steep hillside and in mossy forest. Proposed G. Murud N.P., 1600 m, Yii, P.C. S 44402; Lepo Bunga, 1750 m, Julaihi, L. S 70859; 1500 m, S 75231.

*Dendrochilum gracilipes* Carr

Epiphyte. On ridge. Route to Tama Abu Range, 1550 m, Awa, D. S 51102.

*Dendrochilum lancilabium* Ames

Terrestrial plant about 35 cm tall and growing on boulder and epiphyte. In mossy forest and on rock and in garden. Ba' Kalalan to G. Murud, 1829 m, Burt, B.L. B 5319; G. Murud, 2134 m, Ilias, P. S 26455; G. Murud Church Camp, 2090 m, Pearce, K.G. S 95169.

*Dendrochilum longipes* J. J. Sm.

Creeping epiphyte about 30 cm tall and terrestrial herb to 40 cm tall. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos* and on sandstone summit in mossy forest and in scrubby summit vegetation about 4 m tall on peat over roots and among scattered trees up to 17 m tall with undergrowth of *Racemobambos*, epiphytes and shrubs to about 3 m. Proposed G. Murud N.P., 2250 m, Yii, P.C. S 44432; G. Murud summit, 2400 m, Julaihi, L. S 80115; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94927; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95152; Foot of False Summit at end of Plank Walk, 2176 m, Pearce, K.G. S 95477.

*Dendrochilum longirachis* Ames

Primary forest. Belapan river, 1100 m, Nooteboom, H.P. 1890.

*Dendrochilum* cf. *longirachis* Ames

Kerangas forest. Ulu Pa Menalio, 1100 m, Rantai, J. S 94825.

*Dendrochilum* cf. *mucronatum* J.J. Sm.

Epiphyte 15 cm tall. Mossy forest. From ulu Pa Selonok W towards Tama Abu Range, 1740 m, Pearce, K.G. S 94894.

*Dendrochilum muluense* J. J. Wood

Epiphyte 15 cm tall on fallen wood and log. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos* and in mossy forest and on peat soil in open, disturbed forest. Proposed G. Murud N.P., 2200 m, Yii, P.C. S 44616; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95151; G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96032, S 96036.

*Dendrochilum murudense* (J.J. Wood) J.J. Wood

Epiphyte 1.5 m up tree. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and in mossy forest. G. Murud, 2400 m, Nootboom, H.P. 1995; Proposed G. Murud N.P., 2250 m, Yii, P.C. S 44430; G. Murud, Helipad, near Church, 2100 m, Julaihi, L. S 80067; False Summit on route to Church Camp, 2215 m, Pearce, K.G. S 95465.

*Dendrochilum ochrolabium* J.J. Wood

Epiphyte 2.5 m up tree. On bank behind river. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93419.

*Dendrochilum pallideflavens* Blume

Epiphyte on felled tree. Alluvial forest 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95872.

*Dendrochilum pandurichilum* J.J. Wood

Small epiphyte on tree 16 m tall. Along stream at steep hillside with clay with rocks. G. Batu Buli, 1500 m, Julaihi, L. S 75229.

*Dendrochilum pubescens* L.O. Williams

Epiphyte 2 m up tree. On peat in open forest. NW of Pa Menalio, 1300 m, Rantai, J. S 93446.

*Dendrochilum simplex* J.J. Sm.

Epiphyte on tree 2 m high. Forest. G. Murud summit ridge, Helipad, near Church, 2100 m, Julaihi, L. S 80075.

*Dilochia cantleyi* Ridl.

Terrestrial herb to 1.6 m tall. In open scrub sandstone vegetation and on Kerangas soil in open vegetation to about 7 m tall. G. Murud, N side near Camp 5, 2073 m, Burt, B.L. B 5443; G. Murud, 2370 m, Rena, G. S 63301; Summit SW of Long Rapung, 1320 m, Pearce, K.G. S 95999.

*Dilochia rigida* (Ridl.) J.J. Wood

Epiphyte on tree 2 m high and lithophyte 50 cm tall and terrestrial plant 10 cm tall. Amidst sandstone boulders with peat between in scrub about 2 m high and on peat over roots in scrubby summit vegetation about 4 m tall and on rock and growing among mosses and on summit and on hillslope. G. Murud, ulu Pahdapur, Ba' Kelalan, 2362 m, Ilias, P. S 26538; Tama Abu Range, 1750 m, Awa, D. S 51170; G. Murud, 2370 m, Rena, G. S 60392; G. Murud summit ridge, Helipad, near Church, 2100 m, Julaihi, L. S 80072; G. Murud summit, 2400 m, Julaihi, L. S 80116; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94913; G. Murud summit, 2433 m, Pearce, K.G. S 95376.

*Dilochia wallichii* Lindl.

Epiphyte 1.5 m long. In disturbed forest about 4 m tall with scattered taller trees to about 22 m. *Racemobambos* abundant. New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95314.

*Dipodium pictum* Reichb.f.

Epiphyte to 1 m long on tree trunk 4 m high. Near stream, riparian forest and on yellow sandy clay. Sg. Menalio, Pa Dapur, 950 m, Bernard, L.M.H. S 51068; Lepo Bunga, 1130 m, Julaihi, L. S 80174.

*Epigeneium* sp.

G. Murud summit ridge, 2100 m, Julaihi, L. S.80055.

*Epigeneium kinabaluense* (Ridl.) Summerhayes

Epiphyte. On peat over roots in scrubby summit vegetation about 4 m tall. G. Murud, 2200 m, Rena, G. S 63344; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94903.

*Eria* PTNP 2

Epiphyte on tree. On clay covered with humus in forest about 30 m tall. N of Long Belaban up ridge, 1500 m, Pearce, K.G. S 95821.

*Eria* PTNP 3

Epiphyte on tree 1.5 m high. Tama Abu Range, 1550 m, Awa, D. S 51108; Lepo Bunga, 1750 m, Julaihi, L. S 70855.

*Eria* PTNP 4

Epiphyte 1 m up tree. On peat soil in pole forest with *Agathis*. Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 95206.

*Eria* PTNP 5

G. Murud, 1710 m, Rena, G. S 60364.

*Eria* PTNP 6

Epiphyte about 1.5 m up tree. On peaty soil in Kerangas forest. Near confluence of Pa Menalio and Pa Merakoh, 1150 m, Pearce, K.G. S 95229.



*Eria* PTNP 7

Epiphyte about 70 cm tall. In open, mossy forest. Pa Aru, 1200 m, Pearce, K.G. S 94873.

*Eria* PTNP 8

Epiphyte. On peaty soil over roots and large sandstone boulders in open, summit pole forest. Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 95209.

*Eria* PTNP 9

Terrestrial herb 2.25 m tall. On exposed sandstone rocks criss-crossed by roots covered with moss and peat in open vegetation with scattered, crooked trees to about 12 m tall. New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95344.

*Eria* PTNP 10

Epiphyte 2.5 m up tree. In disturbed forest about 4 m tall with scattered taller trees to about 22 m. *Racemobambos* abundant. New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95316.

*Eria* PTNP 11

Epiphyte about 6 m up tree. On loam covered by 1-2 cm humus in disturbed forest to 30 m tall. Sg. Menalio, Pa Dapur, 1050 m, Awa, D. S 51099; Ridge running upstream SW of Long Rusu, 1320 m, Pearce, K.G. S 95926; 0.5 km E of Long Belaban going more or less E, 1160 m, Pearce, K.G. S 95949.

*Eria* PTNP 12

Terrestrial herb 60 cm tall. On peat soil in open, disturbed forest and in garden. 2200 m, Rena, G. S 63343; G. Murud summit, 2400 m, Julaihi, L. S 80009; G. Murud Church Camp, 2090 m, Pearce, K.G. S 95170; G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96058.

*Eria* PTNP 13

Epiphyte 3 m up tree. On peat at least 15 cm deep in forest to 25 m tall and on top of ridge. Pa Selunok, ulu Pa Menalio, 1220 m, Pearce, K.G. S 93440.

*Eria* PTNP 14

Epiphyte. Kerangas forest. Ulu Pa Menalio, 1100 m, Rantai, J. S 94830.

*Eria* PTNP 15

Herb. On mossy log and on peat soil in open, disturbed forest. G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96051.

*Eria crassipes* Ridl.

Terrestrial plant 25 cm tall and epiphyte. Mossy forest on sandstone summit. G. Murud, 2400 m, Nooteboom, H.P. 2065; Proposed G. Murud N.P., 2250 m, Yii, P.C. S 44431; Tama Abu Range, 1750 m, Awa, D. S 51132.

*Eria crucigera* Ridley

Epiphyte 3 m up tree, about 80 cm long. On peat soil in mossy forest 20 m tall. Tama Abu Range on the way to the summit, 1580 m, Pearce, K.G. S 94965.

*Eria cymbidifolia* Ridl. var. *cymbidifolia*

Epiphyte 1 m up tree. On peat over tree roots with grey sand beneath. On ridge S of Pa Menalio, 1300 m, Rantai, J. S 93482.

*Eria cymbidifolia* Ridl. var. *pandanifolia* J. J. Wood

Epiphyte. Summit. G. Murud, 2370 m, Rena, G. S 63303.

*Eria* aff. *lancifolia* Hook.f.

Epiphyte. Mossy forest 20 - 25 m tall. Tama Abu Range summit, 1470 m, Pearce, K.G. S 94946.

*Eria lanuginosa* J. J. Wood

Epiphyte. Near stream, riparian forest. Sg. Menalio, 950 m, Awa, D. S 51069.

*Eria leiophylla* Lindl.

Epiphyte on fallen branch. On peat over tree roots with grey sand beneath and on slope in forest. G. Murud, 1250 m, Rena, G. S 61097; S of Pa Menalio, 1220 m, Pearce, K.G. S 93475.

*Eria megalopha* Ridl.

Epiphyte. Riparian forest. Tama Abu Range, 1250 m, Awa, D. S 51182.

*Eria nutans* Lindl.

Terrestrial herb 35 cm tall and epiphyte. Mossy forest and riverain forest. G. Murud, 1300 m, Rena, G. S 60329; From ulu Pa Selonok W towards Tama Abu Range, 1740 m, Pearce, K.G. S 94896.

*Eria obliqua* Lindl.

Epiphyte 2-3 m up tree. Pole forest on peat soil with *Agathis* and riparian forest. Tama Abu Range, Sg. Menalio, 950 m, Awa, D. S 51040; Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1330 m, Pearce, K.G. S 95221.

*Eria* aff. *obliqua* (Lindl.) Lindl.

Herb on fallen branch. On peat over mossy tree roots in mossy forest 15 - 25 m tall. S of Pa Dapur/Pa Menalio confluence, 1300 m, Pearce, K.G. S 95059.

*Eria* cf. *oblitterata* (Blume) Rchb.f.

Herb about 60 cm tall epiphytic at base of tree. On 30 cm peaty layer over fine alluvial sand at pathside at top of steep riverbank in forest with *Dacrycarpus* and *Gymnostoma*

regenerating. Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95028.

*Eria pseudoleiophylla* J.J. Wood

Epiphyte 1.5 m up tree. On peaty soil over roots and large sandstone boulders in open, pole-size summit forest and in mossy forest 20 - 25 m tall. Tama Abu Range summit, 1470 m, Pearce, K.G. S 94954; Isolated peak N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 94999.

*Eria robusta* (Blume) Lindl.

Epiphyte 60 cm tall on dead trunk and lithophyte and terrestrial plant to about 50 cm tall. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and in open, mossy forest and on a network of tree roots in open dry scrubby forest about 4 m tall and in swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos* and amidst sandstone boulders with peat between in scrub about 2 m high and in summit vegetation and on ridge. Proposed G. Murud N.P., 2300 m, Yii, P.C. S 44491; Tama Abu Range, 1550 m, Awa, D. S 51109; G. Murud 2370 m, Rena, G. S 60391; G. Murud summit, Julaihi, L. S 80117; Pa Aru, 1200 m, Pearce, K.G. S 94875; Tama Abu Range near summit, 1800 m, Pearce, K.G. S 94985; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95154; G. Murud summit, 2433 m, Pearce, K.G. S 95379; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95455.

*Eria* cf. *saccifera* Hook.f.

Epiphyte. On a ridge in Kerangas forest and in swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos*. On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95184; Route to Tama Abu Range, Sg. Menalio, Pa Dapur, 1000 m, Awa, D. S 51050.

*Eria*?

Ulu Pa Selonok, 1580 m, Pearce, K.G. S 94878.

*Liparis* PTNP 1

Epiphyte about 1 m up tree. In forest 10 - 15 m tall. New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95329.

*Liparis* PTNP 2

Epiphyte low down on tree. On loam covered by 1-2 cm humus in disturbed forest to 30 m tall. Ridge running upstream SW of Long Rusu, 1320 m, Pearce, K.G. S 95921; 0.5 km E of Long Belaban going more or less E, 1160 m, Pearce, K.G. S 95942.

*Liparis* PTNP 3

Epiphyte about 1.5 m up tree and terrestrial herb. In disturbed forest about 4 m tall with scattered taller trees to about 22 m with *Racemobambos* abundant and in peat soil

in open, mossy forest about 25 m tall with abundant *Racemobambos*. New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95317; SE of Plank Walk at junction with trail to Long Belaban, 2130 m, Pearce, K.G. S 96064.

*Liparis anopheles* J. J. Wood

Terrestrial herb 50 cm tall and growing on dead log. Mossy forest, on a ridge. Tama Abu Range, 1550 m, Awa, D. S 51113; From ulu Pa Selonok W towards Tama Abu Range, 1740 m, Pearce, K.G. S 94893.

*Liparis compressa* (Blume) Lindl.

Mossy sub-montane forest. Lepo Bunga, 1750 m, Julaihi, L. S 70863.

*Liparis compressa* (Blume) Lindl. var. *compressa* Blume

Epiphyte. Forest. G. Murud 1710 m, Rena, G. S 60335.

*Nabalua exaltata* de Vogel

Epiphyte on tree trunk 4 m high and on sandstone. Amidst sandstone boulders with peat between in scrub about 2 m high and on rock. G. Murud, 2134 m, Ilias, P. S 26466; G. Murud, 1710 m, Rena, G. S 60371; 2370 m, S 60394; G. Murud summit ridge, 2150 m, Julaihi, L. S 80051, 2100 m, S 80052; G. Murud summit, 2433 m, Pearce, K.G. S 95390.

*Nieuwiedia veratrifolia* Blume

Herb 40 cm tall. On loam in forest 30 m tall. Ridge running upstream SW of Long Rusu, 1180 m, Pearce, K.G. S 95906.

*Oberonia* sp.

Epiphyte. Near stream, riparian forest and Kerangas forest. Sg. Menalio, 950 m, Awa, D. S 51086; Ulu Pa Menalio, 1100 m, Rantai, J. S 94826.

