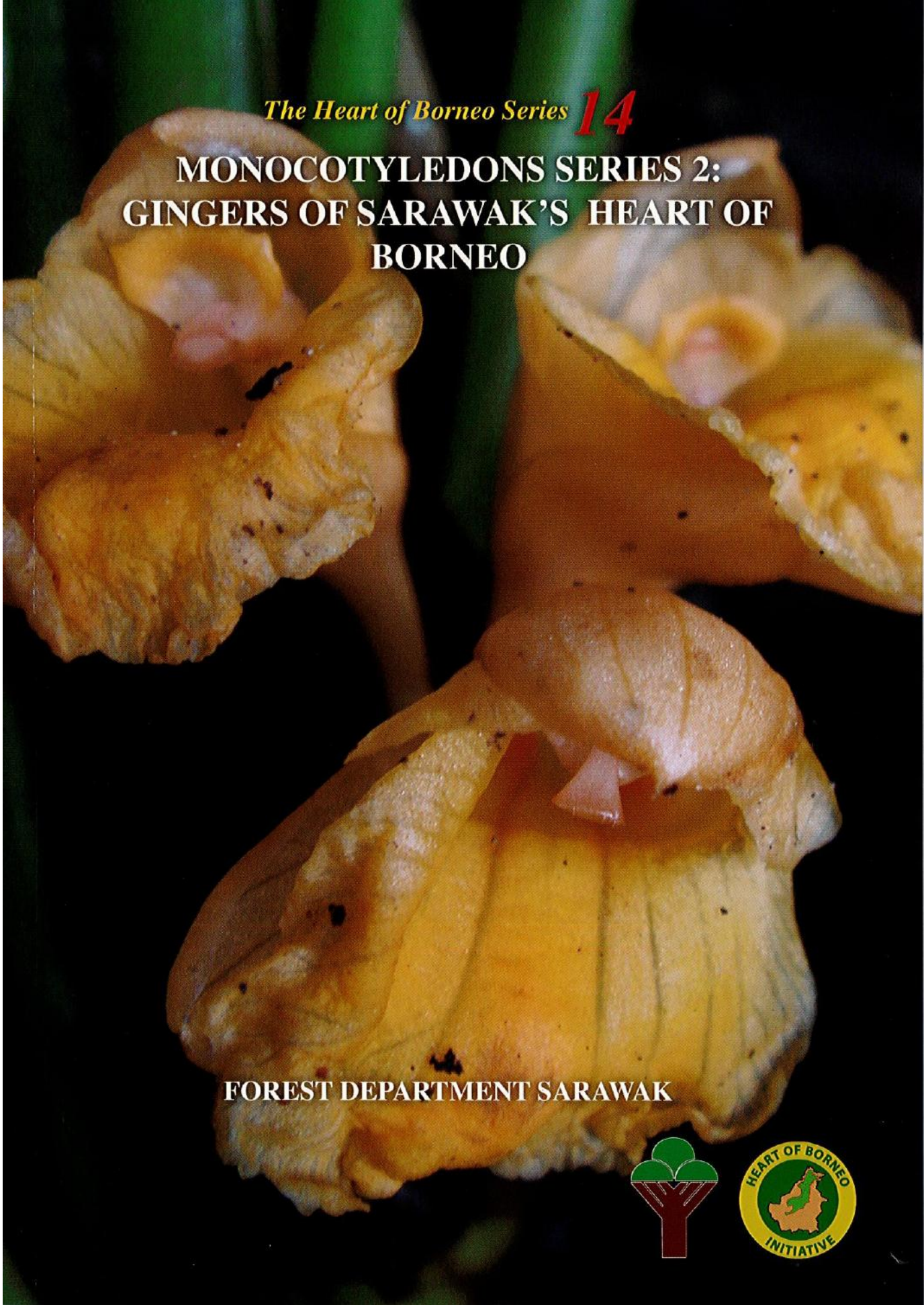


The Heart of Borneo Series **14**

MONOCOTYLEDONS SERIES 2: GINGERS OF SARAWAK'S HEART OF BORNEO

FOREST DEPARTMENT SARAWAK

The Heart of Borneo Series 14

MONOCOTYLEDONS SERIES 2: GINGERS OF SARAWAK'S HEART OF BORNEO

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FOREST DEPARTMENT SARAWAK

Funded by



Ministry of Energy and Natural Resources

Supported by



The State Government of Sarawak



Forest Department Sarawak



Published by
FOREST DEPARTMENT SARAWAK

The Heart of Borneo Series 14: Monocotyledons Series 2 – The Gingers of Sarawak's Heart of Borneo

ISBN: 978-976-26032-2-1

First Published: 2021

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Editorial team: Meekiong, K., Teo, S.P., Liam, J., Yeo, F.K.S., Runi, S.P., Raffi, A., Salina, H., Salleh, H. & Shabdin, Z.

Printed in Malaysia by
MODERN OFFSET PRINTING COMPANY
Lot 1101, Jalan Kwong Lee Bank, Pending 1, 93450 Kuching, Sarawak

Cover: *Boesenbergia latongensis* Meekiong & Ibrahim, H.
rear cover: *Zingiber pseudopungens* R.M. Sm.
2nd rear cover: *Plagiostachys crocydocalyx* (K. Schum.) B.L. Burtt & R.M. Sm.
back cover: *Boesenbergia hirta* (Ridl.) Merr.

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FOREWORD



Bismillahirrahmannirrahim....

This is the second book under the Monocotyledon Series, entitled, *"The Heart of Borneo Series 14: Monocotyledon Series 2 - Ginger of Sarawak's Heart of Borneo".*

A total of 20 genera and over 200 species of gingers have been documented in Sarawak, and majority of them are recorded from the HoB areas. It shows a great diversity of gingers and, as many localities are yet to be surveyed, many specimens are still need to be verified and works on molecular studies are in progress, it is believed that the number of species will be increasing.

The editorial team deserve much credit for the time and effort put in the success of this book published. Special appreciations go to all the valued contributors who have been courteous to provide photos and inputs which concluded into meaningful publication.

YBhg Datu Hamden Bin Haji Mohammad
Director of Forests
SARAWAK

PREFACE

The Heart of Borneo Initiative is a unique voluntary transboundary cooperation which is a programme that is government-led and NGO-supported. It was initiated in 2007 by a joint Declaration by the governments of three countries i.e., Brunei, Indonesia and Malaysia. In Sarawak, the Heart of Borneo covers about 2.7 million ha that straddle along Sarawak's boundaries with Kalimantan and with Sabah and Brunei.

One of the crucial aspects of conservation in the Heart of Borneo area is the conservation and sustainable use of forests and the biodiversity they carry for the benefits of the local communities through a network of protected areas.

The diversity of plants in the Heart of Borneo area in Sarawak is high but their documentation is rather meagre as many species and even new genera await discoveries. The starting point for the conservation, management and sustainable utilisation of biodiversity must surely be their documentation and a proper inventory. To this end, we hereby present the documentation of the often-neglected monocotyledons. Which are not as well documented as the dicotyledons. This series covers the ginger family, Zingiberaceae with colour photographs of most of the species and genera included in order for the wider readers to get acquainted with this myriad and fascinating plant family.

Editors

What is the Heart of Borneo (HoB) Initiative?

Heart of Borneo (HoB) Initiative is a voluntary transboundary cooperation between Brunei, Indonesia and Malaysia to enable conservation and environment protection while enhancing sustainable development that improves the welfare of those living on the island. The cooperation of the three ASEAN nations was officially launched in Brazil on 27 March 2006. On 12 February 2007, the Minister of Natural Resources and Environment, Malaysia; the Minister of Forestry, Republic of Indonesia and the Minister of Industry and Primary Resources, Brunei Darussalam signed and jointly issued a Declaration in Bali, Indonesia.

In view of the global concerns and controversies about the tropical forest development, the long-term objective of the HoB Initiative, as enshrined in the Bali Declaration, is as follows:



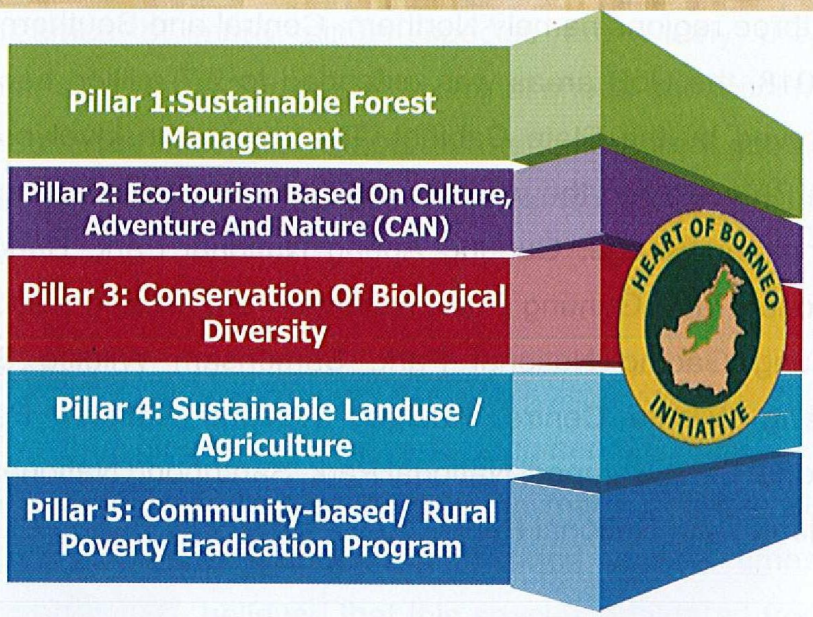
"With one conservation vision and with a view to promote peoples' welfare, we will cooperate in ensuring the effective management of forest resources and conservation of a network of protected areas, productive forests and other sustainable uses".

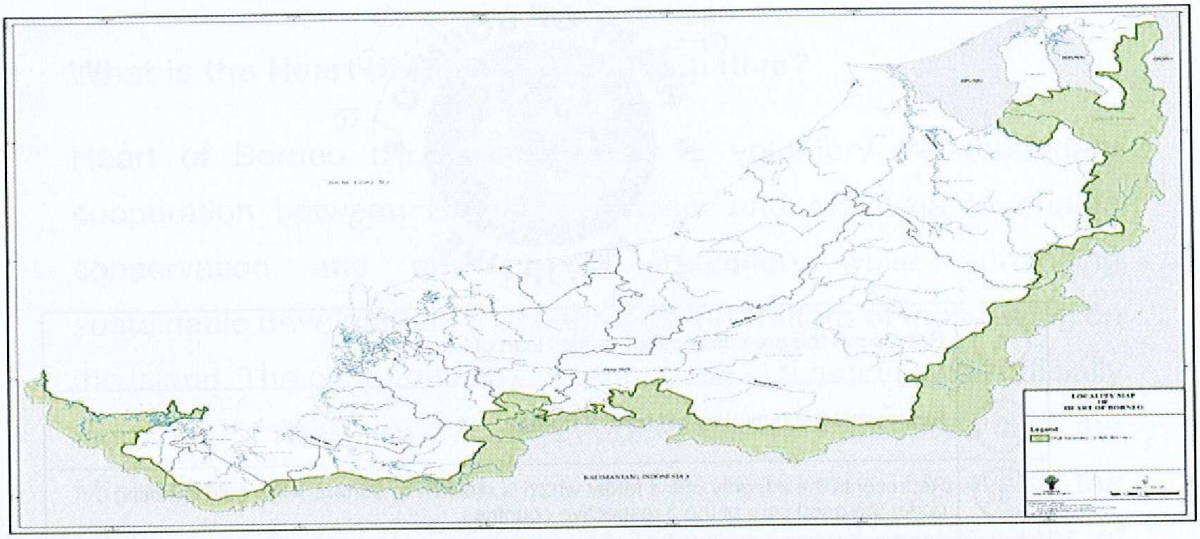
Bali Declaration 2007



1	Represents the area designated as the Heart of Borneo area.
2	Represents the boundary of Heart of Borneo.
3	Represents the integrity of the forest which is crucially important. All in gold denoting under the good care of the 3 respective countries.
4	Represents the forest as the core element of the HoB initiative.
5	Represents the Global Earth
6	• Leaves representing the three pillars of sustainable development which are Economic, Social and Environmental requirements. • They are interlinked to represent the importance of forest connectivity for biodiversity conservation.

5 PILLARS OF THE HEART OF BORNEO





In Sarawak, the HoB covers 2.7 million ha over a contiguous block along Sarawak's boundaries with Kalimantan (Indonesia) and Sabah and Brunei. The HoB is fully in line with the existing policies by both state and federal government.

HoB Sarawak started with a total area of 2.1 million hectares divided into three regions namely Northern, Central and Southern Regions. In 2018, the HoB areas was extended to 2.7 million hectares and approved by the State Cabinet. The expansion involves the area from Batang Ai to the western region of Sarawak. This covers the Kelingkang Range, Gunung Apeng National Park, Bungo Range National Park, Gunung Pueh National Park, Kubah National Park, Gunung Gading National Park, Samunsam Wildlife Sanctuary, Matang Wildlife Centre, Kuching Wetland National Park, Bako National Park, Sampadi National Park, Santubong National Park and Tanjung Datu National Park.

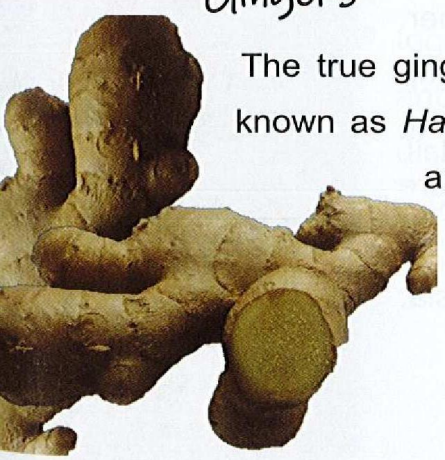
Uses of Zingiberaceae

The members of Zingiberaceae or best known to many people as '*gingers*' are the most useful plant among all the herbaceous plant families. Basically, the gingers are cultivated commercially as spices (e.g. *Alpinia galanga, Curcuma longa, Zingiber officinale* etc.), or food sources, for example, high-quality starch can be extracted from the rhizomes, the inflorescence and young shoots can be harvested as vegetables. Many species are also cultivated throughout the tropics as ornamental and potted decoration plants. Numerous species of gingers are also used as traditional medicines and cosmetics. While few species are used in the cultural event or religious rituals.

Spices

The rhizomes of many ginger species are widely used and commonly sold at the traditional medicinal shops and local markets throughout Southeast Asia. Ginger, turmeric and great galangal are the most common spices and being used since ancient times.

Gingers



The true ginger is referring to *Zingiber officinale,* or locally known as *Halia* has been grown in many tropical countries, and includes China since ancient times. It is believed that this species originated from India and was taken to Europe and East Africa by the

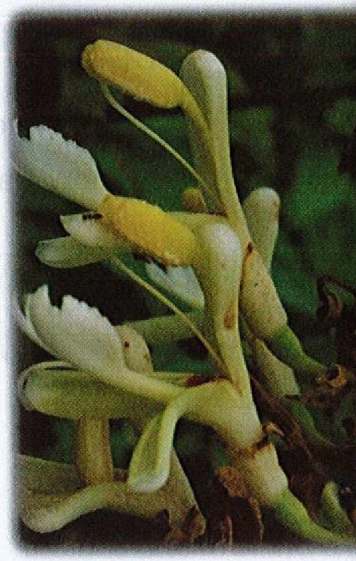
Arab traders, and to southeast Asia, China and Japan by the Indian traders as the precious items of trade. The young and mature rhizomes of *Z. officinale* are widely used in cooking in Southeast Asia, such as chicken soup, beef *rendang*, steam fish etc. The dried ginger (in powder form) is used worldwide for culinary purposes and processed food, especially for dessert and baking. The fresh rhizomes are also used in the preparation of various drinks, such as ginger ale and ginger tea.

Ginger is also widely used in traditional medicine in Malaysia. A decoction of the rhizome is taken for stomachache and as a tonic for women after childbirth. The rhizomes are effective treatment for flatulence, colic, dyspepsia, colds, coughs, fever, nausea, vomiting, nosebleeds and rheumatism.

Galangal

Another ginger species that is widely cultivated in Southeast Asia, India and other tropical countries, purposely for spice or as ornamental. Although it is commonly cultivated in many tropical countries, the origin of this species remains unknown. The rhizomes have strong and pungent taste resembling a mixture of ginger (*Zingiber officinale*) and pepper. Commonly used to flavour food, especially soup and *rendang* dishes. Known as *Lengkuas* in Malay word, the rhizomes are commonly sold in the wet markets or agro bazaar throughout Malaysia.





The local people use the rhizomes to cure skin diseases, colic and dysentery. Also, a common herb used during the confinement period after childbirth.

Turmeric

Turmeric also known as the 'golden spice' or locally known as '*kunyit*' always refer to *Curcuma longa* L. This species has been grown since ancient times, and many believe that this species is originally from India (some believes that its origin is in Southeast Asia), which is also recognized as the centre of diversity of the genus *Curcuma*. This species has been spread to many countries by the traders and cultivated widely for its uses. Though it is cultivated throughout the tropics, large-scale cultivation is still confined to India and Sri Lanka, which supply over 90% of the world market.

The history of turmeric usage as a spice, medicine and in many socio-religious practices has been documented at least 6,000 years ago (Leong-Skornickova & Gallick, 2010). In Sarawak, turmeric has been exploited in many ways. The young leaves and inflorescences are eaten as *ulam,* dipped in *sambal belacan.* The turmeric leaves are sliced and put together with other spices such as *halia, lengkuas* and others as an ingredient to make *rendang* dishes. Iban, Bidayuh and Kelabit use turmeric leaves to wrapped foods. The Malays and Melanau use the





rhizome as a condiment in cooking to add fragrance, flavour and yellow colour to their curry or *senggang* dishes.

In traditional medicine, the turmeric rhizome boiled with milk and sugar is used to relieve colds, aid digestion, to treat infections of the urinogenital system, stomach problems, and pain in the chest and back. The rhizome boiled with garlic and onion is used for treating flatulence in children and diarrhoea. A poultice of the rhizome is applied to the breasts of lactating mothers to stimulate milk flow (Samy et al. 2014).

Torch Ginger

The torch ginger normally refers to the gingers (genus *Etlingera*) with a torch-liked inflorescence, and always refer to *E. elatior* (Jack) R.M. Sm. However, there are few more species that are also so-called torch ginger, e.g. *E. hemisphaerica* (Blume) R.M. Sm., *E. phyramidosphaera* (K. Schum.) R.M. Sm. and *E. venusta* (Ridl.) R.M. Sm. Known as *Kantan* or *Kenchala* by the local people in Sarawak is referring to the two species, *E. elatior* and *E. phyramidosphaera.* The torch gingers, particularly *E. elatior,* now has widely grown as spice herb and landscape ornamentals throughout the tropics. The inner parts of young leafy shoots are eaten raw as



ulam or cooked as a vegetable. Young buds and inflorescences of *Kantan* are an important ingredients in various dishes, e.g. Penang *laksa* and rainbow fried rice (by the Kelabit). The fruits of all torch gingers species are edible, eaten raw or process as candies. A decoction from the fruits is used to treat earache, headache and stomachache.



White variety Kantan (Etlingera elatior)

Vegetables

The young shoots, rhizomes or inflorescences with budding flowers of many ginger species are often consumed raw as *ulam* or cooked as vegetables. The fruits of *E. elatior, E. pyramidosphaera, Hornstedtia havilandii* and *Plagiostachys albiflora* are eaten raw for their sweet and sour aril, and also processed as candies.



Inflorescences of Zingiber pachysiphon and Etlingera elatior and kantan fruits on sell at Kapit wet market

Ornamental

The ginger family and its sisters in the Order Zingiberales, such as bananas, heliconias, spiral gingers and Arrot-roots families have high ornamental potential. Many species have been used for years as landscape and decoration elements in the tropical gardens. It is because of their beautiful, elegan and showy flowers such *Alpinia purpurata, Etlingera elatior, Globba winitii, Zingiber spectabile* etc. and some because of their beautifully designed leaves and thrives in shade, making them suitable as a ground cover such as *Kaempferia elegans, Kaempferia rotunda, Scaphochlamys kuntsleri* etc.

Numerous species of gingers, particularly from genera *Alpinia, Curcuma, Etlingera, Globba* and *Zingiber* are cultivated and sold as cut flowers, mainly for their colourful and long-lasting bracts.



Hedychium roxburghii – planted as ornamental plant in botanical Garden

The Family Zingiberaceae

The gingers are rhizomatous, perennial herbs that are aromatic in any or all plant parts are belonging to the family Zingiberaceae. The family Zingiberaceae comprises 53 genera and more than 1200 species worldwide with its centre of diversity in Southeast Asia. Malaysia harbours almost 40% of the world genera and close to 30% of the world taxa (Ibrahim et al. 2011).

Previously the Zingiberaceae is subdivided into two subfamilies, Costoideae and Zingiberoideae (Smith, 1982). The Costoideae now has been treated as a separate family due to several distinctive characteristics. The family Zingiberaceae has been divided into few manageable groups called tribes and four tribes were recorded in Sarawak namely, Alpineae, Globbeae, Riedelieae and Zingibereae. The tribes Alpineae and Zingibereae were the most diverse with the majority of the gingers in Sarawak were grouped into those two tribes. The tribe Globbeae and Riedelieae are each represented by *Burbidgea* and *Globba,* respectively.

The gingers are diverse in their habits, with most are terrestrial, lithophyte, rheophyte and a few are epiphytic. *Alpinia epiphytica* is an example of a newly described species from Sarawak that is the only member in the genus *Alpinia* with epiphytic habit (Meekiong *et al.* 2011). The gingers are also diverse in habitat, thriving in a shaded forest, mixed dipterocarp forest, kerangas, riverine habitat, secondary forest or alluvial forests and quite a number of species occupied on the limestone areas and as well as adapted to extreme condition on montane forest up to 2000 m altitude. Surprisingly,

gingers are also recorded in the mangrove forest; *Epiamomum roseisquamosum,* an epiphytic species that is recorded in the mangrove forest of Kuching Wetland National Park as an example.

The Genera of Zingiberaceae in the Sarawak's Heart of Borneo Areas

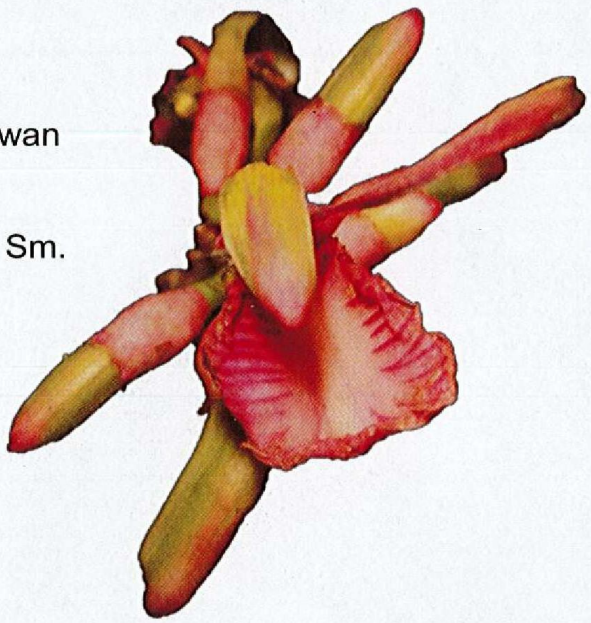
A total of 21 genera have been recorded in Borneo. Of these, 20 genera were recorded from Sarawak with more than 200 species; the exact number has not been established as more work is needed (Poulsen, 2006). The genus *Etlingera* and *Boesenbergia* are the most specious genera in Sarawak with 32 and 30 species, respectively. The genus *Haniffia* is a new geographical distribution record, that previously recorded only from Peninsular Malaysia and Southern Thailand.

ALPINIA

The largest genus in the family with over 230 species in tropical Asia, generally known as shell ginger. The genus is named after a 17th-century Italian botanist, Prospero Alpinio (1535–1616). They are medium-sized to large herbs, about 2–3 m tall, with few species that have been known to reach 8 m. The inflorescence takes the form of a spike, panicle or raceme, terminally on the leafy shoot. Most of the species have long petioles to the leaves and usually grow in clumps. The flowers are large and showy. The fruit is a rounded, dry or fleshy capsule. The plants are generally aromatic due to their essential oils. *Alpinia galanga* is one of the economically important species. The galangal or locally known as *lengkuas* being used as medicine and spice for hundred years ago.