*Phaius tankervilleae* (Banks ex L. Her.) Blume

Terrestrial plant 1.5 m tall. Riverain forest. G. Murud, 1300 m, Rena, G. S 60325.

*Pholidota gibbosa* Lindl. ex de Vriese

Epiphyte about 1 m up tree. On peaty layer 30 cm over fine alluvial sand at pathside at top of steep riverbank in *Agathis* forest with *Dacrycarpus* and *Gymnostoma* regenerating and in open, mossy forest. Route from Ba' Kelalan to G. Murud, near Camp 4, 1920 m, Burt, B.L. B 5390; Pa Aru, 1200 m, Pearce, K.G. S 94874; Confluence of Pa Dapur and Pa Menalio, behind lodge, at top of valley, 1160 m, Pearce, K.G. S 95035, 1080 m, Dennis S 95047.

*Phreatia* sp.

Epiphyte. Riparian forest. Sg. Menalio, route to Tama Abu Range, 950 m, Awa, D. S 51043.

*Podochilus* sp.

*Agathis* forest with *Dacrycarpus*. Confluence of Pa Dapur and Pa Menalio, behind lodge, at top of valley, 1160 m, Pearce, K.G. S 95031, S 95032.

*Podochilus microphyllus* Lindl.

Epiphyte. Riparian Forest. Tama Abu Range, 1250 m, Awa, D. S 51185.

*Podochilus* cf. *tenuis* (Blume) Lindl.

Epiphyte on tree root. On clay covered with 5 cm humus layer in forest about 30 m tall and on clay in open forest about 20 m tall. Going N on ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 94808; NW of Long Belaban, 1260 m, Pearce, K.G. S 95825.

*Robiquetia*?

N of Long Belaban up ridge, 1440 m, Pearce, K.G. S 95814.

*Schoenorchis*

Epiphyte. Alluvial forest 30 m tall and riparian forest. Sg. Menalio, route to Tama Abu Range, 950 m, Awa, D. S 51041; Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95854.

*Thelasis* sp.

Epiphyte on tree 6 m high. On yellow, sandy clay in mossy forest with *Agathis* dominant. Lepo Bunga, 1750 m, Julaihi, L. S 70857.

*Thrixspermum*?

Epiphyte and terrestrial herb. On mossy root, peaty soil in mossy forest 15 - 20 m tall. G. Murud, 1710 m, Rena, G. S 60336; From ulu Pa Selonok W towards Tama Abu Range, 1740 m, Pearce, K.G. S 94889; New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95349.

*Thrixspermum* sp.

G. Murud summit ridge, Helipad, near Church, 2100 m, Julaihi, L. S 80070.

*Thrixspermum* PTNP 2

Epiphyte about 8 m up tree. On clay covered with 5 cm humus layer in forest about 30 m tall. N of Long Belaban up ridge, 1500 m, Pearce, K.G. S 95816.

*Thrixspermum* cf. *borneense* (Rolfe) Ridley

Epiphyte 2 m long, to 2.5 m up tree. On peat soil in open, disturbed forest 10 - 15 m tall and in mossy forest. Tama Abu Range summit, 1800 m, Pearce, K.G. S 94934; New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95325; G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96053.

*Trichoglottis collenetteae* J.J. Wood, C.L. Chan and A. Lamb

Epiphyte 60 cm up tree. Mossy forest 20 - 25 m tall. Tama Abu Range summit, 1470 m, Pearce, K.G. S 94953.

*Trichotosia*

Sg. Menalio, route to Tama Abu Range, 950 m, Awa, D. S 51036; Tama Abu Range, 1550 m, Awa, D. S 51118; G. Murud, 1300 m, Rena, G. S 60327.

*Trichotosia* PTNP 1

Epiphyte about 2 m up tree. On loam covered by 1-2 cm humus in disturbed forest to 27 m tall. 0.5 km E of Long Belaban going more or less E, 1230 m, Pearce, K.G. S 95952.

*Trichotosia* PTNP 2

Terrestrial orchid 1.5 m long. On peat over tree roots with grey sand beneath. S of Pa Menalio, 1220 m, Pearce, K.G. S 93467.

*Trichotosia* PTNP 3

Epiphyte. Forest. G. Murud, 1710 m, Rena, G. S 60343.

*Trichotosia annulata* Blume

Epiphyte about 1 m long. On peat soil over roots on small exposed summit with vegetation about 7 m high. Ridge behind Pa Dapur/Pa Menalio confluence, 1400 m, Pearce, K.G. S 95230.

*Trichotosia* aff. *annulata* Blume

Epiphyte on dead tree 5 m high. Hillside. G. Murud, ulu Sg. Belaban, 1676 m, Ilias, P. S 26353.

*Trichotosia ferox* Blume

Herb 50 cm tall. On rocks and amidst sandstone boulders with peat between in scrub about 2 m high. G. Murud, N side, 2134 m, Burt, B.L. B 5464; G. Murud summit, 2433 m, Pearce, K.G. S 95367.

*Trichotosia poculata* Kraenzl.

Mossy forest, primary forest. G. Murud, path to the top, 1800 m, Nooteboom, H.P. 1946; Lepo Bunga, 1750 m, Julaihi, L. S 70866.

*Trichotosia* cf. *poculata* Kraenzl.

Epiphyte 1.5 m long. In forest 10 - 15 m tall. New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95330.

*Trichotosia*?

Ulu Pa Menalio, 1100 m, Rantai, J. S 94827.

## PANDANACEAE

*Freycinetia kinabaluana* B.C. Stone

G. Murud, path to the top, Nooteboom, H.P. 1939.

*Freycinetia rigidifolia* Hemsl.

Path to G. Murud, Ilias, P. S 26337.

*Pandanus pectinatus* Martelli

Scrambler about 2.5 m long, 5 cm diam. on peat soil in mossy forest 20 m tall with some big *Agathis* trees. Tama Abu Range on the way to the summit, 1580 m, Pearce, K.G. S 94961; On ridge, S part of upper Pa Menalio, 1240 m, Lim, M.T. S 95118.

## POACEAE

*Lophatherum gracile* Brongn.

Herb about 70 cm tall. Above riverbank in disturbed alluvial area with trees 30 m tall and on bank behind river. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93423; Long Rusu along Sg. Dapur up from Long Belaban, 1150 m, Pearce, K.G. S 95885.

*Racemobambos glabra* Holttum

Scrambling bamboo about 5 m long. On sandy soil covered by about 5 cm humus in mossy forest about 18 m tall. On way to Tama Abu Range from ulu Pa Selonok, 1720 m, Pearce, K.G. S 94936.

## SMILACACEAE

*Smilax* PTNP 1

Scrambler 1.5 m long. On peat in open, disturbed forest. By Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96033.

*Smilax* PTNP 2

Erect plant 1.3 m tall. On peaty layer 30 cm over fine alluvial sand at pathside at top of steep riverbank in forest with *Dacrycarpus* and *Gymnostoma* regenerating. Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95026.

*Smilax* PTNP 3

Sprawling vine about 3 m tall. Amidst sandstone boulders with peat between in scrub about 2 m high. G. Murud summit, 2433 m, Pearce, K.G. S 95368.

*Smilax* PTNP 4

Scrambler. On 12 cm peat over clay in pole-sized forest 20 - 25 m tall. W of summit SW of Long Rapung, 1340 m, Pearce, K.G. S 96010.

*Smilax hypoglauca* Benth.

Woody climber 40 cm long. On clay covered with 5 cm humus layer in forest about 30 m tall. NW of Long Belaban, 1260 m, Pearce, K.G. S 95485.

*Smilax lanceifolia* Roxb.

Primary forest. East of mountain, path to the top, 1700 m, Nootboom, H.P. 1936.

*Smilax lanceifolia* Roxb. var. *opaca* A.DC.

Shrub to about 5 m tall. Swampy scrub at edge of cleared area below summit with vegetation about 3 m tall, scattered taller trees and *Racemobambos*. G. Murud, 2400 m, Nootboom, H.P. 1987; Tama Abu Range summit, 1800 m, Pearce, K.G. S 94930; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95162.

## ZINGIBERACEAE

*Alpinia argentea*

Herb to 1.2 m tall. On clay on bank behind river in open forest about 20 m tall. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93417; Going N on ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 94810.

*Alpinia capitellata* Jack

Terrestrial herb to 4 m, in clump. Near stream on slightly disturbed forested slope. Close to Arur Dalan village along trail to Pa Tik, 1150 m, Poulsen, A.D. 1876.

*Alpinia glabra* Ridl.

Herb 1.5 m tall. On 12 cm peat over clay in pole-sized forest 20 - 25 m tall and on clay covered with 5 cm humus layer in forest about 30 m tall and above riverbanks in disturbed alluvial vegetation about 30 m tall and in mossy forest and on a ridge. Tama Abu Range, 1550 m, Awa, D. S 51122; Between Ba' Kelalan and G. Murud, 1650 m, Poulsen, A.D. 1915; From ulu Pa Selonok W towards Tama Abu Range, 1740 m, Pearce, K.G. S 94891; N of Long Belaban up ridge, 1440 m, Pearce, K.G. S 95811; Along ridge running SW, S of tributary of Sg. Rusu, 1160 m, Pearce, K.G. S 95895; W of summit SW of Long Rapung, 1340 m, Pearce, K.G. S 96002.

*Alpinia havilandii* K. Schum.

Terrestrial herb to 1 m. Moist forest understorey. Near saddle point above Arur Dalan towards Pa Tik, 1200 m, Poulsen, A.D. 1866.

*Alpinia nienhuizii* Valet.

Herb 7.5 m tall. Alluvial area above riverbank in disturbed vegetation about 30 m tall. Long Rusu along Sg. Dapur up from Long Belaban, 1150 m, Pearce, K.G. S 95884.



*Alpinia tamacuensis* R.M. Smith

Terrestrial ginger. On summit. Tama Abu Range, 1750 m, Awa, D. S 51139.

*Amomum*

Near Long Repung, near Sg. Debpur, 1180 m, Poulsen, A.D. 1887; New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95341.

*Amomum kinabaluense* R.M. Smith

Terrestrial herb. Forest. Between Ba' Kelalan and G. Murud, 1650 m, Poulsen, A.D. 1900.

*Boesenbergia*

Terrestrial herb to about 0.5 m. 1050 m, Awa, D. S 51096; 1.5 km straight W of Arur Dalan, ridge above Arur Lab valley, 1200 m, Poulsen, A.D. 1867.

*Boesenbergia orbiculata* R.M. Smith

Creeping terrestrial herb. In grazed area near stream. Sg. Menalio, 900 m, Awa, D. S 51085; Close to Arur Dalan village, 1150 m, Poulsen, A.D. 1874.

*Boesenbergia stenophylla* R.M. Sm.

Hill behind Pa Menalio about 1 km from its confluence with Pa Dapur, 1110 m, Pearce, K.G. S 93402.

*Burbidgea* sp.

Lepo Bunga, 1750 m, Julaihi, L. S 70845.

*Burbidgea stenantha* Ridley

Herb 60 cm tall. On peaty layer 30 cm over fine alluvial sand at pathside in forest with *Dacrycarpus* and *Gymnostoma* regenerating. Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95001.

*Elettaria*

Clustering terrestrial herb to 1.2 m tall. On peat soil over clay and roots in open forest 25 m tall, pole-sized with *Tristaniopsis* and *Gymnostoma* and on small hill in intact forest. G. Murud, near Church, summit ridge of mountain, 2100 m, Julaihi, L. S 80095; Lepo Bunga, 1130 m, Julaihi, L. S 80179; Near Long Repung, near Sg. Debpur, 1180 m, Poulsen, A.D. 1886; SW of Long Rapung, just below a summit, 1320 m, Pearce, K.G. S 95989.

*Etlingera*

700 m W of Arur Dalan, 1100 m, Poulsen, A.D. 1844; 1.5 km straight W of Arur Dalan, 1100 m, Poulsen, A.D. 1845; 1.5 km straight W of Arur Dalan, ridge above Arur Lab valley, 1200 m, Poulsen, A.D. 1860, Poulsen, A.D. 1861, Poulsen, A.D. 1871; Near Long Repung, near Sg. Debpur, 1180 m, Poulsen, A.D. 1888; Between Ba' Kelalan and G. Murud, 1650 m, Poulsen, A.D. 1901.

*Etilingera brevilabris* (Val.) R.M. Smith

Terrestrial herb to 2 m. In rather disturbed, grazed forest. 100 m W of Arur Dalan, 1100 m, Poulsen, A.D. 1850.

*Etilingera corrugata* A.D. Poulsen and J. Mood

Terrestrial herb. On wet slopes above stream in forest. Arur Lab, 1200 m, Poulsen, A.D. 1935.

*Etilingera pubescens* (Burt and Smith) R.M. Smith

Terrestrial herb 2-2.5 m. Near old clearing for grazing in moderately disturbed forest. 1.5 km straight W of Arur Dalan, ridge above Arur Lab valley, 1200 m, Poulsen, A.D. 1859.

*Etilingera punicea* (Roxb.) R.M. Smith

Terrestrial herb 8-10 m. In hillside garden on slope near stream. Close to Arur Dalan village along trail to Pa Tik, 1150 m, Poulsen, A.D. 1878.

*Globba atrosanguinea* Teijsm. and Binn.

Herb 40 cm tall. Alluvial forest 30 m tall and on sandy loam covered by 2 cm peat in riverine forest to 25 m tall. Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95085; Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95842.

*Globba brachyanthera* K. Schum.

Herb 40 cm tall. Alluvial forest 30 m tall and on clay by path in oak-laurel-*Syzygium* forest. On hill NW of Bario, 1300 m, Pearce, K.G. S 95150; Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95870.

*Globba franciscii* Ridley

Herb 70 cm tall. On alluvial soil on levee behind river. Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94858.

*Globba muluensis* R.M. Sm. (*ex lit.*)

Herb to 1 m tall. On clay covered with 5 cm humus layer in forest about 30 m tall and in alluvial forest 30 m tall and in open area in oak-laurel-*Syzygium* forest and on loam soil in open forest, about 20 m. Going N on ridge N of Pa Menalio, 1330 m, Pearce, K.G. S 94814; Hill, NW of Arur Dalan, 1320 m, Pearce, K.G. S 95295; N of Long Belaban up ridge, 1360 m, Pearce, K.G. S 95803; Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95831.

*Globba tricolor* Ridley var. *gibbsiae* (Ridley) R.M. Smith

Terrestrial herb less than 0.5 m. Moist forest understorey. Near saddle point above Arur Dalan towards Pa Tik, 1200 m, Poulsen, A.D. 1864.

*Hedychium* sp.

1.5 km straight W or Arur Dalan, valley of Arur Lab, 1100 m, Poulsen, A.D. 1870.