About 17 species were recorded from the Sarawak's HoB areas, include one new geographical record. The species recorded are: -

1. *A. amentacea* R.M. Sm.
2. *A. aquatica* (Retz.) Roscoe
3. *A. argentea* (B.L. Burtt & R.M. Sm.) R.M. Sm.
4. *A. beamanii* R.M. Sm.
5. *A. capitellata* Jack
6. *A. epiphytica* Meekiong, Ipor & Tawan
7. *A. glabra* Ridl. var. *glabra*
8. *A. glabra* Ridl. var. *reticulata* R.M. Sm.
9. *A. hansenii* R.M. Sm.
10. *A. havilandii* K. Schum.
11. *A. ligulata* K. Schum.
12. *A. martini* R.M. Sm.



13. *A. mutica* Roxb.
14. *A. nieuwenhuizii* Valeton
15. *A. tamacuensis* R.M. Sm.
16. *Alpinia* sp.16 (undescribed species)
17. *Alpinia* sp.17 (undescribed species)

Alpinia havilandii, a new geographical record for Sarawak





Alpinia epiphytica Meekiong, Ipor & Tawan, a species described from Lanjak Entimau Wildlife Sancturay



Alpinia amentacea, a common species in the lowland mixed dipterocarp forest (MDF) of the Lanjak Entimau Wildlife Sanctuary (LEWS). Frequently found on the riparian vegetation and wet areas near streams or rivers.



Alpinia argentea, a highland species recorded at the elevations from 850 to 1500 m above sea level. Not common.



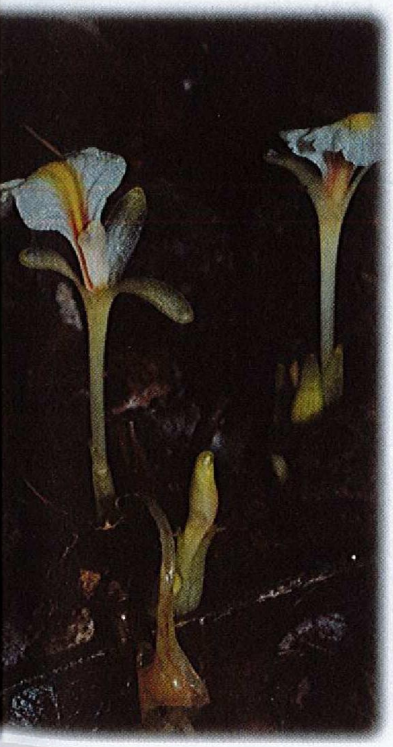
AMOMUM

The genus *Amomum* after re-circumscribed by De Boer et al. (2018) is now consists of approximately 64 species, of which about half of the total number are previously recognised as *Elettariopsis.* The centre of species diversity is found in Northern East India and the Indo-China region and few species are found in the Sundaland. The generic name was derived from the Greek word, *amomon,* which refers to Indian spice.

The members of *Amomum* are mostly small to medium-sized ginger, clump-forming to loosely clump-forming, rarely creeping. Leafy shoots are composed of few leaves, almost always arranged in palmate-liked rather than distichous, and often with long petiole (up to 25 cm long). Flower heads few-to many-flowered, always compact in an arrangement. Labellum white with a yellow patch in the central and red marking, or yellow with or without red markings.

Only four species were reported from Sarawak and all the species can be found in the HoB areas. The species are:

- *A. curtisii* (Baker) Skornick. & Hlavata
- *A. kerbyi* (R.M. Sm.) Skornick. & Hlavata
- *A. smithiae* (Y.K. Kam) Skornick. & Hlavata
- *A. stenosiphon* K. Schum.



A. stenosiphon

BOESENBERGIA

One of the largest Bornean genera with 35 taxa has been described, with many are yet to be named. Most are small forest herbs, about 5–70 cm high (except few species exceed more than 1 m high, e.g., *B. grandifolia*), with shoots consisting of one-leaf to few leaves. The inflorescence arises at the terminal, or between the leaves and is more-or-less enclosed by the leaf sheaths. The bracts are distichous, usually with one bag-shaped flower, and the flowering begins from the top of the inflorescence. The genus was introduced by Carl E.O. Kuntze, a German merchant-botanist, named after Walter Boesenberg.

The majority of species in Sarawak are recorded from the HoB areas. Among the species recorded are: -

B. armeniaca Cowley
B. burttiana R.M. Sm.
B. cordata R.M. Sm.
B. flavoalba R.M. Sm.
B. flavorubra R.M. Sm.
B. grandifolia (Val.) Merr.
B. grandis R.M. Sm.
B. hirta (Ridl.) Merr.
B. hosensis Cowley
B. kerbyi R.M. Sm.
B. hutchinsonii B.L. Burtt & R.M. Sm
B. latongensis Meekiong & H. Ibrahim
B. oligosperma (K. Schum.) R.M. Sm.
B. orbiculata R.M. Sm.
B. parva (Ridl.) Merr.
B. pulchella R.M. Sm.
B. stenophylla R.M. Sm.
B. variegata R.M. Sm.







Boesenbergia armeniaca, the second biggest species in Sarawak (80–100 cm tall). This species is associated to the limestone habitat, and by far recorded only from Mulu National Park areas.



Boesenbergia grandifolia, the biggest among all the species in Sarawak (1–1.5 m tall), usually in primary lowland MDF. Recorded from the southern (Serian) to central part of Sarawak (Kapit), but not common.





Boesenbergia flavoalba, one of the common species, recorded throughout Sarawak. A Small dwelling herb with dark green upper surface leaves. In various habitat, elevations from 30 m to 1000 m above sea level.

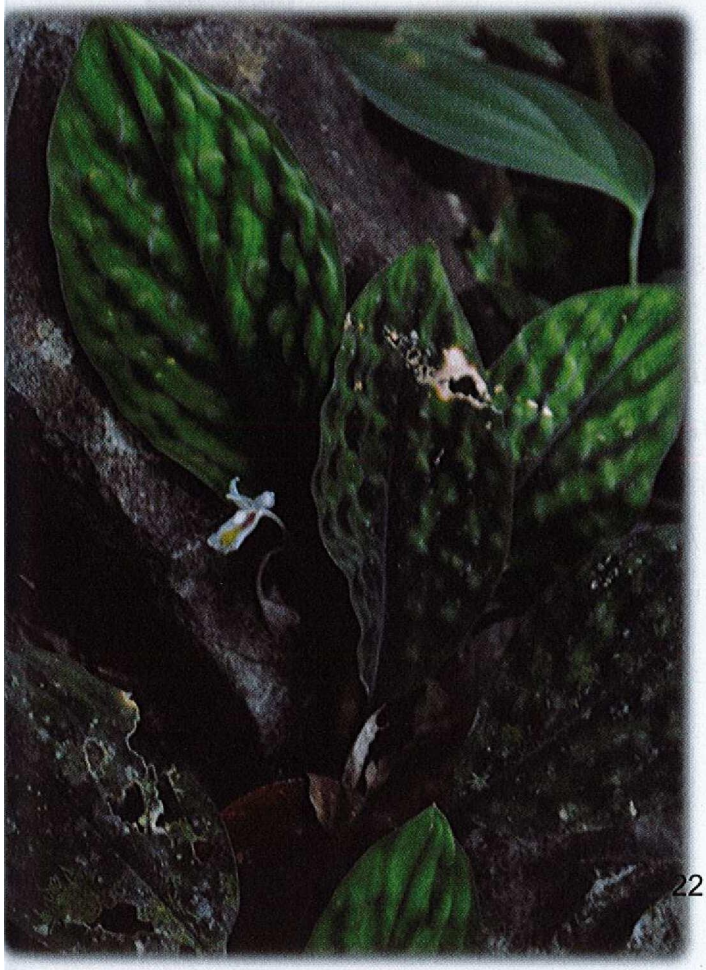


Boesenbergia flavorubra, a limestone associate species, found on wet and damp places, or near streams on the foothill of limestone. So far, this species is recorded only from Mulu National Park.





Boesenbergia pulchella, locally known as *Jerangau merah,* is the most widely distributed in Sarawak. Found in various type habitats, but frequently on limestone associate soils. Wide range of altitudes, from 10 m to 1200 m above sea level.



Boesenbergia variegata, a limestone specialist, previously recorded only from Mulu National Park. A one-leaf species, usually lithophyte, easily recognise by the variegated and strong bullate character on the upper leaf surface. The distribution, however now extended to central part of Sarawak.



BURBIDGEA

A small genus of five species that are endemic to Borneo. Small to medium-sized plants, up to 1.2 m high. All members of the genus have terminal unbranched inflorescence on leafy shoots. Flowers are yellow or orange that pollinated mostly by butterflies. The generic is named after the British gardener, and explorer Frederick W. Burbidge. All five species are found in the Sarawak's HoB areas.

B. longiflora (Ridl.) R.M. Sm.

B. nitida Hook. *f.*

B. pauciflora Valeton

B. schizochiela Hackett

B. stenantha Ridl.





Burbidgea pauchiflorum, usually found as epiphytic on trees or lithophyte on rock surfaces. This species forms a large clump, up to 20 plants, with orange flowers. A common species in primary forests in central part of Sarawak. Also recorded from limestone areas in Kuching.

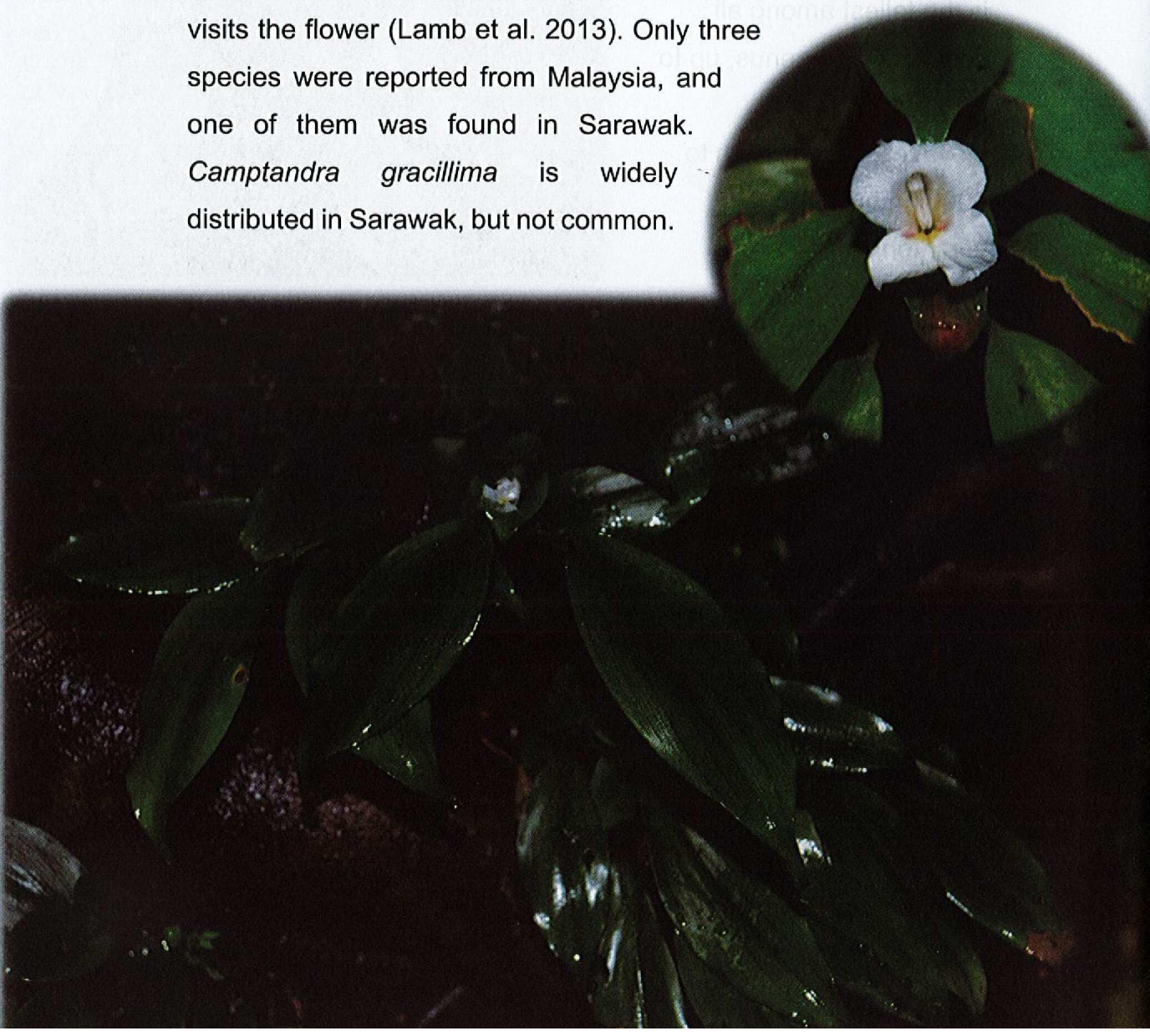
Burbidgea schizochiela, a terrestrial herb, up to 1 m high. Probably the most stunning species in the genus with many-flowered that opening several in a time. In Sarawak, recorded from Limbang and Lawas areas. *Burbidgea stenantha* is the tallest among all species in the genus, up to 2 m high. Found at elevations from 400 m to 1000 m, but is not a common species in Sarawak.





CAMPTANDRA

A small genus of 4–5 species native to Southeast Asia, with characteristics that easily distinguish from others. They are small herbs with a leafy stem, asymmetric leaf blades with strongly marked veins. The inflorescence is terminal by the one large, concave green bract subtending a small inflorescence with few flowers that open one in a time. Flowers are small, white to pale violet, with a broad, bilobed labellum (Larsen et al. 1999). The generic name means 'bent male' due to the anther being flexible when the pollinator visits the flower (Lamb et al. 2013). Only three species were reported from Malaysia, and one of them was found in Sarawak. *Camptandra gracillima* is widely distributed in Sarawak, but not common.



CONAMOMUM

A small genus with about 10 species distributed in primary evergreen lowland to montane forests from Indochina to Southeast Asia region. A medium-sized to large ginger, clump-forming plant with distichous leafy shoot consisting of sessile leaf blades. Bracts coriaceous, becoming brown and papery with age and persisting until fruiting. Flowers are gullet type, fruits smooth with appressed hair. The genus was introduced by Ridley in 1899, and then it was lumped into the genus *Amomum*. Recent molecular study by de Boer et al. (2018), reintroduce this genus to accommodate several species. *Conamomum cylindrostchys* and *C. xanthophlebium* are the only two species in the genus recorded from Sarawak's HoB areas. Both species are widely distributed in Borneo, from lowland to lower montane forests, occupying various habitats.



Conamomum cylindrostachys (syn. *Amomum coriaceum*) is one of the smallest species in the genus, up to 1.2 m tall. Found in lowland forests, in kerangas or swampy areas to lower montane forest at 1200 m above sea level.

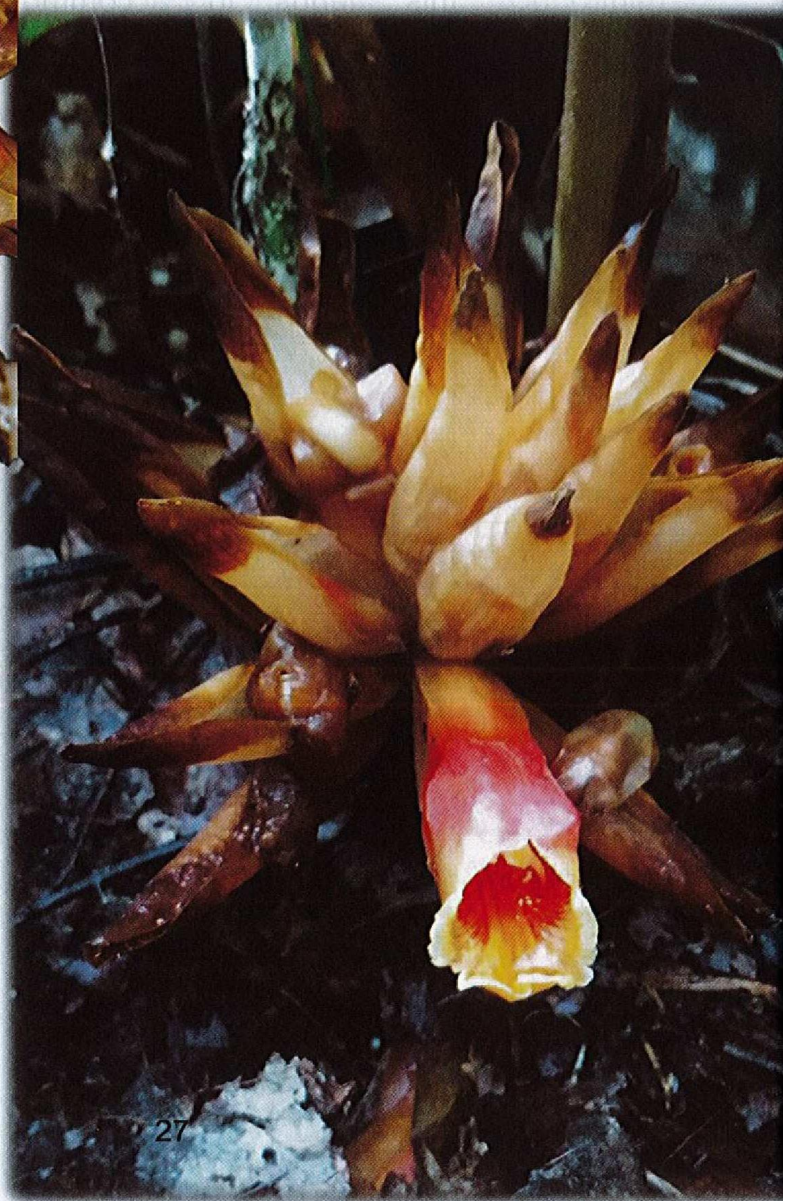
Conamomum xanthophlebium (Baker) Skornick. & A.D. Poulsen

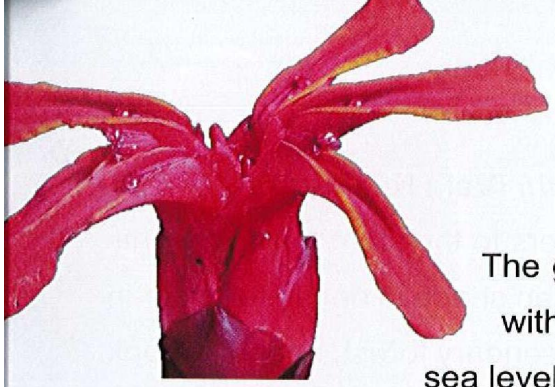
Synonym: *Amomum xanthophlebium* Baker; *A. stenoglossum* Baker

Medium to large-sized ginger, to 5 m tall, sometimes with stilt roots. Found in various habitats, but commonly in peat swamp and kerangas forest, elevation up to 1300 m above sea level. The flowers are harvested to be used as flavouring in curries or in *sambal.*



C. xanthophlebium



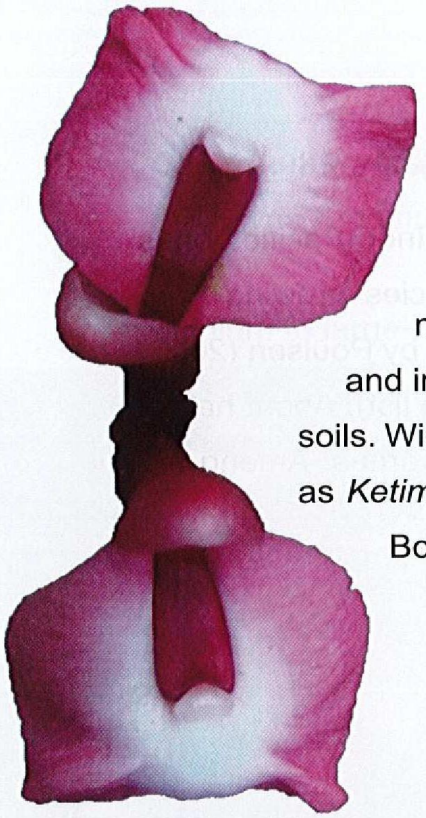


ETLINGERA

The genus *Etlingera* is an Indo-Pacific genus with more than 100 species growing from sea level to 2500 m. A revision by Poulsen (2006) treated 42 taxa (including 19 new names into the list). About half of the number can be found in the Sarawak's HoB areas. Among the species recorded are:

- *E. amomoides* A.D. Poulsen & Mood
- *E. aurantia* A.D. Poulsen
- *E. baculutea* A.D. Poulsen
- *E. baramensis* S. Sakai & Nagam.
- *E. barioensis* A.D. Poulsen
- *E. brevilabrum* (Val.) R.M. Sm.
- *E. fimbriobracteata* (K. Schum.) R.M. Sm.
- *E. kenyalang* A.D. Poulsen & H. Chr.



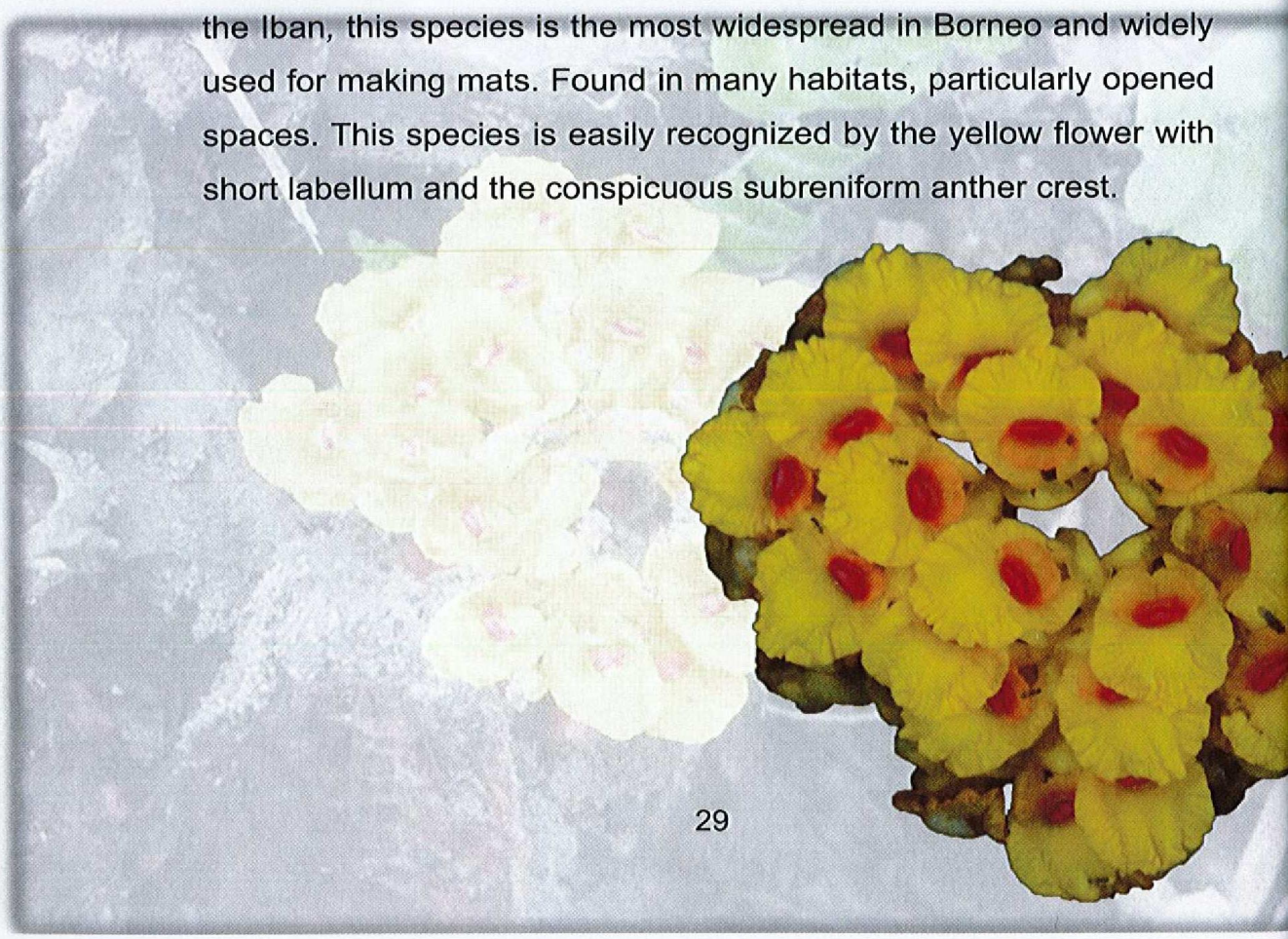


Etlingera brevilabrum (Val.) R.M. Sm.