*Hedychium cylindricum* Ridley

Herb 70 cm tall. On alluvial soil on levee behind river and in swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos*. Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94848; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95172.

*Hedychium* cf. *cylindricum* Ridley

Herb 90 cm tall. On peaty soil over roots and large sandstone boulders in open, pole-size summit forest and in mossy forest. From ulu Pa Selonok W towards Tama Abu Range, 1740 m, Pearce, K.G. S 94888; Isolated peak N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 94998.

*Hedychium muluense* R.M. Sm.

Herb about 60 cm tall. In peat soil at edge of temporary pool in Kerangas forest. Near confluence of Pa Menalio and Pa Merakoh, 1150 m, Lim, M.T. S 95228.

*Hedychium* aff. *muluense* R.M. Sm.

Terrestrial herb. In clay soil in forest about 25 m tall. Just below summit SW of Long Rapung, 1230 m, Pearce, K.G. S 96024.

*Hornstedtia*

Trail from Arur Dalan to Pa Tik, 1150 m, Poulsen, A.D. 1862; Between Ba' Kelalan and G. Murud, ridge broad walk to Batu Lianit, 2200 m, Poulsen, A.D. 1903; Trail from Arur Dalan to Pa Tik, 1150 m, Poulsen, A.D. 1863; Arur Lab, 1200 m, Poulsen, A.D. 1938.

*Hornstedtia pininga* (Blume) Val.

Clustered herb about 2 m tall. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos*. On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95196.

*Plagiostachys* PTNP 1

Herb 70 cm tall. Alluvial forest 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95861.

*Plagiostachys bracteolata* R.M. Smith

Terrestrial herb 1.2 m tall and lithophyte on mossy rocks. In swampy scrub at edge of cleared area in vegetation about 3 m tall with scattered taller trees and *Racemobambos* and in open bamboo forest. Between Ba' Kelalan and G. Murud, 1850 m, Poulsen, A.D. 1899; Trail between Church and G. Murud, 2050 m, Poulsen, A.D. 1904; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95197.

*Plagiostachys crocydocalyx* (K. Schum.) B.L. Burtt and R.M. Smith

Terrestrial herb to 4 m. Moderately disturbed secondary forest. Between Ba' Kelalan and G. Murud, near road below Lepo Bungah, 1430 m, Poulsen, A.D. 1907; 1.5 km straight W of Arur Dalan, valley of Arur Lab, 1100 m, Poulsen, A.D. 1869.

*Zingiber*

Lepo Bunga, 1750 m, Julaihi, L. S 78022; Close to Arur Dalan village along trail to Pa Tik, 1150 m, Poulsen, A.D. 1875, Poulsen, A.D. 1877.

*Zingiber* sp. C (*sensu* R.M. Smith)

Herb to 2 m tall. Alluvial forest 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95838, S 95847.

*Zingiber incomptum* B.L. Burtt and R.M. Smith

Terrestrial herb to 2 m. Secondary forest matured for 40 years. Near Sg. Debpur, 1180 m, Poulsen, A.D. 1884.

*Zingiber kelabitianum* Theilade and Christansen

Terrestrial herb to about 1.5 m. Wet place near stream 1.5 km straight W of Arur Dalan, ridge above Arur Lab valley, 1100 m, Poulsen, A.D. 1868.

*Zingiber pseudopungens* R.M. Sm.

Herb 2.5 m tall. Open area in oak-laurel-*Syzygium* forest and in mossy forest. From ulu Pa Selonok W towards Tama Abu Range, 1580 m, Pearce, K.G. S 94886; Hill NW of Arur Dalan, 1320 m, Pearce, K.G. S 95297.

## Gymnosperms

### ARAUCARIACEAE

*Agathis endertii* Meijer Drees

Tree 13 m tall, 10 cm diam. In scattered scrub at edge of swampy, cleared area with *Racemobambos* and taller trees. On trail from Church Camp to G. Murud, 2060 m, Pearce, K.G. S 95301.

*Agathis kinabaluensis* D.J. de Laubenfels

Tree to 10 m tall, 30 cm diam. In shrubby top vegetation just below summit and in mossy forest. G. Murud, 2400 m, Nooteboom, H.P. 2013; G. Murud N.P., 2300 m, Yii, P.C. S 44461.

*Agathis lenticula* D.J. de Laubenfels

Tree 40 m tall, 75 cm diam. On ridge. G. Murud, 1250 m, Rena, G. S 61095.

## PODOCARPACEAE

*Dacrycarpus imbricatus* (Blume) D.J. de Laubenfels

Tree 28 m tall, 25 cm diam. On loam in forest 30 m tall 1200 m, Yii, P.C. S 44683; Ridge running upstream SW of Long Rusu, 1180 m, Pearce, K.G. S 95903.

*Dacrycarpus steupii* (Wasscher) D.J. de Laubenfels

Fallen tree. On peat soil in open, disturbed forest. G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96035.

*Dacrydium xanthandrum* Pilger

Tree to 11 m tall, 25 cm diam. On thick humus on sandstone formation in mossy forest and in scrubby vegetation about 1.5 m tall with scattered *Dacrydium* to 3+ m and at and near sandstone summit and on ridge. G. Murud, 2420 m, Anderson, J.A.R. S 26471; Ba' Kelalan to G. Murud, above Camp 4, 2134 m, Burt, B.L. B 5355; G. Murud, near Camp, 2149 m, Ilias, P. S 26505; G. Murud N.P. 2200 m, Yii, P.C. S 44608; G. Murud, summit, 2400 m, Julaihi, L. S 80012; G. Murud, below Kebun Batu, 2200 m, Pearce, K.G. S 95427.

*Phyllocladus hypophylla* Hook.f.

Tree 11 m tall, 5 cm diam. On thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall and in peat over mossy tree roots in mossy forest 15 - 25 m tall on or near sandstone summit. G. Murud, near Camp 5, Ilias, P. S 26509; G. Murud N.P., 2250 m, Yii, P.C. S 44440, 2200 m, S 44607; S of Pa Dapur/Pa Menalio confluence, 1300 m, Pearce, K.G. S 95049; About 0.5 km SW of N3° 33.5', E115° 23.9', 1400 m, Pearce, K.G. S 95256.

*Podocarpus* sp.

G. Murud summit ridge, 2150 m, Julaihi, L. S 80022.

*Podocarpus borneensis* D.J. de Laubenfels

Treelet 2 m tall, 2.5 cm diam. Near river. G. Murud, 2103 m, Ilias, P. S 26468.

*Podocarpus laubenfelsii* S.K.K. Tiong

Tree about 28 m tall, about 50 cm diam. On peat at least 15 cm deep in forest to 25 m tall and on ridge summit. Pa Selunok, ulu Pa Menalio, 1220 m, Pearce, K.G. S 93445.

## Pteridophytes

### ADIANTACEAE

*Syngamma* cf. *alismifolia* (C. Presl) J. Sm.

On 30 cm peat over fine alluvial sand at pathside with *Dacrycarpus* and *Gymnostoma* regenerating. Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95014.

*Syngamma wallichii* (Hook.) Bedd.

Primary forest. Belapan River - Dapo River, 1100 m, Nootboom, H.P. 1846.

*Taenitis blechnoides* (Willd.) Sw.

Herb 1 m tall. On 30 cm peat over fine alluvial sand at pathside in *Agathis* forest with *Dacrycarpus* and *Gymnostoma* regenerating and on clay covered with humus. At top of steep bank along Pa Menalio, behind its confluence with Pa Dapur, 1160 m, Pearce, K.G. S 95045; N of Long Belaban up ridge, 1360 m, Pearce, K.G. S 95804.

### ASPLENIACEAE

*Asplenium* sp.

NW of Long Belaban, 1260 m, Pearce, K.G. S 95486.

*Asplenium excisum* C. Presl.

Herb 20 cm tall. Alluvial forest about 30 m tall. Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95859.

*Asplenium normale* G. Don

Herb about 35 cm tall. On clay covered with humus in forest about 30 m tall. N of Long Belaban up ridge, 1360 m, Pearce, K.G. S 95806.

### CHEIROPLEURIACEAE

*Cheiropleuria bicuspis* (Blume) C. Presl

Herb. On 12 cm peat over clay among pole-sized trees 20 - 25 m tall. W of summit SW of Long Rapung, 1340 m, Pearce, K.G. S 96013.

## CYATHEACEAE

### *Cyathea*

Tama Abu Range on the way to the summit, 1600 m, Pearce, K.G. S 94973; Along ridge running SW, S of tributary of Sg. Rusu, 1160 m, Pearce, K.G. S 95898.

### *Cyathea* PTNP 1

Herb 3 m to top of shaft. By stream and on exposed sandstone rocks criss-crossed by roots covered with moss and peat and in open vegetation with scattered, crooked trees to about 12 m tall and on peat in open, mossy forest about 25 m tall with abundant *Racemobambos* and on bank behind river. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93415; New trail to G. Murud just past junction with old trail, 2012 m, Pearce, K.G. S 95336; SE of Plank Walk at junction with trail to Long Belaban, 2130 m, Pearce, K.G. S 96067.

### *Cyathea moluccana* R. Br.

In damp gully. Camp 4, 1920 m, Burt, B.L. B 5379.

## DAVALLIACEAE

### *Humata subvestita* (C. Chr.) Parris

Epiphyte on fallen trunk. On clay in open forest about 20 m tall. Going N on ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 94805.

## DENNSTAEDTIACEAE

### Genus unknown

Ridge running upstream SW of Long Rusu, 1650 m, Rantai, J. S 95935.

### *Lindsaea* PTNP 1

Terrestrial herb. On clay in open forest about 20 m tall. Going N on ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 94801.

### *Lindsaea* PTNP 2

Terrestrial herb. On clay in open forest about 20 m tall. Going N on ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 94803.

### *Lindsaea* cf. *parasitica* (Roxb. ex Griffith) Hieron.

Epiphyte. Just below summit in elfin forest. Tama Abu Range near summit, 1800 m, Pearce, K.G. S 94990.

*Odontosoria chinensis* (L.) J. Sm.

In disturbed area. G. Murud near Church Camp, 2012 m, Pearce, K.G. S 95357.

*Tapeinidium* sp.

Terrestrial herb 60 cm tall. On loam in forest 30 m tall and on peat in pole forest with *Agathis*. Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1300 m, Pearce, K.G. S 95225; Ridge running upstream SW of Long Rusu, 1180 m, Pearce, K.G. S 95905.

## DICKSONIACEAE

Genus unknown

On rocky riverside. 0.5 km up Pa Menalio from its confluence with Pa Dapur, 1150 m, Pearce, K.G. S 95269.

## DIPTERIDACEAE

*Dipteris conjugata* Reinw.

Herb about 1.3 m tall. On peat soil over roots on small exposed summit with forest about 7 m tall. Ridge behind Pa Dapur/Pa Menalio confluence, 1400 m, Pearce, K.G. S 95231.

*Dipteris lobbiana* (Hook.) T. Moore

On riverbank in primary forest. Belapan River - Dapo River, 1100 m, Nooteboom, H.P. 1853.

## GRAMMITIDACEAE

*Ctenopteris brevivenosa* (Alderw.) Holttum

Second summit, 2240 m, Julaihi, L. S 80154

*Grammitis reinwardtii* Blume

Epiphyte 1 m up mossy trunk. On peat in 25 m tall, open, mossy forest with abundant *Racemobambos*. SE of Plank Walk at junction with trail to Long Belaban, 2020 m, Pearce, K.G. S 96071.

*Prosaptia alata* (Blume) H. Christ.

Epiphyte on fallen branch and at base of tree trunk. In alluvial forest 30 m tall and in mossy forest and on clay in *Tristaniopsis* forest. Belapan River - Dapo River, Nooteboom, H.P. 1834; G. Murud summit ridge, way to 2<sup>nd</sup> summit, 2100 m, Julaihi, L. S 80169; On ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 93499; Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95846.



*Prosaptia burbidgei* (Baker) Parris

Tama Abu Range on the way to the summit, 1580 m, Pearce, K.G. S 94959.

*Prosaptia contigua* (G. Forst) C. Presl

Epiphyte 40 cm tall. On peat in mossy forest 20 m tall. Tama Abu Range on the way to the summit, 1580 m, Pearce, K.G. S 94962.

*Prosaptia obliquata* (Blume) Mett.

Epiphyte. At base of tree and on clay in open forest about 20 m tall. Going N on ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 94802.

*Scleroglossum pusillum* (Blume) Alderw.

Herb. On a network of tree roots in open dry scrubby forest about 4 m tall. Tama Abu Range near summit, 1800 m, Pearce, K.G. S 94981.

*Scleroglossum pyxidatum* Alderw.

Epiphyte about 1 m up tree. On thick peat and tree roots in dry ridge forest and in about 4 m tall vegetation with large sandstone rocks and on exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m. Pa Menalio, about 0.5 km SW of N3°33.5', E115°23.9', 1400 m, Pearce, K.G. S 95250; False Summit on route to Church Camp, 2248 m, Pearce, K.G. S 95459.

*Scleroglossum sulcatum* (Kuhn) Alderw.

Epiphyte 1.5 m up tree. On bank behind river. Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93422.

*Xiphopteris hieronymusii* (C. Chr.) Holttum

Epiphyte. On fallen trunk and on clay in open forest about 20 m tall and on 12 cm peat over clay in pole forest 20 - 25 m tall. Going N on ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 94806; W of summit SW of Long Rapung, 1340 m, Pearce, K.G. S 96007.

## **HYMENOPHYLLACEAE**

Genus unknown

SE of Plank Walk at junction with trail to Long Belaban, 2020 m, Pearce, K.G. S 96081.

*Macroglena meifolia* (Bory ex Willd.) Copel.

Epiphyte on log. On peat in open, mossy forest about 25 m tall with abundant *Racemobambos*. SE of Plank Walk at junction with trail to Long Belaban, 2020 m, Pearce, K.G. S 96073.

*Meringium* sp.

About 1 m up mossy trunk. On peat in open, mossy forest about 25 m tall with abundant *Racemobambos*. SE of Plank Walk at junction with trail to Long Belaban, 2130 m, Pearce, K.G. S 96070.

*Pleuromanetes* cf. *pallidum* (Blume) C. Presl.

1 m up mossy tree trunk. On peat in open, mossy forest about 25 m tall with abundant *Racemobambos*. SE of Plank Walk at junction with trail to Long Belaban, 2020 m, Pearce, K.G. S 96080.

## LOMARIOPSIDACEAE

*Elaphoglossum* sp.

Epiphyte 2 m up trunk. On peat in mossy forest 20 m tall. G. Murud summit ridge, way to 2<sup>nd</sup> summit, 2100 m, Julaihi, L. S 80168; Tama Abu Range on the way to the summit, 1580 m, Pearce, K.G. S 94968.