The epithet name refers to the short labellum. This species is found in deep shade in dense forest or in marsh, young or old secondary forest, near riverbank and in alluvial, limestone, sandstone, sandy and rich clay soils. Wide range, from 10 to 1200 m above sea level. Known as *Ketimbang* by the Iban, this species is well distributed in Borneo.

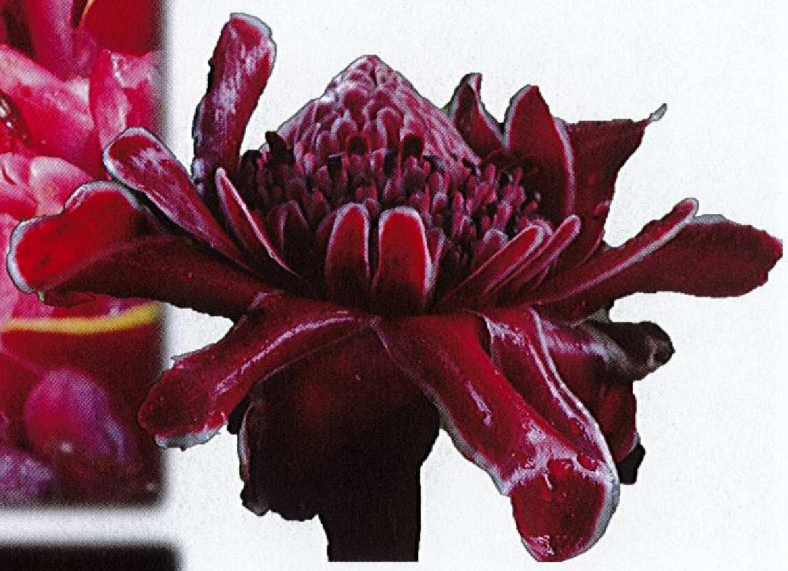
Etlingera fimbriobracteata (K. Schum.) R.M. Sm.

The epithet refers to the hairy bracts. Locally known as *Tukung* by the Iban, this species is the most widespread in Borneo and widely used for making mats. Found in many habitats, particularly opened spaces. This species is easily recognized by the yellow flower with short labellum and the conspicuous subreniform anther crest.





Etlingera elatior





Etlingera barioensis





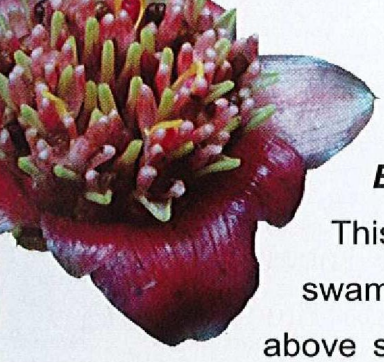
Etlingera foetens





Etlingera coccinea

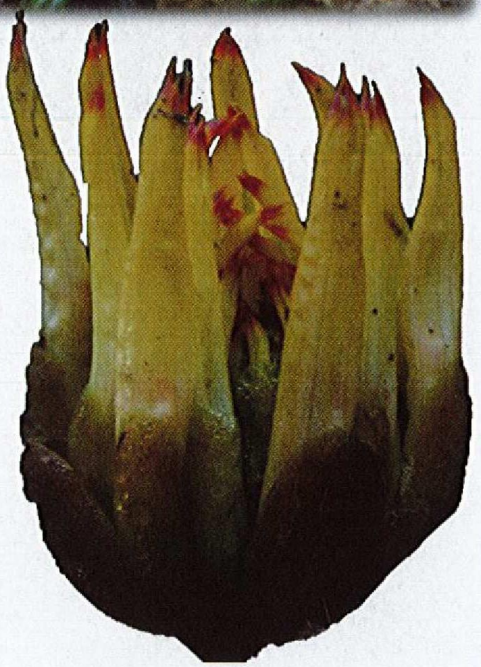




Etlingera pyramidosphaera (K. Schum) R.M. Sm. This species can be found in many habitats, from peat swamp to lower montane forest at elevation 10 – 900 m above sea level, often in valleys of wet habitats. Locally known as *Kechala* by the Iban, the epithet name refers to the shape of the infructescence that having a form like a pyramid.



Etlingera kenyalang A.D. Poulsen & H. Chr. *Tepus kenyalang,* is endemic to Sarawak, only observed and documented from Batang Ai National Park and Sabal Forest Reserve. A lowland species, in swampy areas near rivers or stream.



EPIAMOMUM

A small genus of six species that are mostly known only from Sarawak, except *E. angustipetalum* extends to Brunei and *E. borneense* is known to occur also in Kalimantan. Small to medium-sized, clump-forming gingers. Most are epiphytic, but sometimes also lithophyte or rarely terrestrial. Bracts are coriaceous, persisting until the fruiting stage, always subtending a single flower. Flowers are elongate, tubular, with short and recurved labellum. The generic name denotes its affinity to *Amomum* and the epiphytic habit of some of these species. All the members of this genus are previously placed under the *Amomum,* and recently separated based on molecular study by de Boer et al. (2018). Four species recorded in Sarawak's HoB areas are: -

E. angustipelatum

E. epiphyticum

E. hanseni

E. pungens

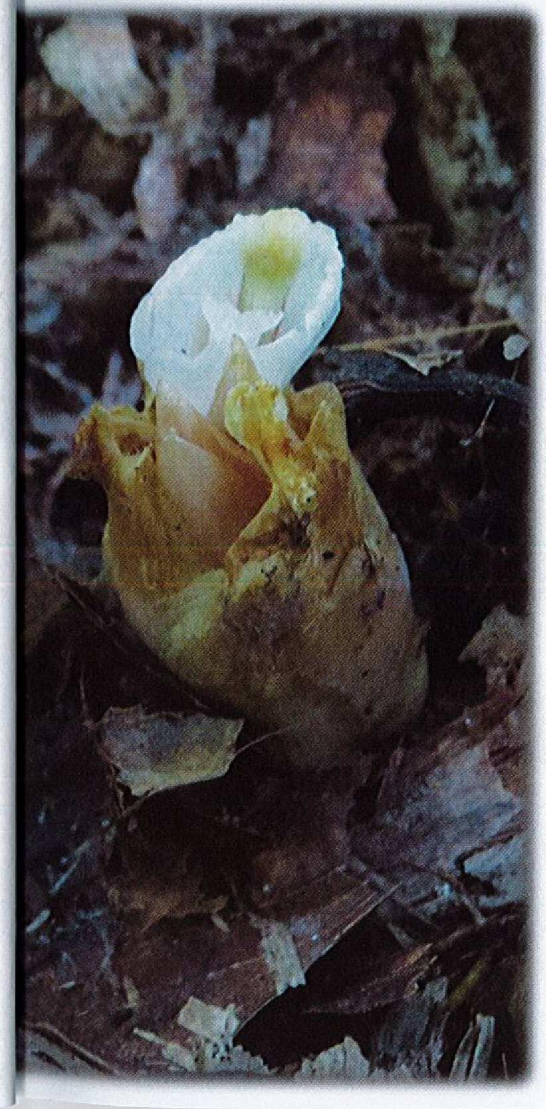


E. angustipetalum – photo recorded from Tama Abu HoB Scientific expedition.





Epiamomum epiphyticum, one of the most common epiphytic ginger species in riparian forest of Sg. Katibas and Sg. Baleh, in central part of Sarawak.



Epiamomum hanseni, photo recorded during the Sarawak HoB Long Banga Scientific Expedition.

GEOCHARIS

A small genus of eight species that are native to Southeast Asia, with highly localized taxa. All the members are with leafy shoots, moderately tall, up to 1.7 m. Inflorescences are separate on terminal leafless shoots, with erect or curved rachis, small bracts and flowers are borne singly. The generic name is derived from two Latin words, *Geo* meaning ground-dwelling and *charis* meaning beauty, referring to the flowers. Three taxa were recorded in Borneo, *G. fusiformis* var. *borneensis* R.M. Sm. (recorded from Sabah) and *G. rubra* Ridl. and *G. rubra* var. *puberula* (Sarawak).







GEOSTACHYS

Terrestrial herbs, about 1 – 2.5 m high with a stout rhizome that is never below the ground, most often raised above the forest floor on robust stilt roots. The inflorescence is on a separate side shoot but never buried on the soil. The peduncles are short, covered with stiff sheaths, rachis erect or bent slightly downwards.

This genus is native to Southeast Asia. About 25 species have been described with Peninsular Malaysia was the centre of species diversity. Only two species were recorded from Borneo and both were recorded in the HoB areas. *Geostachys meliauensis* C.K. Lim & K.H. Lau was described from Meliau Basin Sabah, and while *Geostachys penangensis* Ridl. was recorded from Limbang and Lawas areas in Sarawak.



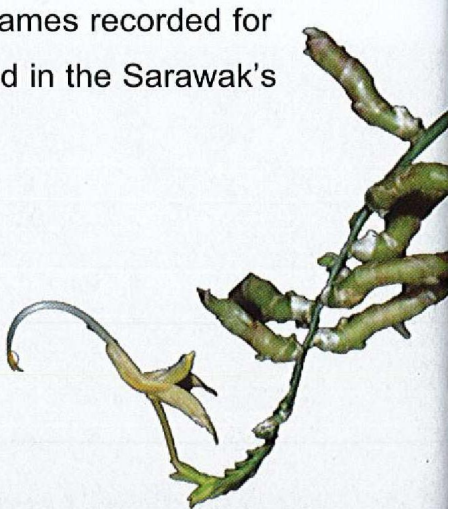
Geostachys penangensis



GLOBBA



Small slender herb, rarely above 60 cm tall, inflorescence on a terminal on the leafy shoot with overlapping to widely spaced bracts which are bright-coloured for most of the species. The flower is with characteristic with its lip joined to the stamen and the long-exerted, curved stamen. Inflorescence can elongate half of the plant size or equally length (30–45 cm long!). Sometimes, bulbils are produced to replace the flowers that occur on inflorescence or may also occur in the leaf axils. The generic name is based on the Indonesian plant name *galoba* – a spice from Ambon (Lamb et al. 2013) The genus is mainly distributed in the tropical Asia monsoon forest areas. About 100 names are recognized, and only 17 names recorded for Borneo so far. The seven species recorded in the Sarawak's HoB areas, which are: -



G. atrosanguinea Teijsm. & Binn.

G. brachyanthera K. Schum.

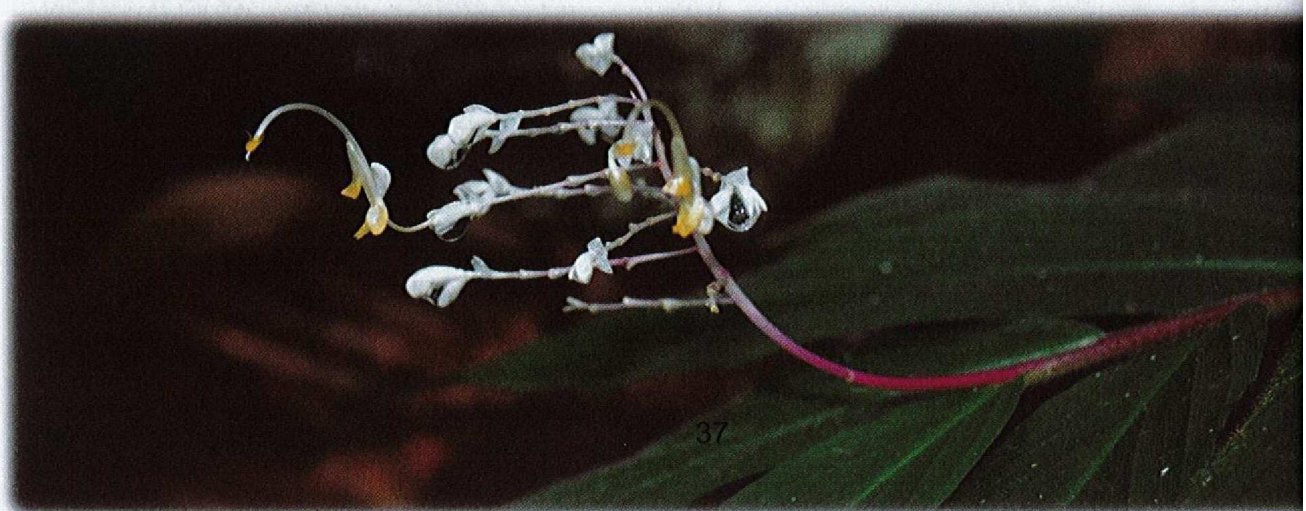
G. franciscii Ridl.