## LYCOPODIACEAE

*Huperzia*

S of Pa Dapur/Pa Menalio confluence, 1300 m, Pearce, K.G. S 95056; NW of Long Belaban, 1320 m, Pearce, K.G. S 95493.

*Huperzia laxa* (Presl) T. Sen and U. Sen

Primary forest. G. Murud East, path to the top, 1700 m, Nooteboom, H.P. 1934.

*Huperzia phlegmaria* (L.) Rothm.

Epiphyte at up to 1.5 m high and lithophytic herb 60 cm long. On clay covered with 5 cm humus layer in forest about 30 m tall and in peaty soil over roots and large sandstone boulders in open, pole-size summit forest and in riparian forest. Route to Tama Abu Range, 950 m, Awa, D. S 51044; Isolated peak N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 94997; N of Long Belaban up ridge, 1500 m, Pearce, K.G. S 95823.

## MATTONIACEAE

*Mattonia* aff. *pectinata* R.Br.

Herb about 1 m tall. On peat over roots in forest about 7 m tall on small exposed summit. Ridge behind Pa Dapur/Pa Menalio confluence, 1400 m, Pearce, K.G. S 95232.

## OLEANDRACEAE

### *Oleandra* PTNP 1

Woody-stemmed herb to 1.5 m tall. On exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and on Kerangas soil in open vegetation to about 7 m tall and in peat at least 15 cm deep in forest up to 25 m and at top of ridge. Pa Selunok, ulu Pa Menalio, 1220 m, Pearce, K.G. S 93442; False Summit on route to Church Camp, 2215 m, Pearce, K.G. S 95467; Summit SW of Long Rapung, 1320 m, Pearce, K.G. S 95998.

## OPHIOGLOSSACEAE

### *Ophioglossum* sp.

Epiphyte on tree trunk 4 m high and terrestrial herb 40 cm tall. In peat over mossy tree roots in mossy forest 15 - 25 m tall and on yellow, sandy clay in mossy forest with *Agathis* dominant. Lepo Bunga, 1750 m, Julaihi, L. S 70879; S of Pa Dapur/Pa Menalio confluence, 1300 m, Pearce, K.G. S 95057.

## POLYPODIACEAE

### *Belvisia* sp.

Epiphyte on fallen tree. On clay soil in open forest about 20 m tall. Going N on ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 94804.

### *Paragramma longifolia* (Blume) T. Moore

Epiphyte 4 m up tree. On sandy loam covered by 2 cm peat in riverine forest to 25 m. Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95087.

### *Selliguea* sp.

N of Long Belaban up ridge, 1500 m, Pearce, K.G. S 95818.

### *Selliguea* PTNP 1

Epiphyte about 2 m up tree. Above riverbank in disturbed alluvial vegetation about 30 m tall. Long Rusu along Sg. Dapur up from Long Belaban, 1150 m, Pearce, K.G. S 95881.

### *Selliguea* PTNP 2

Epiphyte. On clay covered with 5 cm humus layer in forest about 30 m tall. N of Long Belaban up ridge, 1360 m, Pearce, K.G. S 95807.

*Selliguea albidopaleata* (Copel.) Parris

Terrestrial, to 10 cm long. G. Murud Summit, 2240 m, Pearce, K.G. S 80147; False Summit on route to Church Camp, 2215 m, Pearce, K.G. S 95461.

*Selliguea* cf. *platyphylla* (Sw.) Ching

Epiphyte on fallen log. On loam covered by 1-2 cm humus in disturbed forest 27 m tall. 0.5 km E of Long Belaban going more or less E, 1300 m, Pearce, K.G. S 95963.

*Selliguea* cf. *soridens* (Hook.) Parris

Epiphyte on branch. On thick peat and tree roots in dry ridge forest and with large sandstone rocks in forest about 4 m tall. About 0.5 km SW of N3<sup>o</sup> 33.5', E115<sup>o</sup> 23.9', 1400 m, Pearce, K.G. S 95253.

*Selliguea sri-ratu* Hovenkamp

Epiphyte 50 cm up tree. On clay covered with 5 cm humus layer in forest about 30 m tall. N of Long Belaban up ridge, 1440 m, Pearce, K.G. S 95808.

*Selliguea triloba* (Houtt.) M.G. Price

G. Murud, below Kebun Batu, 2200 m, Pearce, K.G. S 95423.

## SCHIZAEACEAE

*Schizaea* sp.

Shrubby top vegetation on thick peat layers. G. Murud, 2400 m, Nooteboom, H.P. 2064.

## THELYPTERIDACEAE

*Coryphopteris* sp.

Herb. In crevice beneath root and on exposed peat soil and white sandstone boulders on exposed summit surrounded by ericaceous scrub 1 - 1.5 m tall and scattered *Dacrydium* and *Leptospermum* to 4.5 m and on peat soil in open, disturbed forest. False Summit on route to Church Camp, 2215 m, Pearce, K.G. S 95462; G. Murud, by Plank Walk at top of trail from Lepo Bunga to Church Camp, 2130 m, Pearce, K.G. S 96057.

*Coryphopteris*?

False Summit on route to Church Camp, 2215 m, Pearce, K.G. S 95463.

*Pronephrium* cf. *repandum* (Fee) Holttum

Herb. On loam in forest 30 m tall. Ridge running upstream SW of Long Rusu, 1250 m, Pearce, K.G. S 95909.

## VITTARIACEAE

*Antrophyum* sp.

Epiphyte 2.5 m up tree. Above riverbank in disturbed alluvial vegetation about 30 m tall. Along ridge running SW, S of tributary of Sg. Rusu, 1160 m, Pearce, K.G. S 95897.

## WOODSIACEAE

*Diplazium* cf. *bantamense* Blume

Terrestrial herb. On clay covered with 5 cm humus layer in forest about 30 m tall. N of Long Belaban up ridge, 1500 m, Pearce, K.G. S 95822.

*Diplazium* cf. *crenatoserratum* (Blume) T. Moore

Herb 60 cm tall. On clay covered with 5 cm humus layer in forest about 30 m tall. N of Long Belaban up ridge, 1360 m, Pearce, K.G. S 95805.

## Bryophyte

Genus unknown

On peat soil in pole forest with *Agathis*. Towards summit about 3 km N of Pa Menalio/ Pa Batang Aru confluence, 1640 m, Lim, M.T. S 95217.

## Appendix 3b: Checklist of Plants of Pulong Tau National Park with Ethnobotanical Uses

### Angiosperms – Dicotyledons

## ANNONACEAE

*Artabotrys* sp.

Apub bara [Lun Bawang]

Lun Bawang: To treat serious swelling caused by sabotage by a certain type of plant hidden in one's shoe or placed under the strap of one's carrying basket ('bekang'), take the stem of this plant, burn to charcoal and mix with oil and apply to the affected part. NW of Long Belaban, 1320 m, Pearce, K.G. S 95489.

*Fissistigma manubriatum* (J.D. Hook. and Thompson) Merr.

Sebului puan [Penan]

Kelabit: To treat swelling and cramp caused by people who sabotage others using magic ('ilmu') burn the root and sweep the smoke over the affected part from the top downwards; rub the charcoal on the affected part.

Penan: To treat stomachache crush root, boil and drink water. S of Pa Menalio, 1220m, Pearce, K.G. S 93457.

*Friesodielsia* cf. *biglandulosa* (Blume) Steenis

Lapad akos [Lun Bawang]

Lun Bawang: As a remedy for wasting disease e.g. of leg due to sabotage by a certain type of plant hidden in one's shoe or clothing, burn the stem and let the smoke reach the affected part, then take the charcoal from the burnt stem, mix with oil and apply to the affected part from the top downwards.

NW of Long Belaban, 1260 m, Pearce, K.G. S 95487.

*Goniothalamus fasciculatus* Boerl.

Buwau [Kelabit]; Buhau paya [Penan]

Kelabit/Penan: Sick dogs (coughing or cannot smell) can be treated with scraped-off bark in water.

Penan: As a remedy for headache or stomachache eat leaves and bark.  
Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94847.

*Goniothalamus umbrosus* J. Sinc.

Buau [Kelabit]; Getimang [Penan]

Kelabit: If a dog is sick crush skin, cook and put in dog food.

Penan: (i) To treat stings crush bark and apply; (ii) To treat stomachaches scrape bark, boil with water and drink.

On ridge N of Pa Menalio, 1190 m, Pearce, K.G. S 93490.

## APOCYNACEAE

*Alyxia angustifolia* Ridl.

War kelawit [Kelabit]; Lakar [Penan]

Penan: To make a dog bark, dry leaves, put in dog's nose.

On ridge N of Pa Menalio, 1190 m, Pearce, K.G. S 93489.

*Alyxia palawanensis* F. Markgraf

Peruat [Lun Bawang]

Lun Bawang: To treat suspected poisoning. If you suspect you have been poisoned chew the stem and it will not taste bitter (as it normally does). Swallow the stem and it will cause you to vomit out the poison.

NW of Long Belaban, 1320 m, Pearce, K.G. S 95494.

*Anodendron?*

Lakar [Penan]

Penan: To make dogs fierce rub their nose and teeth with the exudate.

S of Pa Dapur/Pa Menalio confluence, 1370 m, Pearce, K.G. S 95068.

## ARALIACEAE

*Schefflera cf. remotiserrata* Merr.

Rukang [Lun Bawang]

Lun Bawang: To treat scabies ('kudis') burn leaves and apply.

On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95179, S 95180;  
False summit on route to Church Camp, 2248 m, Pearce, K.G. S 95444; NW of Long  
Belaban, 1260 m, Pearce, K.G. S 95479.

## BEGONIACEAE

*Begonia* PTNP 3

Penan: Leaves can be eaten.

Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce,  
K.G. S 95079; 0.5 km E of Long Belaban going more or less E, 1300 m, Pearce, K.G.  
S 95964.

*Begonia* aff. *chlorocarpa* Irmscher ex Sands

Tuna kecha [Lun Bawang]

Lun Bawang: To make a dog bark and chase wild boar burn the plant and put into dog's rice.  
Long Belaban, 1143 m, Pearce, K.G. S 95826.

## CECROPIACEAE

*Poikilospermum scabrinervium* (Barg.-Petr.) Merr.

Rirup [Lun Bawang]

Lun Bawang: Young shoots (red) can be cooked as vegetable.

Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95839.

## CLUSIACEAE

*Calophyllum cf. nodosum* Vesque

Betaurr [Kelabit]; Kutun, Tegelem [Penan]

Kelabit: Wood good for making houses and for house posts.

Penan: (i) Firewood; (ii) Birds and squirrels eat the fruit.

S of Pa Menalio, 1220 m, Pearce, K.G. S 93465; On ridge N of Pa Menalio, 1190 m,  
Pearce, K.G. S 93487.

*Garcinia* sp.

Kesi, Ale takang [Kelabit]

Kelabit/Penan: Fruit edible, sweet.

Confluence of Pa Dapur and Pa Menalio, behind lodge, 1150 m, Pearce, K.G. S 95016.

*Garcinia trianii* Pierre

Bua kechi [Lun Bawang]; Bua tepusang [Penan]

Penan: Fruit good to eat.

0.5 km E of Long Belaban going more or less E, 1160 m, Pearce, K.G. S 95953.

*Garcinia* cf. *trianii* Pierre

Bua abpul [Kelabit]; Terpusang [Penan]

Penan: People and animals eat the fruit.

Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 95215.

## CONVOLVULACEAE

*Erycibe* sp.

Uduh bakaraya [Lun Bawang]

Lun Bawang: (i) To treat dogs that only want to chase small pigs to make them look for big pigs take the end of a shoot of this climber that is growing pointed downhill, take stem, burn and take charcoal and mix with dog's rice. However, the pig must be shot not killed with a parang or the pig will bite the dog to death.

(ii) To detect poisoned food items take and dry a piece of the stem and place under the food or drink served to one. If any item has been poisoned that item will become spoiled and inedible. A glass containing poisoned drink can break.

NW of Long Belaban, 1320 m, Pearce, K.G. S95491.

## CRYPTERONIACEAE

*Axinandra* aff. *coriacea* Baill.

Mara lam [Kelabit]; Guhum [Penan]

Kelabit: Bark beaten in water to poison fish.

Penan: Bears eat fruit.

On ridge N of Pa Menalio, 1190 m, Pearce, K.G. S 93491.

## ELAEOCARPACEAE

*Elaeocarpus* PTNP 1

Sepungan [Penan]

Penan: (i) Fruit can be used as fish bait; (ii) Birds eat the fruit.



Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95098.

## ERICACEAE

*Vaccinium* PTNP 1

Tegkang; Lakar [Kelabit, Penan]

Kelabit: To make dogs bark dry leaves, crush and mix with dog food.

On the way to the summit, Tama Abu Range, 1580 m, Pearce, K.G. S 94967.

*Vaccinium laurifolium* (Blume) Miq.

Merading [Penan]; Onei [Lun Bawang]

Penan: Firewood.

S of Pa Menalio, 1220 m, Pearce, K.G. S 93461; Summit SW of Long Rapung, 1320 m, Pearce, K.G. S 95991.

## EUPHORBIACEAE

*Antidesma* cf. *neurocarpum* Miq.

Lapad eetuk dalam [Lun Bawang]

Lun Bawang: For prevention of sabotage by other plants ('penakis') keep a piece of stem in clothes or in the latex on one's parang.

Ridge running upstream SW of Long Rusu, 1350 m, Pearce, K.G. S 95929.

*Baccaurea* cf. *lanceolata* (Miq.) Muell.-Arg.

Bua pika, Buah lipau [Lun Bawang]

Lun Bawang: (i) Fruit is sour and can be used to cook with fish; (ii) Ripe fruit can be eaten.

Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95841, S 95849.

*Homalanthus grandifolius* Ridley

Kang lau [Lun Bawang]

Lun Bawang: Used to feed young deer ('kijang', 'pelandok', 'rusa').

On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95174;

*Macaranga angulata* S.J. Davies

Kayu belasing [Kelabit]; Blasing/Binasing [Lun Bawang]; Benua [Penan]

Kelabit: Firewood.

Summit, Tama Abu Range, 1470 m, Pearce, K.G. S 94956.

## FAGACEAE

*Lithocarpus pulcher* (King) Markg.

Salad uru [Lun Bawang]; Tekalad palan [Penan]

Lun Bawang/Penan: (i) For house posts - lasting; (ii) Wild boar eat the fruits.

0.5 km E of Long Belaban going more or less E, 1300 m, Pearce, K.G. S 95959.

## GESNERIACEAE

*Aeschynanthus magnifica* Stapf

Busak pelakad [Lun Bawang]

A husband who wants another girl puts flower beneath wife's pillow so that she does not want him any more.

On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95157.

## ICACINACEAE

*Stemonorus?*

Kayu merat dara [Lun Bawang]

Lun Bawang: To cure passing blood or vomiting blood chop the root, boil and drink the water. This remedy has recently been found effective with nosebleeds and menstruation that does not stop.