G. muluensis R.M. Sm.

G. pendula Roxb.

G. propinqua Ridl.

G. tricolor Ridl.





Globba atrosanguinea Teijsm. & Binn.
The most widespread and common species in Borneo in many habitats. It is found from lowland to upper hill forest, at an elevation from sea level to 1200 m. The epithet name refers to the conspicuous red bracts. Locally known with many names, this species has ethnomedicine values.

Globba muluensis R.M. Sm.
A small ginger up to 40 cm tall, this species is found on damp and wet habitats, often near streams or riverbanks. Sometimes found as lithophytes on the limestone rock surface. Inflorescences are terminal, with bright orange bracts and sometimes with reddish bulbils. Recorded in many localities within the HoB areas, but not common. The epithet name refers to the type locality, where the first specimen was collected.



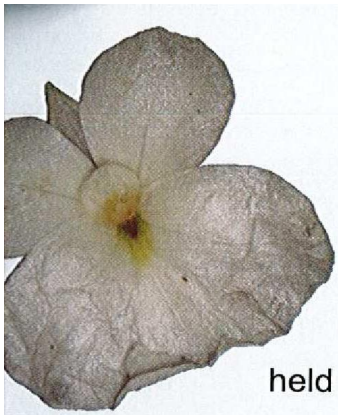


HANIFFIA

Haniffia is a small genus of four species that is native to Southern Thailand, Peninsular Malaysia and Sarawak. They are small dwelling herbs on the forest floor with leafy stems. Inflorescence on separate side shoots from the rhizomes with slender rachis. Flowers are without bracteoles, staminodes narrow and anther lacking in basal appendages. The genus was named after Mohamed Haniff, field worker of Penang Botanic Gardens. Only one species recorded in Sarawak, *Haniffia santubongensis* is a recently described species, and endemic to its type locality.



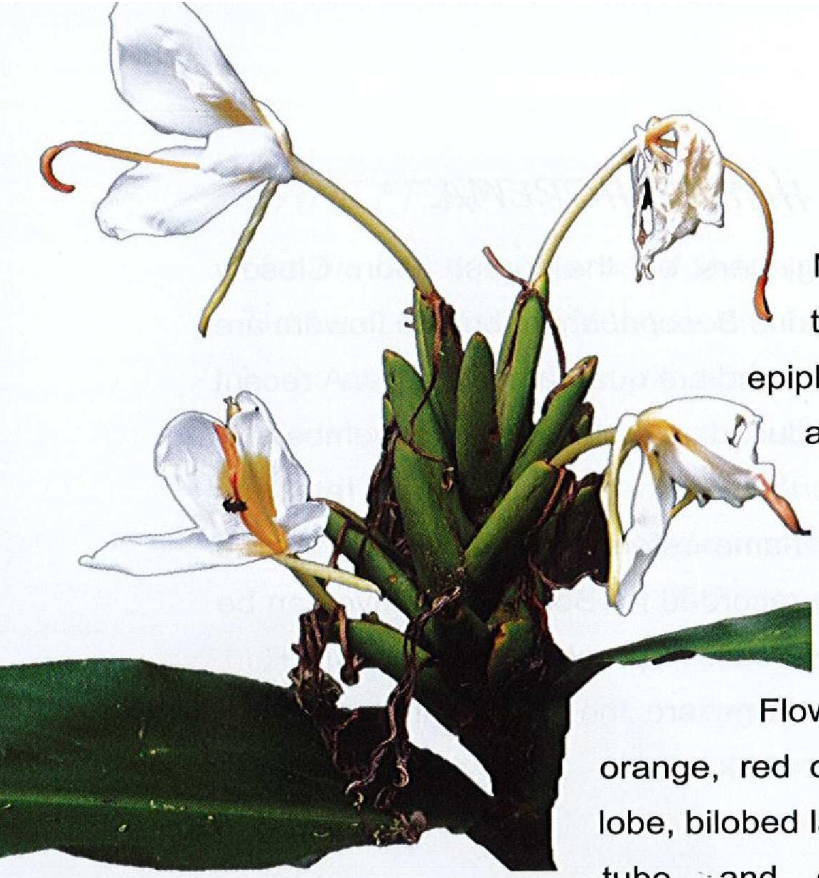




HAPLOCHOREMA

Small tufted gingers on the forest floor. Closely related to the genus *Boesenbergia,* but the flowers are held flat, not sack-like, and are quadrate in shape. A recent study by Mood et al. (2020) reduced, and placed all the members of this genus into genus *Boesenbergia* (for this publication retain as *Haplochorema*). This genus name refers to the one-chambered ovary. Six species have been recorded for Borneo, and five can be found in the Sarawak's HoB areas. *Haplochorema magnum* R.M. Sm. and *H. pauciflorum* R.M. Sm. are the two common species found in the central part of Sarawak.

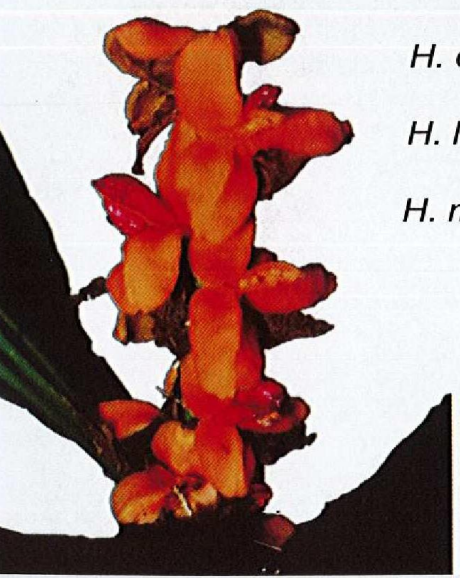




HEDYCHIUM

Medium-sized gingers, most of the wild species in Sarawak are epiphytes or lithophytes. Rhizomes are stout, fleshy; inflorescence terminal on the leafy shoot. Bracts are broad and closely overlapping forming a more or less cone-like inflorescence. Flowers are white, yellowish, orange, red or creamy, with narrow corolla lobe, bilobed labellum, and long, slender floral tube, and often distinct long exserted stamens. The fruits are capsules, usually orange when ripe, which when open, expose the bright yellow or orange interior of the capsule, and seeds are with bright red arils to attract dispersal agents. The generic name means 'sweet snow' referring to the white flowers and sweet scent of the very first described species, *H. coronarium.* Among the wild species recorded in the Sarawak's HoB areas are:

H. borneense R.M. Sm.



H. cylindricum Ridl.

H. lineare R.M. Sm.

H. muluense R.M. Sm.



Hedychium cylindricum Ridl., is the tallest *Hedychium* species in Sarawak, up to 1.5 m tall. This species is considered a highland species and common species in the northern part of Sarawak's HoB areas, found in upper hill forest to 1700 m above sea level.



Hedychium muluense R.M. Sm. is endemic species to Borneo. First discovered in Mulu National Park (as the epithet given) during the famous expedition in 1977. Distributed throughout Borneo, but not common.

HORNSTEDTIA

Medium-sized ginger, but sometimes reaching a height of 7 m tall or more. The leafy shoot is coarse, often swollen at the base, and frequently with stilt roots. Most of the members of this genus are easily recognizable by the inflorescence arising on a separate leafless shoot, which is somewhat spindle-shaped that composed of many sterile bracts. This genus is named after the Swedish surgeon and naturalist Claes F. Hornstedt. Sixteen species are recorded from Borneo and all can be found in the HoB areas. Among the species recorded for Sarawak: -

- *H. affinis* Ridl.
- *H. conica* Ridl.
- *H. havilandii* (K. Schum.) K. Schum.
- *H. incana* R.M. SM.
- *H. leonurus* (J. Koenig) Retz.
- *H. merahjambu* Angela, Tawan & Meekiong
- *H. phaeochoana* (K. Schum.) K. Schum.
- *H. pinanga* var. *borneense* R.M. Sm.
- *H. putih* Angela, Tawan & Meekiong
- *H. reticulata* (K. Schum.) K. Schum.
- *H. scyphifera* (J. Koenig) Steud.
- *H. tomentosa* (Bl.) Bakh. *f.*





Hornstedtia merahjambu Angela, Tawan & Meekiong

This species was described in 2018 from Kelingkang Range Forest of Sri Aman. *Hornstedtia merahjambu* is unique among the species within the genus by having very slender pseudostem, linear leaves and bright coloured inflorescence. The epithet name was given due to its pinkish colour of inflorescence (*merahjambu* = *pinkish*; Malay word).

Recorded only from patches of kerangas forest on sandy soils in Sri Aman. Endemic to Sarawak.





Hornstedtia havilandii (K. Schum) K. Schum

Endemic to Borneo, this common species is found in lowland MDF to upper hill forest up to 1000 m above sea level, often near the streams. Locally known as *Sengang,* the inflorescences are harvested and cooked as a vegetable. The seeds are edible. This species is named after George D. Haviland, Sarawak Museum Curator (1889 – 1895).





Hornstedtia tomentosa (Bl.) Bakh. *f.*

Medium to tall gingers, to 2 m high, forms a clump of stout leafy stems, with densely hairy leaves. The inflorescences are spindle-shaped, flowers are yellow, resembling the shape of the duck-billed platypus. Distribution in West Java, Borneo and Sumatra. The epithet refers to tomentose leaves.



MEISTERA

The genus *Meistera* was reintroduced to accommodate about 41 species of *Amomum* and *Elettaria carnicarpa* Wight based on the recent molecular study by De Boer et al. (2018). Meistera species are characterised by anther crest semilunar, echinate fruits and fertile bracts supporting a single flower. The generic name was given after Georg Meister, a gardener and botanist to the Elector of Saxony in Dresden, and the gardener for the Netherlands' Vereenigde Oost-Indische Compagnie, stationed in Java (1677–1688). Of the total number, only three species were recorded from Sarawak, and all can be found in the HoB areas. The species are:

- *M. gyrolophos* (R.M. Sm.) Skornick & M.F. Newman
- *M. oligantha* (K. Schum) Skornick & M.F. Newman
- *M. sceletescens* (R.M. Sm.) Skornick & M.F. Newman



Meistera gyrolophos



PLAGIOSTACHYS

Tall ginger to 2 m or more, easily recognizable by the inflorescence breaking through the leaf sheaths and appearing lateral on the leafy shoot (thus the generic means – oblique or slanting spike of flowers or inflorescence). The flowers are usually small, densely arranged in a compact head, and pollinated by birds or halictid bees. This group of ginger is poorly known for the early disintegration of the inflorescence in many species into a mucilaginous mass that makes studies of herbarium specimens difficult or impossible. Currently, 15 taxa are recorded for Borneo, and eight species are found in the Sarawak HoB areas. The species are:

- *P. albiflora* Ridl.
- *P. altistachya* Meekiong & C.K. Lim
- *P. bracteolata* R.M. Sm.
- *P. crocydocalyx* (K. Schum.) B.L. Burtt & R.M. Sm.
- *P. glandulosa* S. Sakai & Nagam.
- *P. parva* Cowley
- *P. strobilifera* (Baker) Ridl.
- *P. strobilifera* (Baker) Ridl. var. *conica* Salasiah & Meekiong



Plagiostachys strobilifera

Plagiostachys crocydocalyx (K. Schum) B.L. Burtt & R.M. Sm.

Locally known as *Banjang* by the Iban, this species is endemic to Borneo, commonly found in the lowland, open spaces along the roadside and secondary forests. The inflorescence head is probably the longest among all the ginger species, reaching up to 1.2 m long. The fruits are edible and reported to have high energy and mineral levels.