NW of Long Belaban, 1340 m, Pearce, K.G. S 95492.

## JUGLANDACEAE

*Engelhardtia* aff. *serrata* Blume

Kayu feir [Lun Bawang]; Ranga [Penan]

Lun Bawang: (i) Makes good quality planks; (ii) Formerly the bark was stripped off and used for the roof of a cooking area.

0.5 km E of Long Belaban going more or less E, 1300 m, Pearce, K.G. S 95960.

## LAURACEAE

*Actinodaphne percoriacea* S. Julia

Sepungan [Penan]

Penan: To treat 'ipoh' (*Antiaris toxicaria*) poisoning, crush the bark and apply to the affected place (other 'sepungan' which have a smell can also be used).

On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95175.

*Actinodaphne pruinosa* Nees

Sepungan [Penan]

Penan: To treat 'ipoh' (*Antiaris toxicaria*) poisoning, crush the bark and apply to the affected place (other 'sepungan' which have a smell can also be used).

On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95176; SE of plank walk at junction with trail to Long Belaban, 2020 m, Pearce, K.G. S 96072.

*Actinodaphne sulcata* S. Julia var. *longipetiolata* S. Julia

Sepungan ja'au [Penan]

Penan: To treat 'ipoh' (*Antiaris toxicaria*) poisoning crush the bark and apply to the affected place (other 'sepungan' which have a smell can also be used).

On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95200.

*Cinnamomum* spp.

Boot, But [Penan]; Pegerong, Tabar [Lun Bawang]

Lun Bawang: To treat wind in stomach boil the root and drink the water;

Penan: (i) To treat insect sting pound petiole and apply to place stung; (ii) To treat stomachache chew petiole.

Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93413; NW of Long Belaban, 1260 m, Pearce, K.G. S 95484; Ridge running upstream SW of Long Rusu, 1180 m, Pearce, K.G. S 95902.

*Cryptocarya*?

Sepungan [Penan]

Penan: Wood good for making perahu and planks.

On ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 93495; W of Summit SW of Long Rapung, 1340 m, Pearce, K.G. S 96011.

*Litsea* cf. *aban-gibotii* Ng

Penan: People and squirrels can eat the sour fruit

New trail to G. Murud just past junction with old trail, 2058 m, Pearce, K.G. S 95327.

*Litsea* cf. *accedens* (Blume) Boerl. var. *accedens*

Sepungan [Penan]

Penan: Antidote ('penawar') for 'ipoh' (*Antiaris toxicaria*) poison. If you lay a carcass on these leaves the next time you use blowpipe poison it has no effect.

0.5 km E of Long Belaban going more or less E, 1230 m, Pearce, K.G. S 95951.

*Litsea sessiliflora* Hook.f. var. *sessiliflora*

Sarobaya [Lun Bawang]

Lun Bawang: If a dog or pig is not eating well take the bark and pound and mix with the animal's food.

NW of Long Belaban, 1320 m, Pearce, K.G. S 95490; Ridge running upstream SW of Long Rusu, 1320 m, Pearce, K.G. S 95924.

## LOGANIACEAE

*Fagraea stenophylla* Becc. ex Merr.

Kenyatong Ba' [Penan]

Penan: To treat backache pluck leafy shoots, warm by fire and lie down on them.  
Confluence of Pa Menalio and Pa Aru, 1200 m, Pearce, K.G. S 94834; By Pa Menalio close to its confluence with Pa Dapur, 1160 m, Pearce, K.G. S 95038.

## MAGNOLIACEAE

*Magnolia maingayi* King

Temabar apad [Kelabit]; Kayu Ba'oh [Penan]

Penan: (i) Firewood; (ii) Squirrels eat fruits.

Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95279.

## MELASTOMATACEAE

*Melastoma sanguineum* Sims

Sekeli [Lun Bawang]; Siang [Kelabit, Penan]

Kelabit/Penan: To stop bleeding chew leaves and place on cut.

Lun Bawang/Penan: To stop bleeding crush leaf and apply to wound.

Lun Bawang (i) If wound doesn't stop bleeding heat wood in fire and apply so flesh is burnt; (ii) To kill worms in a wound on a buffalo chew and apply young shoots.

Tama Abu Range on route to summit, 1800 m, Pearce, K.G. S 94993; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95187; Below Kebun Batu, G. Murud, 2300 m, Pearce, K.G. S 95408.

*Melastoma cf. sanguineum* Sims

Skeli [Lun Bawang]; Siang [Penan]

Lun Bawang: Use flowering branch to hit a man who has used a charm to attract a girl.

By plank walk at top of trail from Lepoh Bunga to Church Camp, G. Murud, 2130 m, Pearce, K.G. S 96028.

*Memecylon aff. argenteum* K. Bremer

Ubur [Kelabit]

Iban: Wood hard, used for pole for boat.

By Pa Menalio close to its confluence with Pa Dapur, 1160 m, Pearce, K.G. S 95037.

*Memecylon scolopacinum* Ridley

Semerar [Kelabit]; Ubah [Lun Bawang]; Merading, Ubur [Penan]

Kelabit/Penan: Wood good for boat paddle and punting pole.

Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94857; Just below summit SW of Long Rapung, 1240 m, Pearce, K.G. S 96022.

*Sonerila cf. crassiuscula* Stapf

Bunga; Selega buang [Kelabit, Penan]

Penan: Children rub the leaf to make their hands red for fun.

Tama Abu Range near summit, 1800 m, Pearce, K.G. S 94983; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95158; False summit on route to Church Camp, 2215 m, Pearce, K.G. S 95471; SE of plank walk at junction with trail to Long Belaban, 2020 m, Pearce, K.G. S 96075.

## MELIACEAE

*Aglaia tomentosa* Teijsm. and Binn. ssp. *tomentosa*

Bua punyau [Penan]

Penan: (i) Firewood; (ii) Squirrels and monkeys can eat the fruit but humans cannot. 1150 m, Pearce, K.G. S 94866.

## MENISPERMACEAE

*Arcangelisia flava* (L.) Merr.

Ipak [Kelabit]; Mukai [Penan]

Kelabit/Penan: Leaves dried, pounded and used in cooking as monosodium glutamate-type flavour-enhancer.

S of Pa Menalio, 1220 m, Pearce, K.G. S 93478; Ulu Pa Selonok, 1580 m, Pearce, K.G. S 94884.

*Arcangelisia cf. flava* (L.) Merr.

Ipa [Lun Bawang]

Lun Bawang: (i) Dry leaves, blend and cook with bamboo shoots as flavouring (like monosodium glutamate); (ii) If challenged to a drinking competition chew the stem first and you will not be affected by the drink.

NW of Long Belaban, 1320 m, Pearce, K.G. S 95488.

## MORACEAE

*Ficus deltoidea* Jack var. *recurvata* Kochummen

Ubur paya [Kelabit]; Nonok [Penan]

Kelabit/Penan: Remedy for high blood pressure: boil leaves and drink the water.

Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94853.

## MYRSINACEAE

*Ardisia synneura* Scheff.

Dedurr [Kelabit]; Ngiratai, Nyeratai [Penan]

Kelabit: (i) Fruit used for making juice by pounding it in a bamboo. (ii) Birds eat the fruit.

Penan: Children eat ripe (black) fruits for fun.

On ridge N of Pa Menalio, 1300 m, Pearce, K.G. 93496; S of Pa Dapur/Pa Menalio confluence, 1300 m, Pearce, K.G. S 95061.

*Embelia* PTNP 1

Bua ilang [Lun Bawang]

Lun Bawang: Fruit eaten.

Nearly at G. Murud summit, 2430 m, Pearce, K.G. S 95393.

## MYRTACEAE

*Decaspermum fruticosum* Forst.

Kayu beliput [Kelabit]; Ubah [Penan]

Kelabit: Fruits can be eaten.

Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95286.

*Leptospermum flavescens* Sm.

Kayu onei [Kelabit]; Ubah [Penan]

Penan: Firewood.

Tama Abu Range near summit, 1800 m, Pearce, K.G. S 94980; G. Murud summit, 2433 m, Pearce, K.G. S 95382; False summit on route to Church Camp, 2248 m, Pearce, K.G. S 95458.

*Syzygium brachyrachis* Merr. and Perry

Uburr [Kelabit, Lun Bawang]; Ubah [Penan]

Kelabit/Penan: Firewood.

Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94835; Long Rusu along Sg Dapur up from Long Belaban, 1150 m, Pearce, K.G. S 95882.

*Syzygium kalahiense* Korth.

Uburr [Kelabit]; Ubah [Penan]

Penan: (i) Firewood; (ii) Fish, animals eat the fruit. People can eat it for fun.

S of Pa Menalio, 1220 m, Pearce, K.G. S 93469; On ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 93494; S of Pa Dapur/Pa Menalio confluence, 1370 m, Pearce, K.G. S 95074.

*Syzygium steenisii* Merr. and Perry

Ubur, Ubur paya [Kelabit]; Ubah, Ubah paya [Penan]

Penan: Firewood.

Tama Abu Range summit, 1800 m, Pearce, K.G. S 94917, near summit, 1800 m, Pearce, K.G. S 94986.

## NEPENTHACEAE

*Nepenthes reinwardtiana* Miq.

Sepiung, Spiung [Kelabit]; Telongan bechok [Lun Bawang]; Telor medok [Penan]

Kelabit: Used to cook rice.

Lun Bawang: Can cook rice in the pitcher of this species.

Penan: To treat dog with itch crush stem, mix with water, bathe dog; (ii) To treat itch pound the roots in water and apply; (iii) Water in the still-closed pitcher can be drunk.

Pa Aru, 1200 m, Pearce, K.G. S 94872; Summit, Tama Abu Range, 1470 m, Pearce, K.G. S 94949.

## OLEACEAE

*Chionanthus polygamus* (Roxb.) Kiew

Kemanyah tulang [Penan]; Ubah paya [Penan]

Penan: Good firewood.

S of Pa Menalio, 1220m, Pearce, K.G. S 93452, S 93459

## PIPERACEAE

*Piper* PTNP 1

Ari [Penan]

Penan: (i) To treat headache drink the sap of a wrist-sized stem; (ii) To treat a coughing dog crush a little of the leaf and feed to dog.

On hill NW of Bario, 1550 m, Pearce, K.G. S 95139.

*Piper muricatum* Blume

Mait tulang [Kelabit]; Kayu tawan sakit tulang [Penan]

Kelabit/Penan: To treat aching bones cut the stem, boil and drink the water.

Along ridge running SW, S of tributary of Sg. Rusu, 1160 m, Pearce, K.G. S 95899; Ulu Pa Menalio, 1150 m, Solomon, S. S 94862.

## ROSACEAE

*Rubus* cf. *moluccanus* L.

Serinit [Lun Bawang]

Lun Bawang: Fruit can be eaten.

Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S95857.

## RUBIACEAE

*Geophila* sp.

Lun Bawang: To treat syphyllis chop leaves, cover with hot water and drink.

Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95836.

*Lasianthus* cf. *pilosus* Wight

Selah ulud [Penan]

Penan: To treat itch due to caterpillar wash soil off root and chew or rub affected part with root.

Ridge running upstream SW of Long Rusu, 1250 m, Pearce, K.G. S 95910.

*Pleiocarpidia borneensis* (Miq.) Brem.

Kayu basa' [Penan]

Penan: (i) Fruit can be used as bait for fish; (ii) Animals and birds eat the fruit.

Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95080.

*Porterandia sessiliflora* Ridley

Kayu onok [Kelabit]

Kelabit: Firewood.

From ulu Pa Selonok W towards Tama Abu Range, 1740 m, Pearce, K.G. S 94899.

## RUTACEAE

*Melicope* cf. PTNP 1

Ubur, Ubah [Lun Bawang, Penan]

Lun Bawang/Penan: Firewood.

On trail from Church Camp to G. Murud, 2060 m, Pearce, K.G. S 95302.

## SAURAUACEAE

*Saurauia* cf. *glabra* Merr.

Terung [Kelabit]; Kayu lanya lotok [Penan]



Kelabit: Wood for planks.

Penan: Birds eat the fruit.

Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94839.

## SCHIZANDRACEAE

*Kadsura* sp.

Penawar, Penawat [Penan]

Penan: (i) To treat stomachache, scrape stem, put on stomach; (ii) To treat stomach or headache boil stem in water and drink the water; (iii) Effective antidote for 'ipoh' (*Antiaris toxicaria*) poison, snake and insect bites. Scrape off skin of stem and swallow, or dry, boil and drink the water. Close to Pa Menalio/Pa dapur confluence, 1150 m, Noh, B. S 93447; Long Rusu along Sg Dapur up from Long Belaban, 1150 m, Pearce, K.G. S 95886.

## SYMPLOCACEAE

*Symplocos henschelii* (Moritzi) Benth. ex C.B. Clarke ssp. *henschelii* var. *henschelii*  
Ilieu [Penan]

Penan: To treat backache warm shoots by fire and lie down on them.

Ulu Pa Menalio, 1150m, Pearce, K.G. S 94861; Hill NW of Arur Dalan, 1320 m, Pearce, K.G. S 95300.

## THEACEAE

*Adinandra* PTNP 1

Belaban lumut [Lun Bawang]

Lun Bawang: Used locally for house posts at Murud, and firewood.

On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95186.

*Adinandra* aff. *nunokensis* Kobuski

Kayu uburr [Kelabit]; Benoteh [Penan]

Penan: Firewood.

Summit, Tama Abu Range, 1470 m, Pearce, K.G. S 94943.

*Ternstroemia* PTNP 3

Kayu turung [Kelabit]; Benotei [Penan]

Penan: (i) Firewood (ii) Animals can eat the fruit.

Summit, Tama Abu Range, 1470 m, Pearce, K.G. S 94955.

*Ternstroemia* PTNP 4

Anit labor [Kelabit]; Kayu jawa [Penan]

Kelabit: Firewood.

Tama Abu Range near summit, 1800 m, Pearce, K.G. S 94979.

## TILIACEAE

*Microcos* cf. *antidesmifolia* (King) Burret

Kerong [Penan]

Penan: (i) Deer ('kijang') eat the fruit; (ii) The bark can be used for cords to tie and carry.

Going N on ridge N of Pa Menalio, 1300 m, Pearce, K.G. S 94813.

## VITACEAE

*Tetrastigma diepenhorstii* (Miq.) Latiff

Barah buku [Lun Bawang]

Lun Bawang: For swollen finger joints take swollen joints of stem, burn, mix with coconut or peanut oil and apply.

NW of Long Belaban, 1260 m, Pearce, K.G. S 95482.

## Angiosperms - Monocotyledons

### ARACEAE

*Homalomena* sp.

Duli [Lun Bawang]; Long [Penan]

Lun Bawang/Penan: (i) To stop bleeding if out in forest, pound rhizome and apply; (ii) Add to blowpipe dart poison to make the animal vomit so the hunter can hear where it is.

Along ridge running SW, S of tributary of Sg. Rusu, 1160 m, Pearce, K.G. S 95900.

### ARECACEAE

*Areca minuta* Scheff.

Tubu [Kelabit]; Datei, Nyakau [Penan]

Kelabit: Old folks used to use the stem to mash rice.

S of Pa Menalio, 1220 m, Pearce, K.G. S 93448, S 93466.

*Calamus* PTNP 1

Wei Kera' [Kelabit]; Dangan [Penan]

Kelabit: Palm cabbage ('umbud') eaten.

Penan: Palm cabbage ('umbud') can be eaten raw on a journey and can be cooked and used to treat white spots on tongue of infants.

Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95275.

*Calamus conirostris* Becc.

Wai kuran [Kelabit]; Savit pedun, Tahai [Penan]

Kelabit/Penan: Fruits can be eaten when ripe.

Penan: (i) Palm cabbage ('umbud') can be eaten; (ii) Rattan can be used.

Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95100; Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95272.

*Calamus convallium* J. Dransf.

Wei leluduh [Lun Bawang]; Wai janan paya [Penan]

Lun Bawang: (i) The palm cabbage can be eaten. (ii) The rattan is lasting and can be used to make a lasso to catch buffalo.

Penan: Fruit can be eaten.

Ridge running upstream SW of Long Rusu, 1350 m, Pearce, K.G. S 95932.

*Calamus javensis* Blume

Wei rabun [Kelabit]; Wei bumum tepun [Penan]

Kelabit/Penan: For making baskets.

Towards summit about 3 km N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K.G. S 95213.

*Calamus pogonacanthus* Becc. ex Winkler

Wei [Kelabit]; Wai savit tetong [Penan]

Penan: Weaving for baskets, good for back-pack ('bekang') and basket ('bakul').

Pa Menalio/Pa Dapur confluence, 1150 m, Pearce, K.G. S 95271.

*Daemonorops asteracanthus* Becc.

Wei [Kelabit]; Savit tokong, Uwai [Penan]

Kelabit: Rotan used to tie house frame together before nails were available.

Penan: (i) Palm cabbage ('umbud') can be eaten; (ii) Children eat ripe fruit and palm cabbage ('ubud') for fun.

S of Pa Menalio, 1220 m, Pearce, K.G. S 93471; Tama Abu Range near summit, 1800 m, Pearce, K.G. S 94991.

*Daemonorops longistipes* Burret

Kelawit wei, Uwei [Kelabit]; Wei dara [Lun Bawang]; Savit tokong, Wai lebu [Penan]

Kelabit or Penan: (i) Skin of stem used to make bangle; (ii) Palm cabbage ('ubud') can be eaten; (iii) Leaves to make a roof in the jungle.

Kelabit/Penan: (i) Palm cabbage ('ubud') and ripe fruits edible; (ii) Rattan for baskets;  
Lun Bawang: (i) Fruit can be eaten; (ii) Palm cabbage ('umbud') can be eaten raw or cooked.  
On the way to the summit, Tama Abu Range, 1580 m, Pearce, K.G. S 94970; Confluence  
of Pa Dapur and Pa Menalio, behind lodge, at top of valley, 1160 m, Pearce, K.G. S  
95040; N of Long Belaban up ridge, 1360 m, Pearce, K.G. S 95801; 0.5 km E of Long  
Belaban going more or less E, 1160 m, Pearce, K.G. S 95937.

*Licuala collina* L.G. Saw

Ilad [Lun Bawang]

Lun Bawang: (i) Palm cabbage ('umbud') can be eaten; (ii) Leaves used to make hats.  
N of Long Belaban up ridge, 1360 m, Pearce, K.G. S 95802.

*Pinanga lepidota* Rendle

Ubud bera [Kelabit]; Datei [Penan]

Kelabit: Palm cabbage ('ubud') can be eaten.

Penan: If eaten, causes one to be 'drunk' ('mabuk').

S of Pa Dapur/Pa Menalio confluence, 1300 m, Pearce, K.G. S 95063; W of Summit  
SW of Long Rapung, 1340 m, Pearce, K.G. S 96001.

## HANGUANACEAE

*Hanguana* sp.

Bua bakong

Kelabit: Fruit good for fishing.

Penan: To treat ringworm ('kurap') crush 1 or 2 fruits only and apply. Fruit poisonous  
- cannot be eaten.

Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G.  
S 95099

## HYPOXIDACEAE

*Curculigo* sp.

Temar [Lun Bawang]

Lun Bawang: Used to wrap rice to cook it in bamboo - gives a good taste.  
Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95856.

## MARANTACEAE

*Phrynium capitatum* Willd.

Itip [Lun Bawang]

Lun Bawang: Leaves used to wrap rice.

Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95848.

## ORCHIDACEAE

*Calanthe pulchra* (Blume) Lindl.

Orkid tamar [Kelabit]; Tuban [Penan]

Kelabit: Leaves dried, woven together and used for straps for carrying basket ('bekang').

Pa Aru, 1200 m, Pearce, K.G. S 94876.

*Trichotosia* PTNP 2

Pereseng [Penan]

Kelabit: Leaves given to dogs to make them chase wild boar.

Penan: To make dogs bark, burn, mix the charcoal with the dog's food.

S of Pa Menalio, 1220 m, Pearce, K.G. S 93467.

## POACEAE

*Lophatherum gracile* Brongn.

Temar bulu [Lun Bawang]; Terguli [Penan]

Lun Bawang: (i) To treat syphyllis (in man and dogs) cook roots in water and drink the water; (ii) Leaves are found in pig's stomach and the pigs may have eaten them as a medicine.

Penan: As a remedy for pain when urinating ('sakit kencing') the tubers are crushed and boiled in water, which is drunk.

Pa Selunok, ulu Pa Menalio, 1120 m, Pearce, K.G. S 93423; Long Rusu along Sg Dapur up from Long Belaban, 1150 m, Pearce, K.G. S 95885.

*Racemobambos glabra* Holttum

Bulo' [Kelabit]; Bulo avun [Penan]

Penan: Can be used to make a flute.

On way to Tama Abu Range from ulu Pa Selonok, 1720 m, Pearce, K.G. S 94936

## SMILACACEAE

*Smilax hypoglauca* Benth.

Wei laya [Lun Bawang]

Lun Bawang: (i) For difficulty in urinating ('kencing sumbat') crush whole plant, boil and drink the water; (ii) If challenged to eat a glass bottle chew the stem and then one can eat broken glass as though it were soft like plastic.

NW of Long Belaban, 1260 m, Pearce, K.G. S 95485.

## ZINGIBERACEAE

*Alpinia nierenhuizii* Valet.

Terabak [Lun Bawang]; Tobo [Penan]

Lun Bawang: (i) Palm cabbage ('umbud') and fruit can be eaten; (ii) Leaves can be used to wrap rice - good flavour.

Long Rusu along Sg Dapur up from Long Belaban, 1150 m, Pearce, K.G. S 95884.

*Boesenbergia stenophylla* R.M. Sm.

Keburor, Jerangau merah [Kelabit]; Telenga [Penan]

Kelabit/Penan: (i) For stomachache crush root, boil in water; (ii) To prevent air-sickness chew rhizome.

Chew dried rhizome before drinking to prevent getting drunk.

Hill behind Pa Menalio about 1 km from its confluence with Pa Dapur, 1110 m, Pearce, K.G. S 93402.

*Globba atrosanguinea* Teijsm. and Binn.

Tobo [Penan]; Tubo [Lun Bawang]

Penan: To make a dog chase wild boar put inflorescence in its nose. Effective. Along Pa Menalio about 1 km from its confluence with Pa Dapur, 1410 m, Pearce, K.G. S 95085; Rebaruh Idang, downstream from Long Belaban, 1150 m, Pearce, K.G. S 95842.

*Globba franciscii* Ridley

Tubu [Kelabit and Penan]

Kelabit/Penan: To make dogs bark.

Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94858.

*Hedychium cylindricum* Ridley

Tubu [Kelabit]; Baku tubu [Lun Bawang]; Tobo teding [Penan]

Penan: To make dogs bark put the stem in their nose.

Ulu Pa Menalio, 1150 m, Pearce, K.G. S 94848; On trail from Church Camp to G. Murud, 2090 m, Pearce, K.G. S 95172.

*Hedychium cf. cylindricum* Ridley

Tubu [Kelabit]; Tubo, Tobo teding [Penan]

Penan: To make a dog bark crush rhizome and put in its nose.

From ulu Pa Selonok W towards Tama Abu Range, 1740m, Pearce, K.G. S 94888;

Isolated peak N of Pa Menalio/Pa Batang Aru confluence, 1640 m, Pearce, K. G. S 94998.

## Gymnosperms

### ARAUCARIACEAE

*Agathis endertii* Meijer Drees

Tumu [Lun Bawang]; Pelayor [Penan]

Lun Bawang: (i) Wood for planks; (ii) Damar to start fires, caulk boat.

Penan: (i) Damar mixed with petrol to make varnish; (ii) Deer ('kijang') and squirrels ('tupai') eat fruit.

On trail from Church Camp to G. Murud, 2060 m, Pearce, K.G. S 95301.

### PODOCARPACEAE

*Dacrycarpus steupii* (Wasscher) D.J. de Laubenfels

Pirur [Lun Bawang]; Ahau perah [Penan]

Lun Bawang: Wood for planks.

Penan: (i) Wood for planks; (ii) Wild boar eat the fruit.

By Plank Walk at top of trail from Lepoh Bunga to Church Camp, G. Murud, 2130 m, Pearce, K.G. S 96035.

## Pteridophytes

### CHEIROPLEURIACEAE

*Cheiropleuria bicuspis* (Blume) C. Presl

Pelamai lawid [Lun Bawang]

Lun Bawang: Fern leaf (looks like fish tail) is fixed at the end of a fish trap ('bubuh') to attract fish.

W of Summit SW of Long Rapung, 1340 m, Pearce, K.G. S 96013.

### DENNSTAEDTIACEAE

*Odontosoria chinensis* (L.) J. Sm.

Urau [Penan]

Penan: To make a dog tame ('jinak') and follow a person either burn plant to ash and mix with dog's rice or light a bit of the fern and let the smoke near the dog's nose.

Near Church Camp, G. Murud, 2012 m, Pearce, K.G. S 95357.

## **HYMENOPHYLLACEAE**

*Meringium* sp.

Lumut [Lun Bawang, Penan]

Lun Bawang: To treat stomachache or cough boil and drink the water.

SE of plank walk at junction with trail to Long Belaban, 2130 m, Pearce, K.G. S 96070.

## **LYCOPODIACEAE**

*Huperzia* sp.

Sang perkian [Penan]

Penan: Used for decoration.

S of Pa Dapur/Pa Menalio confluence, 1300 m, Pearce, K.G. S 95056; NW of Long Belaban, 1320 m, Pearce, K.G. S 95493.

## **THELYPTERIDACEAE**

*Pronephrium* cf. *repandum* (Fee) Holttum

Kerab [Lun Bawang]

Lun Bawang: Used when one suspects sabotage by a poisonous plant: (i) If you suspect the place where you are about to sit has been sabotaged hit the place with this plant; (ii) To prevent the effect of sabotage place a piece of rachis in carrying basket or in edge of shirt. Ridge running upstream SW of Long Rusu, 1250 m, Pearce, K.G. S 95909.

### **Appendix 4: Plant Species Reported from Pulong Tau National Park Not Represented in the ITTO Checklist**

#### **Angiosperms – Dicotyledons**

## **APOCYNACEAE**

*Leuconotis eugenifolius* (Wall. ex G. Don) A. DC. Mjoberg 124 [Beaman J.H. (1998)]

## **BEGONIACEAE**

*Begonia murudensis* Merr. Mjoberg 119 [Beaman J.H. (1998)]

## **CAPRIFOLIACEAE**

*Viburnum beccarii* Gamble. [Soepadmo, E. *et al.* (Eds.) (1996)]



## **CASUARINACEAE**

*Gymnostoma sumatranum* (Jungh. ex de Vriese) L.A.S. Johnson. [Observed during ITTO fieldwork]

## **ESCALLONIACEAE**

*Polyosma mjobergii* Merr. Mjoberg 107, S 44426 [Beaman J.H. (1998)]

## **EUPHORBIACEAE**

*Austrobuxus nitidus* Miq. S 26521 [Beaman J.H. (1998)]

## **FAGACEAE**

*Castanopsis acuminatissima* (Blume) A.DC. [Soepadmo, E. and L.G. Saw (Eds.) 2000]

## **GESNERIACEAE**

*Cyrtandra horizontalis* B.L. Burtt. Beaman 11493 [Beaman J.H. (1998)]

## **MELASTOMATACEAE**

*Sonerila macrantha* Merr. Mjoberg 75 [Beaman J.H. (1998)]

*Sonerila pulchella* Stapf. Beaman 11494 [Beaman J.H. (1998)]

## **MYRSINACEAE**

*Ardisia mjobergii* Merr. Mjoberg 80 [Beaman J.H. (1998)]

## **MYRTACEAE**

*Baeckea taxifolia* Merr. Mjoberg 84, Mjoberg 111 [Beaman J.H. (1998)]

*Leptospermum javanicum* Blume. Mjoberg 92, Beaman 11442 [Beaman J.H. (1998)]

*Syzygium pallidilimbium* Merr. and Perry. S 26406, S. 26472, S. 44467, Beaman 11446 [Beaman J.H. (1998)]

## **NEPENTHACEAE**

*Nepenthes vogelii* Schuit. and de Vogel. [Ch'ien Lee pers. comm.]