SCAPHOCHLAMYS

Small plants on the forest floor, with creeping thin rhizomes, or sometimes supported by stilt roots (few species). One-leaf to multi-leaves. Inflorescences are terminal, carried by a short or long scape. The flowers are white or creamy coloured and often with a median yellow or purplish band. The labellum is flat, obovate, and more or less deeply bilobed. The genus name refers to large persistent bracts that provide a boat-shaped covering. The plants are often confused with *Boesenbergia*. Previously, only six species were recorded in Sarawak, until recently Meekiong et al. (2015) and Ooi et al. (2017) added three and eleven species to the list, respectively. Among the species are:

S. biru Meekiong

S. lanjakensis Ooi, Meekiong & S.Y. Wong

S. limiana Meekiong & Hidir

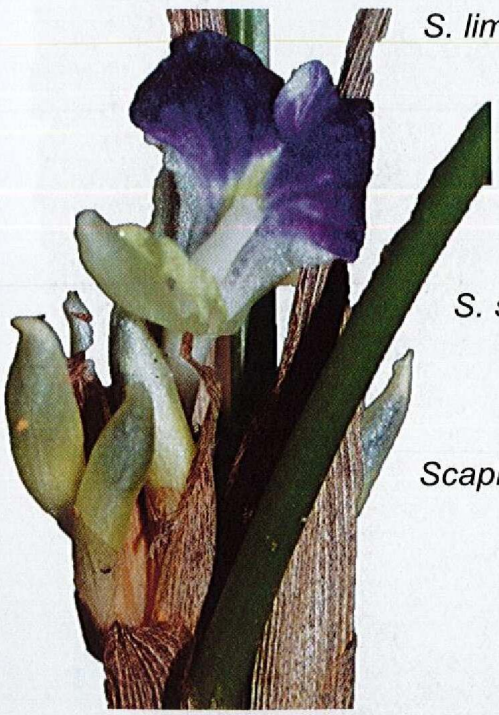
S. iporii Meekiong & A. Ampeng

S. penyamar Ooi, Meekiong & S.Y. Wong

S. polyphylla (K. Schum) B.L. Burtt & R.M. Sm.

S. samunsamensis Meekiong & Yazid

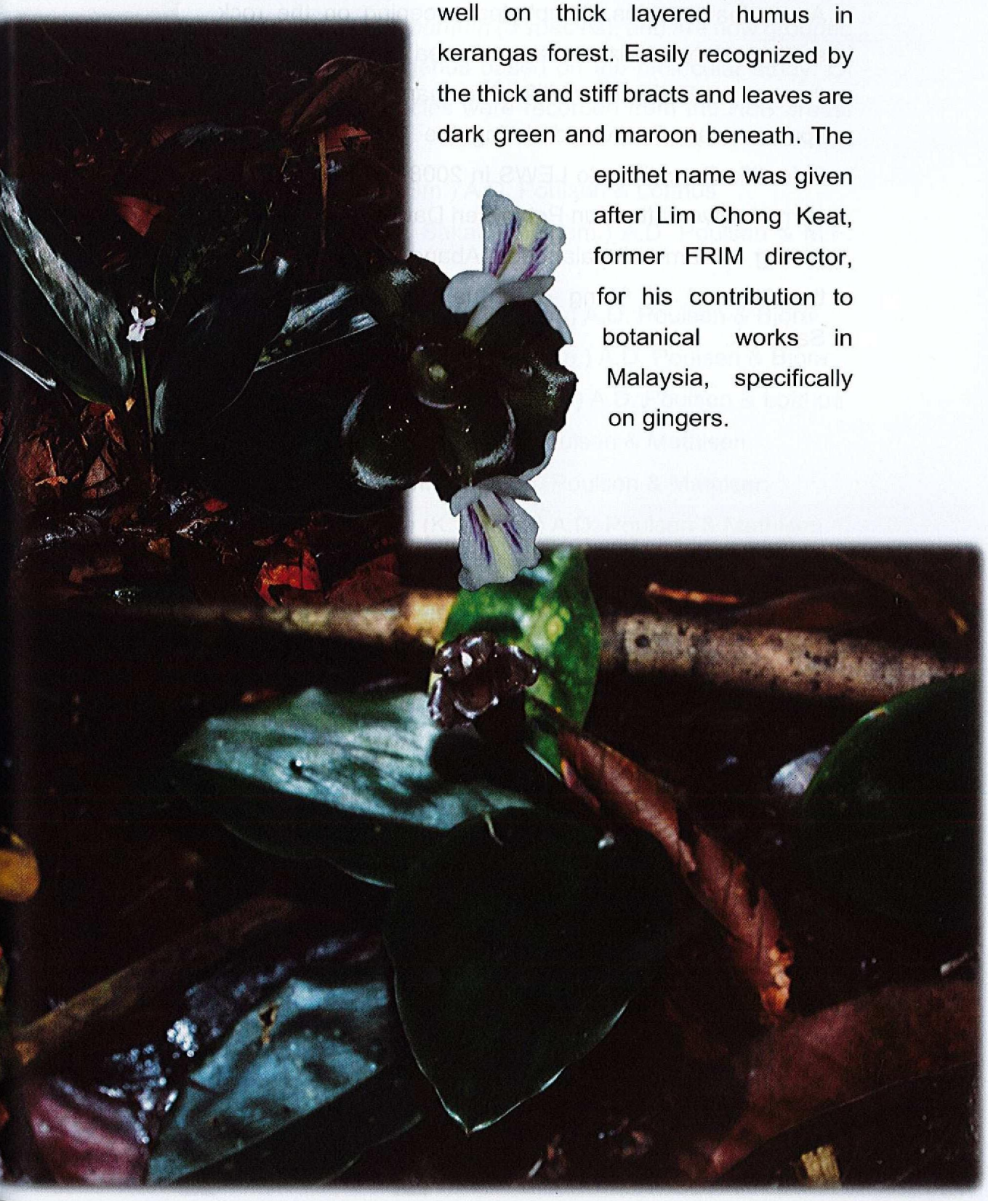
S. salahuddiniana Meekiong, A. Ampeng & Ipor



Scaphochlamys biru

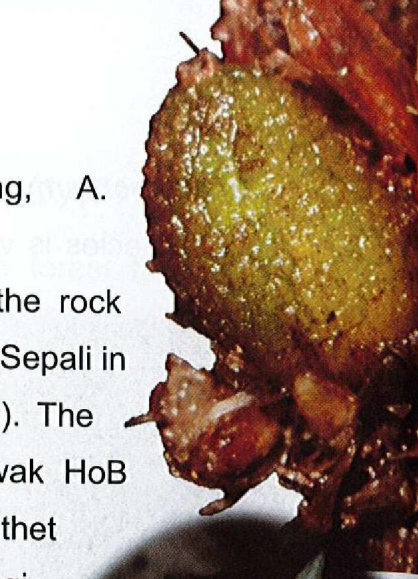
Scaphochlamys limiana Meekiong & Hidir

This species is very localized to a small area of Sematan, thriving well on thick layered humus in kerangas forest. Easily recognized by the thick and stiff bracts and leaves are dark green and maroon beneath. The epithet name was given after Lim Chong Keat, former FRIM director, for his contribution to botanical works in Malaysia, specifically on gingers.



Scaphochlamys salahuddiniana Meekiong, A. Ampeng & Ipor

A one-leaf species, lithophytes, creeping on the rock surface. Very localized to a small area of Mount Sepali in the Lanjak Entimau Wildlife Sanctuary (LEWS). The species was discovered during the 1st Sarawak HoB Scientific Expedition to LEWS in 2008. This epithet name is given after Tun Pehin Seri Datuk Patinggi Abang Muhammad Salahuddin Abang Barieng, the 3rd and 6th Yang di-Pertua Negeri of Sarawak.



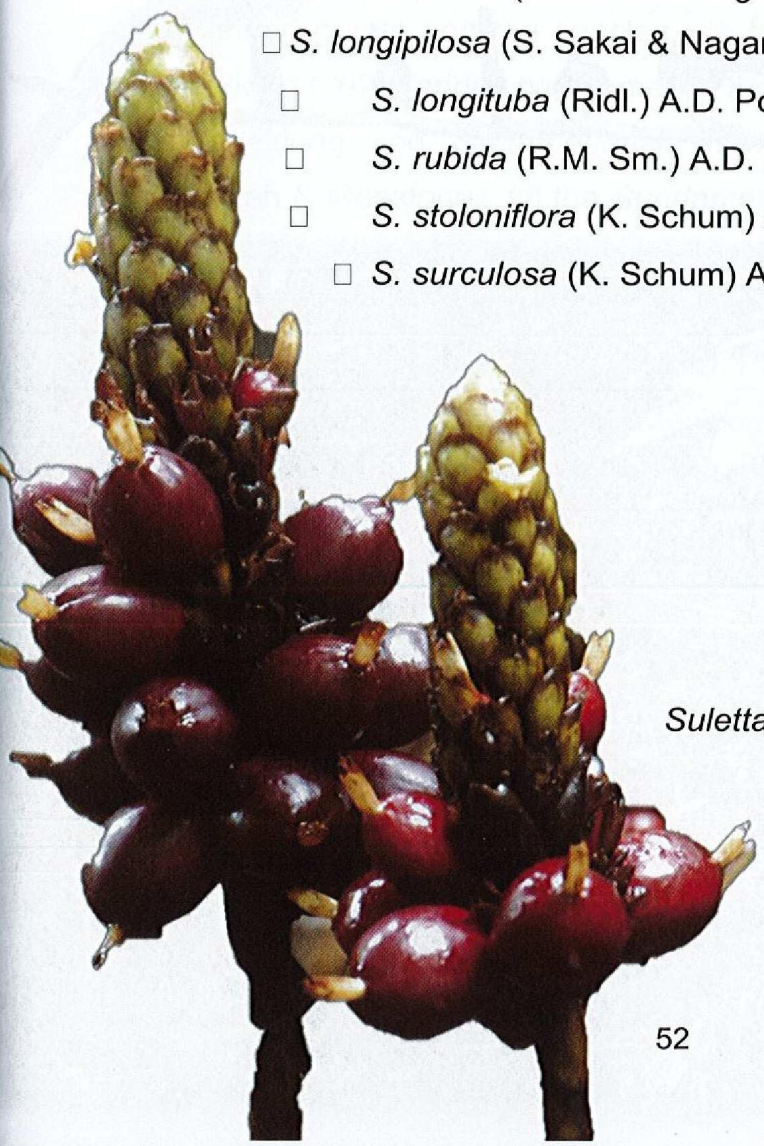




SULETTARIA

Most of the members are previously treated under the genus *Elettaria* (7 species) and *Amomum* (8 species), and are now grouped into this newly described genus based on the molecular study. Of the total number, nine species were recorded from the HoB areas. Among the species are:

- *S. anomala* (R.M. Sm.) A.D. Poulsen & Lofthus
- *S. brachycalyx* (S. Sakai & Nagam.) A.D. Poulsen & M.F. Newman
- *S. kapitensis* (S. Sakai & Nagam.) A.D. Poulsen & Bjora
- *S. linearicrista* (S. Sakai & Nagam.) A.D. Poulsen & Bjora
- *S. longipilosa* (S. Sakai & Nagam.) A.D. Poulsen & Lofthus
- *S. longituba* (Ridl.) A.D. Poulsen & Mathisen
- *S. rubida* (R.M. Sm.) A.D. Poulsen & Mathisen
- *S. stoloniflora* (K. Schum) A.D. Poulsen & Mathisen
- *S. surculosa* (K. Schum) A.D. Poulsen & Mathisen

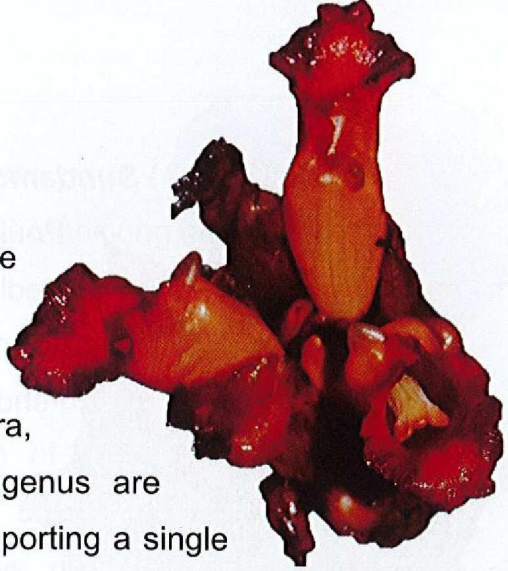


Sulettaria anomala

Sulettaria longituba (Ridl.) A.D. Poulsen & Mathisen

This species forms a large robust clump of leafy shoots, up to 30 plants or more, 1.5–2.5 m tall. Inflorescences are prostrate, and mostly buried in the ground with white flowers that arose on the surface. A widespread species, distributed in Peninsular Malaysia, Sumatra and Borneo. Found in lowland up to the lower montane forest, to 1000 m elevation, often in wet places near streams and river banks. The epithet refers to the long corolla tube.