## **PENTAPHRAGMATACEAE**

*Pentaphragma aurantiaca* Stapf. Mjoberg 112, Beaman 11443 [Beaman J.H. (1998)]

## **POLYGALACEAE**

*Polygala venenosa* Juss. ex Poir. Mjoberg 95 [Beaman J.H. (1998)]

## **ROSACEAE**

*Prunus arborea* (Blume) Kalkman var. *alticola* Kalkman. Beaman 11452 [Beaman J.H. (1998)]

## RUBIACEAE

*Ixora sessililimba* Merr. Mjoberg 116 [Beaman J.H. (1998)]

## THEACEAE

*Ternstroemia denticulata* (Pierre) Ridl. S 44484, S. 44485, S. 44605 [Beaman J.H. (1998)]

*Ternstroemia lowii* Stapf. Beaman 11453 [Beaman J.H. (1998)]

## Angiosperms - Monocotyledons

## ARECACEAE

*Calamus mattanensis* Becc. Mjoberg 126 [Beaman J.H. (1998)]

*Calamus pilosellus* Becc. Mjoberg 128 [Beaman J.H. (1998)]

## ORCHIDACEAE

*Bulbophyllum lobbii* Lindl. TEB 227 [Beaman, T.E. *et al.* (1998)]

*Bulbophyllum stipitabulbum* J.J. Sm. Burt, B.L. 5406 [Royal Botanic Garden, Edinburgh webpage]

*Coelogyne kinabaluensis* Ames and C. Schweinf. Burt, B.L. 5273 [Royal Botanic Garden, Edinburgh webpage]

*Dendrochilum crassifolium* Ames. B 5241, N&C 1955 A [Wood, J.J. (2001)]

*Dendrochilum dewindtianum* W.W. Sm. var. *dewindtianum*. Beaman 11448 [Beaman J.H. (1998)]

*Dendrochilum graminoides* Carr. B s.n. C 5468 E [Wood, J.J. (2001)]

*Dendrochilum hologyne* Carr. Mjoberg 65 [Wood, J.J. (2001)]

*Dendrochilum imbricatum* Ames. Mjoberg 64 [Wood, J.J. (2001)]

*Dendrochilum integrilabium* Carr. Moulton SFN 6660 [Wood, J.J. (2001)]

*Dendrochilum kingii* J.J. Sm. var. *kingii*. Moulton SFN 6761 [Wood, J.J. (2001)]

*Dendrochilum saccatum* J.J. Wood. Moulton SFN 6762 [Wood, J.J. (2001)]

*Dendrochilum subintegrum* Ames. Moulton SFN 6670 [Wood, J.J. (2001)]

*Dendrochilum sublobatum* Carr. Mjoberg 46 [Wood, J.J. (2001)]

*Kuhlhasseltia javanica* J.J. Sm. Burt, B.L. 5408 [Royal Botanic Garden, Edinburgh webpage]

*Oberonia* cf. *griffithiana* Lindl. Burt, B.L. 5393 [Royal Botanic Garden, Edinburgh webpage]

*Paphiopedilum javanicum* (Reinw. ex Lindl.) Pfitzer var. *virens* (Rchb.f.) Stein. TEB 289 [Beaman, T.E. *et al.* (1998)]

*Pilophyllum villosum* (Blume) Schltr. TEB 290 [Beaman, T.E. *et al.* (1998)]

*Pristiglottis occulta* (Blume) Cretz and J.J. Sm. Burt, B.L. 5433 [Royal Botanic Garden, Edinburgh webpage]

*Robiquetia transversisaccata* (Ames and C. Schweinf.) J.J. Wood. TEB 226 [Beaman, T.E. *et al.* (1998)]

*Trichotomia pilosissima* (Rolfe) J.J. Wood. B 5230 [Beaman J.H. (1998)]

*Vanilla kinabaluensis* Carr. Beaman 11494A [Beaman, T.E. *et al.* (1998)]

## ZINGIBERACEAE

- Alpinia glabra* Ridley var. *reticulata* R.M. Smith. B 5289 [Smith, R.M. (1985)]  
*Amomum anomalum* R.M. Smith. [Smith, R.M. (1985)]  
*Amomum luteum* R.M. Smith. B 5372 [Smith, R.M. (1985)]  
*Burbidgea nitida* Hook.f. Mjoberg 122 [Beaman J.H. (1998)]  
*Burbidgea pubescens* Ridley. B 5314 [Smith, R.M. (1986)]  
*Etilingera longipetiolata* (Burt and Smith) R.M. Smith. B 5343 [Smith, R.M. (1986)]  
*Hornstedtia incana* R.M. Smith. B 5402 [Smith, R.M. (1985)]

## Gymnosperms

### PODOCARPACEAE

- Dacrydium beccarii* Parl. in DC. Mjoberg 100 [Beaman J.H. (1998)]  
*Dacrydium gibbsiae* Stapf in Gibbs. S 26471, S. 26505, Beaman 11440 [Beaman J.H. (1998)]  
*Podocarpus neriifolius* G. Don. Beaman 11480 [Beaman J.H. (1998)]

## Pteridophytes

### ASPLENIACEAE

- Asplenium nidus* L. Mjoberg 204 [Beaman J.H. (1998)]

### BLECHNACEAE

- Blechnum procerum auct. non* (Forst.) Sw. Mjoberg 214 [Beaman J.H. (1998)]

### CYATHEACEAE

- Cyathea capitata* Copel. Mjoberg 95 [Beaman J.H. (1998)]

### DENNSTAEDTIACEAE

- Histiopteris incisa* (Thunb.) J. Sm. Mjoberg 108 [Beaman J.H. (1998)]

### DIPTERIDACEAE

- Dipteris quinquefurcata* H.Christ. Mjoberg s.n. [Beaman J.H. (1998)]

### GLEICHENIACEAE

- Gleichenia peltophora* Copel. var. *schizolepis* C. Chr. ex Holttum [Parris, B.S. and A. Latiff (1997) - endemic, only known from type]

### GRAMMITIDACEAE

- Themelium taxodioides* (Baker) Parris Mjoberg 70 [B. Parris pers. comm.]  
*Xiphopteris murudensis* (Copel.) Copel [Parris, B.S. and A. Latiff (1997) - endemic to G. Murud]

## **LYCOPODIACEAE**

*Huperzia verticillata* (L.f.) Trevis. Mjoberg 73 [Parris, B.S. and A. Latiff (1997) - endemic to G. Murud]

## **OLEANDRACEAE**

*Oleandra neriiformis* Cav. Mjoberg s.n. [Beaman J.H. (1998)]

## **PLAGIOGYRIACEAE**

*Plagiogyria pycnophylla* (Kunze) Mett. Mjoberg 22 [Beaman J.H. (1998)]

*Plagiogyria rotundipinnata* Bonap. [Parris, B.S. and A. Latiff (1997) - endemic to G. Murud, known only from type]

*Plagiogyria tuberculata* Copel. Mjoberg s.n. [Beaman J.H. (1998)]

## **POLYPODIACEAE**

*Selliguea albidosquamata* (Blume) Parris. Mjoberg 71 [Beaman J.H. (1998)]

*Selliguea enervis* (Cav.) Ching. Mjoberg 68 [Beaman J.H. (1998)]

*Selliguea murudensis* (C.Chr.) Parris. [Parris, B.S. and A. Latiff (1997)]

## **THELYPTERIDACEAE**

*Coryphopteris plumosa* (C. Chr.) Holttum [Parris, B.S. and A. Latiff (1997) - endemic to G. Murud, known only from type]

## **WOODSIACEAE**

*Diplazium porphyrorachis* (Baker) Diels. Sarawak Museum Native Collector 2937 [Beaman J.H. (1998)]

## **Appendix 5: Species Endemic to Borneo Reported from Pulong Tau National Park**

### **Angiosperms – Dicotyledons**

## **ANACARDIACEAE**

*Rhus borneensis* Stapf

## **AQUIFOLIACEAE**

*Ilex havilandii* Loes.

*I. spicata* Blume var. *harmsiana* (Loes.) S. Andrews

## **CAPRIFOLIACEAE**

*Viburnum beccarii* Gamble

*V. hispidulum* Kern

*V. vernicosum* L.S. Gibbs

## **CELASTRACEAE**

*Microtropis* cf. *keningauensis* Kochummen  
*M. wallichiana* Wight ex Thwaites

## **CLETHRACEAE**

*Clethra canescens* Reinw. ex Blume  
*C. pachyphylla* Merr.

## **CRYPTERONIACEAE**

*Axinandra* aff. *coriacea* Baill.  
*Crypteronia elegans* J.T. Pereira and K.M. Wong

## **DAPHNIPHYLLACEAE**

*Daphniphyllum borneense* Stapf  
*D. dichotomum* (T.C. Huang) T.C. Huang

## **DIPTEROCARPACEAE**

*Parashorea* cf. *parvifolia* Wyatt-Sm. ex P.S. Ashton  
*Shorea monticola* P.S. Ashton  
*S. venulosa* G.H.S. Wood ex Meijer  
*Vatica albiramis* v. Slooten

## **ERICACEAE**

*Diplycosia acuminata* Becc.  
*D. barbigera* Sleumer  
*D. cinnamomifolia* Stapf  
*D. fimbriata* Sleumer  
*D. punctulata* Stapf  
*D. salicifolia* Sleumer  
*D. saurauoides* J.J. Sm.  
*D.* cf. *urceolata* Stapf  
*Vaccinium bigibbum* J.J. Sm.  
*V. circidifolium* J.J. Sm.  
*V. claoxylon* J.J. Sm.  
*V. clementis* Merr.  
*V. coriaceum* Hk.f.  
*V.* cf. *dipladenium* Sleumer  
*V. flagellatifolium* H.F. Copeland  
*V. pachydermum* Stapf  
*V. simulans* Sleumer var. *leptopodium* Sleumer  
*V. uroglossum* Sleumer

## **EUPHORBIACEAE**

*Baccaurea* cf. *edulis* Merr.

*Glochidion* cf. *lancisepalum* Merr.

*Macaranga depressa* (Muell.Arg.) Muell.Arg. forma *strigosa* Whitmore

## **FAGACEAE**

*Castanopsis clemensii* Soepadmo

*Lithocarpus echinifer* (Merr.) A. Camus

*L. luteus* Soepadmo

*L. pulcher* (King) Markg.

*L. turbinatus* (Stapf) Forman

*Quercus kinabaluensis* Soepadmo

*Q. valdinervosa* Soepadmo

## **ILLICIACEAE**

*Illicium stapfi* Merr.

## **LAURACEAE**

*Actinodaphne borneensis* Meisn.

*A. percoriacea* S. Julia

*A. sulcata* S. Julia var. *longipetiolata* S. Julia

*A. venosa* S. Julia

## **LOGANIACEAE**

*Fagraea montana* Wong and Sugau

*F.* cf. *oreophila* Wong and Sugau

*F. stenophylla* Becc. ex Merr.

## **MORACEAE**

*Artocarpus excelsus* Jarrett

*Ficus borneensis* Kochummen

*F. deltoidea* Jack var. *recurvata* Kochummen

*F. hemsleyana* King

*F. macilenta* King

*F. oleifolia* King var. *valida* Corner

*F. rubroscupidata* Corner

*F. setiflora* Stapf var. *adelpa* Corner

*F. setiflora* Stapf var. *puberula* Corner

*F. setiflora* Stapf var. *setiflora*

## **NEPENTHACEAE**

- Nepenthes lowii* Hook.f.  
*N. muluensis* M. Hotta  
*N. murudensis* Culham ex Jebb and Cheek  
*N. stenophylla* Mast.  
*N. veitchii* Hook.f.

## **OLEACEAE**

- Chionanthus globosus* (Kiew) Kiew  
*C. cf. rugosus* Kiew  
*Jasminum oreophilum* Kiew

## **RHIZOPHORACEAE**

- Carallia* sp. 1 (*sensu* Madani and Wong)

## **RUTACEAE**

- Melicope* cf. *clemensiae* T.G. Hartley  
*M. sororia* T.G. Hartley (*ex lit.*)

## **SYMPLOCACEAE**

- Symplocos laeteviridis* Stapf var. *basirotonda* Noot.  
*S. laeteviridis* Stapf var. *mjobergii* Noot.  
*S. laeteviridis* Stapf var. *pauciflora* Noot.  
*S. laeteviridis* Stapf var. *velutinoso* Noot.

## **Angiosperms - Monocotyledons**

### **ARECACEAE**

- Calamus convallium* J. Dransf.  
*C. mattanensis* Becc.  
*C. gibbsianus* Becc.  
*C. pogonacanthus* Becc. *ex* Winkler  
*C. tenompokensis* Furtado  
*Daemonorops asteracanthus* Becc.  
*D. longistipes* Burret  
*Retispatha dumetosa* J. Dransf.

### **Gymnosperms**

- Agathis endertii* Meijer Drees  
*A. kinabaluensis* D.J. de Laubenfels  
*A. lenticula* D.J. de Laubenfels

## Pteridophytes

### GLEICHENIACEAE

*Gleichenia peltophora* Copel. var. *schizolepis* C. Chr. ex Holttum

### GRAMMITIDACEAE

*Xiphopteris murudensis* (Copel.) Copel

### PLAGIOGYRIACEAE

*Plagiogyria rotundipinnata* Bonap.

### THELYPTERIDACEAE

*Coryopteris plumosa* (C. Chr.) Holttum

## Appendix 6: 2006 IUCN Red List Endangered, Vulnerable, Lower Risk and Data Deficient Category Species\* Represented at Pulong Tau National Park

### Angiosperms – Dicotyledons

#### ARALIACEAE

*Schefflera cephalotes* EN\*

#### BOMBACACEAE

*Durio acutifolius* VU\*

#### CELASTRACEAE

*Lophopetalum javanicum* LR\*

*Microtropis* cf. *keningauensis* VU

*Microtropis* aff. *rigida* VU

#### CLUSIACEAE

*Garcinia eugenifolia* LR

*Garcinia maingayi* LR

#### ELAEOCARPACEAE

*Elaeocarpus nanus* LR



**MELIACEAE**

<i>Aglaia exstipulata</i>	LR
<i>Aglaia</i> cf. <i>odoratissima</i>	LR
<i>Aglaia tomentosa</i>	LR

**MYRISTICACEAE**

<i>Knema</i> cf. <i>linguiformis</i>	LR
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**NEPENTHACEAE**

<i>Nepenthes lowii</i>	VU
<i>Nepenthes muluensis</i>	VU
<i>Nepenthes murudensis</i>	EN
<i>Nepenthes reinwardtiana</i>	LR
<i>Nepenthes stenophylla</i>	LR
<i>Nepenthes tentaculata</i>	LR
<i>Nepenthes veitchii</i>	LR

**ROSACEAE**

<i>Prunus arborea</i>	LR
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**RUTACEAE**

<i>Melicope sororia</i>	VU
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**Gymnosperms****ARAUCARIACEAE**

<i>Agathis endertii</i>	LR
<i>Agathis kinabaluensis</i>	VU
<i>Agathis lenticula</i>	VU

**PODOCARPACEAE**

<i>Dacrycarpus imbricatus</i>	LR
<i>Dacrycarpus steupii</i>	LR
<i>Dacrydium beccarii</i>	LR
<i>Dacrydium gibbsiae</i>	LR
<i>Dacrydium xanthandrum</i>	LR
<i>Phyllocladus hypophyllus</i>	LR

<i>Podocarpus borneensis</i>	DD*
<i>Podocarpus laubenfelsii</i>	DD
<i>Podocaps neriifolius</i>	LR

\* 2006 IUCN Red List Category:

EN = Endangered, VU = Vulnerable, LR = Lower Risk, DD = Data Deficient

**Appendix 7: Species\* Represented at Pulong Tau National Park Listed as Protected Plants in the Wild Life Protection Ordinance 1998 (Second Schedule)**

**Angiosperms - Dicotyledons**

**BEGONIACEAE**

*Begonia chlorocarpa*

**CLUSIACEAE**

*Calophyllum teysmannii*

**ERICACEAE**

*Rhododendron bagobonum*

*Rhododendron borneense*

*Rhododendron burtii*

*Rhododendron buxoides*

*Rhododendron crassifolium*

*Rhododendron durionifolium*

*Rhododendron exuberans*

*Rhododendron himantodes*

*Rhododendron lanceolatum*

*Rhododendron longiflorum*

*Rhododendron malayanum*

*Rhododendron micromalayanum*

*Rhododendron niveoflorum*

*Rhododendron orbiculatum*

*Rhododendron pneumonanthum*

*Rhododendron robinsonii*

*Rhododendron stenophyllum*

*Rhododendron suaveolens*

*Rhododendron yongii*

## **GESNERIACEAE**

*Aeschynanthus* cf. *angustifolia*  
*Aeschynanthus gibbsiae*  
*Aeschynanthus magnifica*  
*Aeschynanthus parvifolius*  
*Aeschynanthus speciosa*  
*Aeschynanthus vinaceus*  
*Cyrtandra geesinkiana*  
*Cyrtandra trisepala*  
*Didymocarpus pleuropogon*  
*Didymocarpus simplex*  
*Henckelia* (syn. *Didymocarpus*) *murutorum*

## **MORACEAE**

*Ficus aurantiacea*  
*Ficus borneensis*  
*Ficus deltoidea*  
*Ficus detonsa*  
*Ficus disticha*  
*Ficus hemsleyana*  
*Ficus macilenta*  
*Ficus obscura*  
*Ficus oleifolia*  
*Ficus parietalis*  
*Ficus punctata*  
*Ficus recurva*  
*Ficus rubroscapitata*  
*Ficus schwarzii*  
*Ficus setiflora*  
*Ficus sinuata*  
*Ficus subulata*  
*Ficus uniglandulosa*  
*Ficus villosa*

## **NEPENTHACEAE**

*Nepenthes hurrelliana*  
*Nepenthes lowii*  
*Nepenthes muluensis*  
*Nepenthes murudensis*  
*Nepenthes reinwardtiana*  
*Nepenthes stenophylla*  
*Nepenthes tentaculata*  
*Nepenthes veitchii*  
*Nepenthes vogelii*

## **SIMAROUBACEAE**

*Eurycoma longifolia*

### **Angiosperms - Monocotyledons**

## **ARECACEAE**

*Areca triandra*

## **ORCHIDACEAE**

*Agrostophyllum cyathiforme*  
*Agrostophyllum laterale*  
*Agrostophyllum cf. majus*  
*Agrostophyllum stipulatum*  
*Appendicula calcarata*  
*Appendicula congesta*  
*Appendicula cornuta*  
*Appendicula foliosa*  
*Appendicula longirostrata*  
*Appendicula pendula*  
*Appendicula torta*  
*Appendicula undulata*  
*Appendicula cf. xytriophora*  
*Ascidieria longifolia*  
*Bromheadia cf. cecieliae*  
*Bromheadia crassiflora*  
*Bulbophyllum aff. acuminatum*  
*Bulbophyllum aff. anguliferum*  
*Bulbophyllum aff. auratum*  
*Bulbophyllum cornutum*  
*Bulbophyllum dearei*  
*Bulbophyllum disjunctum*  
*Bulbophyllum elongatum*  
*Bulbophyllum flavescens*  
*Bulbophyllum cf. maleolabrum*  
*Bulbophyllum aff. montense*  
*Bulbophyllum obtusum*  
*Bulbophyllum cf. reticulatum*  
*Bulbophyllum sopoetanense*  
*Bulbophyllum cf. stormii*  
*Bulbophyllum teres*  
*Calanthe cf. otuhanica*  
*Calanthe pulchra*  
*Calanthe cf. speciosa*  
*Calanthe sylvatica*

*Calanthe tenuis*  
*Ceratostylis subulata*  
*Chelonistele brevilamellata*  
*Chelonistele* cf. *sulphurea*  
*Coelogyne* aff. *asperata*  
*Coelogyne compressicaulis*  
*Coelogyne craticulaelabris*  
*Coelogyne cuprea*  
*Coelogyne* cf. *exaltata*  
*Coelogyne* cf. *gibbifera*  
*Coelogyne hirtella*  
*Coelogyne longibulbosa*  
*Coelogyne moultonii*  
*Coelogyne planiscapa*  
*Coelogyne pulverula*  
*Coelogyne radioferens*  
*Coelogyne swaniana*  
*Coelogyne* aff. *vermicularis*  
*Cymbidium elongatum*  
*Cystorchis variegata*  
*Dendrobium alabense*  
*Dendrobium bifarium*  
*Dendrobium cinnabarinum*  
*Dendrobium cumulatum*  
*Dendrobium indivisum*  
*Dendrobium lancilobum*  
*Dendrobium* cf. *oblongum*  
*Dendrobium piranha*  
*Dendrobium* aff. *sandsii*  
*Dendrobium uniflorum*  
*Dendrochilum crassilabium*  
*Dendrochilum galbanum*  
*Dendrochilum geesinkii*  
*Dendrochilum gibbsiae*  
*Dendrochilum gracilipes*  
*Dendrochilum lancilabium*  
*Dendrochilum longipes*  
*Dendrochilum longirachis*  
*Dendrochilum* cf. *mucronatum*  
*Dendrochilum muluense*  
*Dendrochilum murudense*  
*Dendrochilum ochrolabium*  
*Dendrochilum pallideflavens*  
*Dendrochilum pandurichilum*

*Dendrochilum pubescens*  
*Dendrochilum simplex*  
*Dilochia cantleyi*  
*Dilochia rigida*  
*Dilochia wallichii*  
*Dipodium pictum*  
*Epigeneium kinabaluense*  
*Eria crassipes*  
*Eria crucigera*  
*Eria cymbidifolia*  
*Eria aff. lancifolia*  
*Eria lanuginosa*  
*Eria leiophylla*  
*Eria megalopha*  
*Eria nutans*  
*Eria obliqua*  
*Eria cf. oblitterata*  
*Eria pseudoleiophylla*  
*Eria robusta*  
*Eria cf. saccifera*  
*Liparis anopheles*  
*Liparis compressa*  
*Nabalua exaltata*  
*Nieuwiedia veratrifolia*  
*Phaius tankervilleae*  
*Pholidota gibbosa*  
*Podochilus microphyllus*  
*Podochilus cf. tenuis*  
*Thrixspermum cf. borneense*  
*Trichoglottis collenetteae*  
*Trichotosia annulata*  
*Trichotosia ferox*  
*Trichotosia poculata*

## **Pteridophytes**

### **CYATHEACEAE**

*Cyathea capitata*  
*Cyathea moluccana*

CITIES Appendix II  
CITIES Appendix II

### **LYCOPODIACEAE**

*Huperzia (syn. Lycopodium) laxa*  
*Huperzia (syn. Lycopodium) phlegmaria*

Appendix 8: Images of Park Plants and Vegetation (Photographs : K. G. Pearce)

8.1 *Nepenthes* species



*Nepenthes lowii*



*Nepenthes veitchii*



*Nepenthes stenophylla*



*Nepenthes tentaculata*



*Nepenthes reinwardtiana*

8.2 Orchid species



*Bulbophyllum cornutum*



*Calanthe sylvatica*



*Dendrobium uniflorum*



*Eria crucigera*



*Epigeneium kinabaluense*



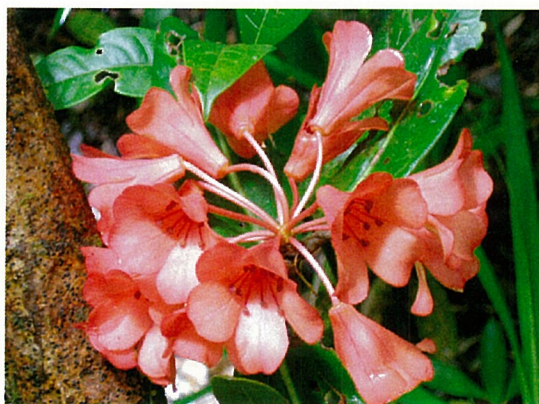
*Trichoglottis collenetteae*



### 8.3 Rhododendron species



*Rhododendron durionifolium*



*Rhododendron crassifolium*



*Rhododendron exuberans*



*Rhododendron himantodes*



*Rhododendron micromalayanum*

## 8.4 Other Species with Potential



*Boesenbergia stenophylla*



*Hedychium muluense*



*Lophatherum gracile*



*Selaginella* sp.



*Sonerila gibbsiae*



*Shrub with red leaf flush*

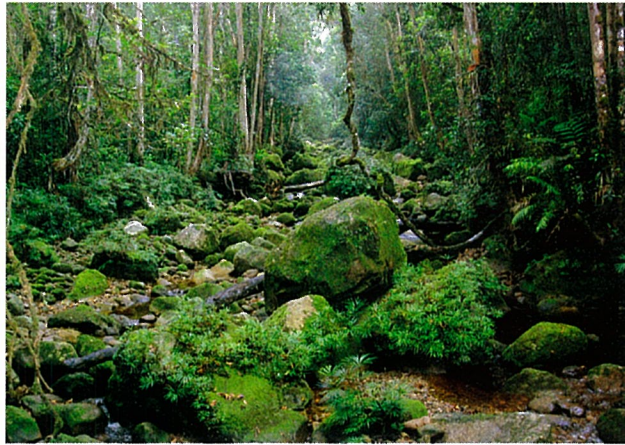
## 8.5 Vegetation Types



*Kerangas Forest S of Pa Menalio*



*Riparian Vegetation - Pa Menalio*



*Riparian Vegetation at Ulu Pa Dapur just up from Long Belaban*



*Lower Montane Forest below Plank Walk*



*Disturbed Forest by Plank Walk*



*Upper Montane Tall Mossy Forest below summit of G. Murud*



*Upper Montane Short Ericaceous Scrub on G. Murud*

## 8.6 Potential Genebank Sites



*Agathis* at potential genebank near Long Rapung



*Agathis* between Plank Walk and Long Belaban

## **Appendix 9: Terms of Reference for Consultant Forest Botanist**

Conduct botanical surveys in the different forest types and obtain voucher specimens of all species collected

Provide a description of the forest types, structures and species composition

Conduct an ethno-botanical study of forest species and studies on eco-tourism potential, with participant of local community informants

Using field data and herbarium records, compile a checklist of the plants of PTNP, indicating the habitats of each species

Inventory of plant species of economic significance for the establishment of gene banks and development of non-timber forest products by the local communities under a socio-development programme

In consultation with the Geomorphologist and Forest Ecologist co-relate the main vegetation formation with the soil types

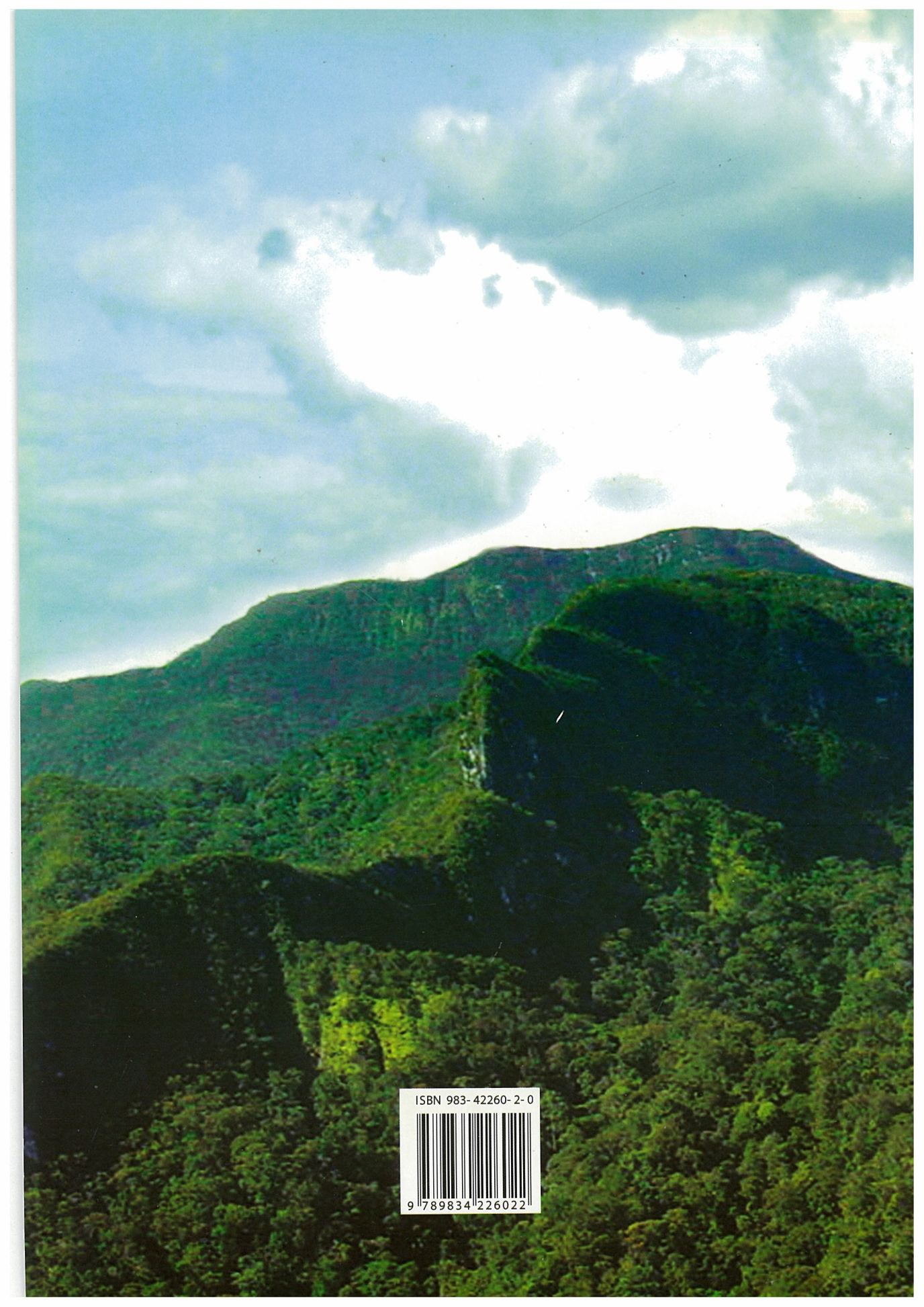
Provide all relevant data for the creation of a PTNP data bank

Recommend studies and activities to be carried out as follow-up action

Propose guidelines for the conservation management of PTNP

Present results in a form that is appropriate for publication





ISBN 983-42260-2-0



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