SUNDAMOMUM

The generic name refers to the Sunda, the western part of Java and *Amomum*. Sundaland or the Sundaic Region is the area including Peninsular Malaysia, Sumatra, Java and Borneo. The species in this genus are characterised by the coriaceous bracts supporting a single flower and persisting to frutescence, flowers open to gullet-shaped, anther crest obscurely trilobed with sidelobes often reduced to a thickened angled margin, and fruits ribbed or grooved. Fourteen previous *Amomum* species have been transferred into this newly described genus and ten species are from Borneo. Salasiah and Meekiong (2020) added two names to the list, *S. corrugata* Salasiah & Meekiong and *S. bungoensis* (Aimi Syazana & Meekiong) Salasiah & Meekiong. All the *Sundamomum* species can be found in the Sarawak HoB areas (except *S. corrugata* – endemic to Similajau National Park). Among the species are:

S. borealiborneense (I.M. Turner) A.D. Poulsen & M.F. Newman

S. bungoensis (Aimi Syazana & Meekiong) Salasiah & Meekiong

S. calyptratum (S. Sakai & Nagam.) A.D. Poulsen & M.F. Newman

S. corrugata Salasiah & Meekiong

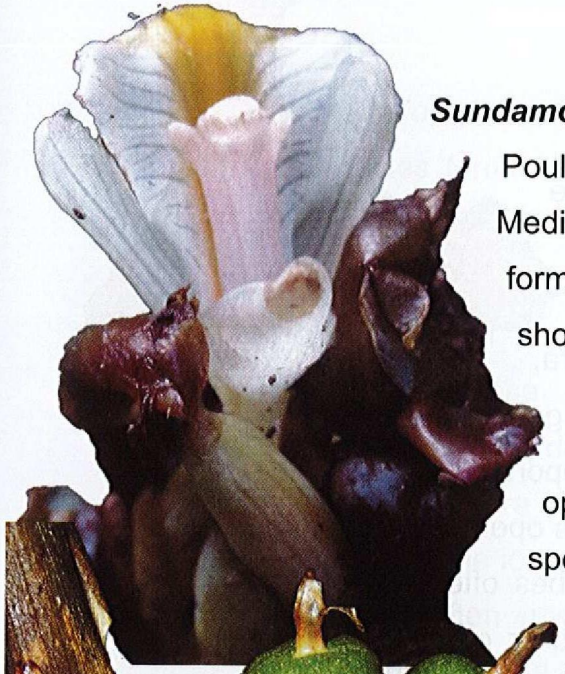
S. dictyocoleum (K. Schum) A.D. Poulsen & M.F. Newman



S. durum (S. Sakai & Nagam.) A.D. Poulsen & M.F. Newman

S. flavoalbum (R.M. Sm.) A.D. Poulsen & M.F. Newman

S. oligophyllum (A.J Droop) A.D. Poulsen & M.F. Newman





Sundamomum borealiborneense (I.M. Turner) A.D. Poulsen & M.F. Newman

Medium to large-sized ginger up to 2 m tall, forming-clump few to many shoots. The leafy shoots are close together and sometimes with many inflorescences that can be seen at the bases. The flowers are white with a flat, open lip with a central yellow band. This species is endemic, widespread in Borneo, found in hill forest, from 100–500 m altitudes. The epithet name refers to it being found in Borneo forests.



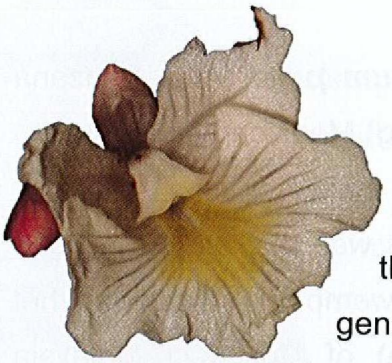




Sundamomum paya (Aimi Syazana *ex.* Meekiong) Meekiong stat. nov.

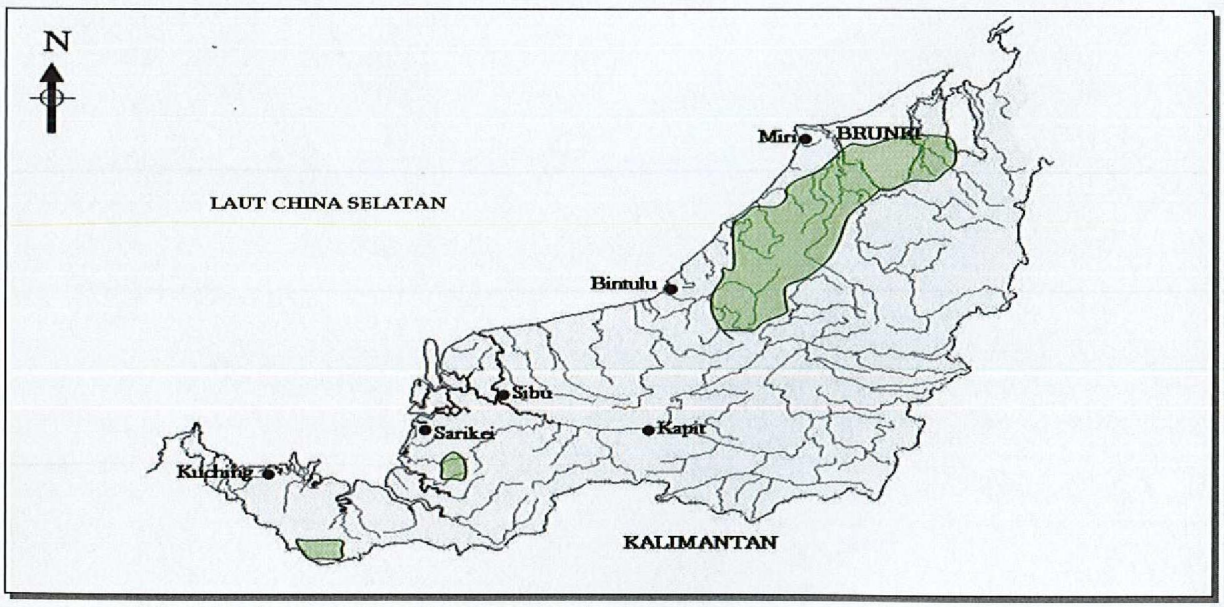
This species was discovered in 2018 in the peat swamp area (as the epithet name given) of Universiti Malaysia Sarawak Educational Forest. *Sundamomum paya* is one of few species that adapted very well in flood conditions of peat areas. The capsulate fruit on the slender peduncle, are eaten by the rodents and sometimes by the tortoise.



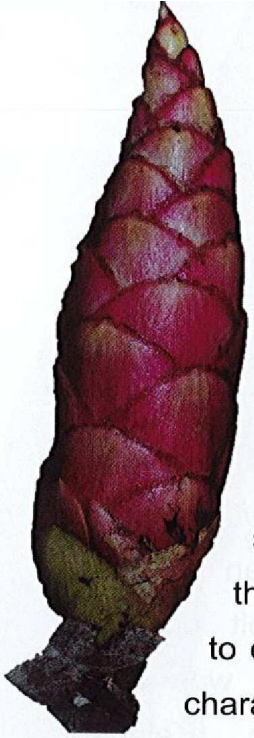


TAMIJIA

The genus *Tamijia* is an unusual genus of the Zingiberaceae, and the only genus in the distinct subfamily, Tamijioideae. This genus is endemic to Borneo, recorded from Brunei, Kalimantan and Sarawak (no record from Sabah yet). The generic name is given in honour of Japanese biologist, Tamiji Inuoe, the leader of a group of biologists working in Lambir Hills National Park, who died in a plane that crashed in the type locality. Previously this genus was considered monotypic, with only one described species; *T. flagellaris* S. Sakai & Nagam. Recently, Meekiong (2018) added *T. erectifolia,* a species from Tubau, Bintulu into the list. Only *T. flagellaris* was recorded from the Sarawak's HoB areas (e.g., Bintulu and Serian).



Distribution of *Tamijia* species in Sarawak



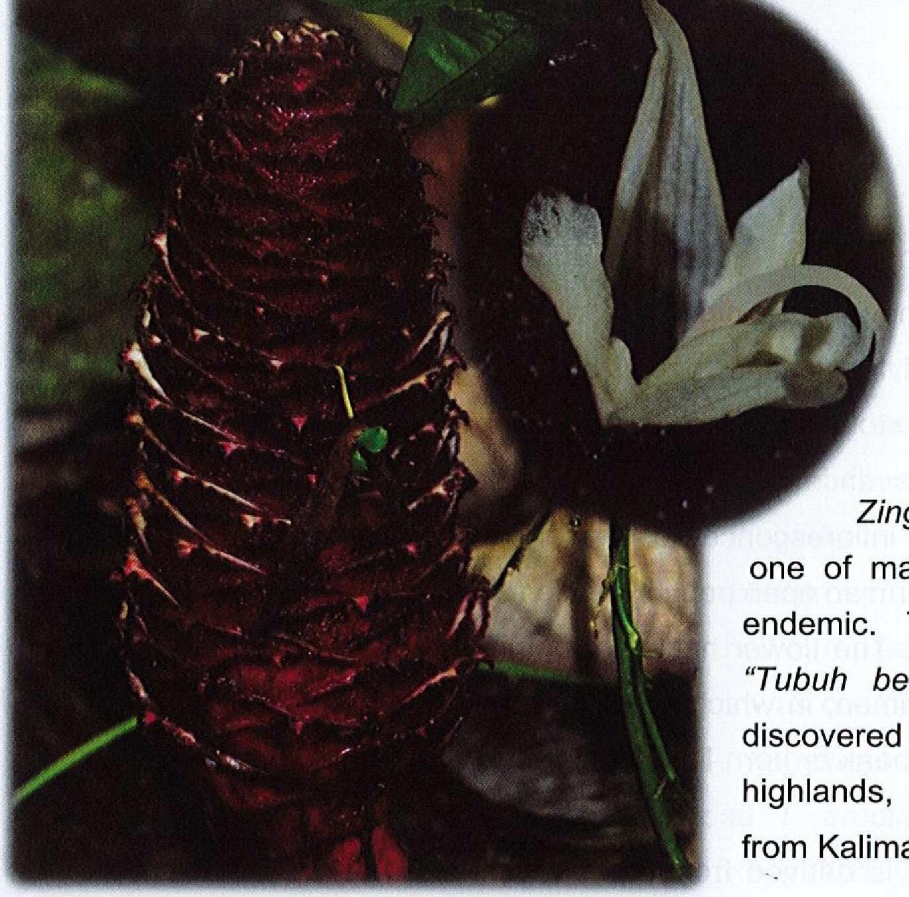
ZINGIBER

One of the largest genera in Borneo with more than 30 species have been described and several are yet to be described. Most of the species are medium-sized with long, creeping, stout rhizomes. In Borneo, all the species have the inflorescence at the base and separate from the leafy shoot. The inflorescence has closely overlapped bracts, or the bracts form an open pouch in which the flower occurs, one to each bract. The flower has a three-lobed lip with a unique character of stamen, in which the tip of the anther is extended into a long-curved beak or horn-like structure.

The generic name is derived from the Sanskrit word, *Sringavera,* which means "horn-shaped root", which refers to the shape of the underground rhizomes. *Zingiber officinale* or locally known as *Halia,* is one of the major spices since ancient times. Among the species recorded from the Sarawak's HoB areas are: -

Z. albiflorum R.M. Sm.
Z. argenteum Mood & Theilade
Z. coloratum N.E. Br.
Z. flagelliforme Mood & Theilade
Z. flammeum Theilade & Mood
Z. griffithii Baker
Z. incomptum B.L. Burtt & R.M. Sm.
Z. kelabitianum Theilade & H. Chr.
Z. longipedunculatum Ridl.
Z. martini R.M. Sm.
Z. pachysiphon B.L. Burtt & R.M. Sm.
Z. pseudopungens R.M. Sm.
Z. puberulum Ridl.

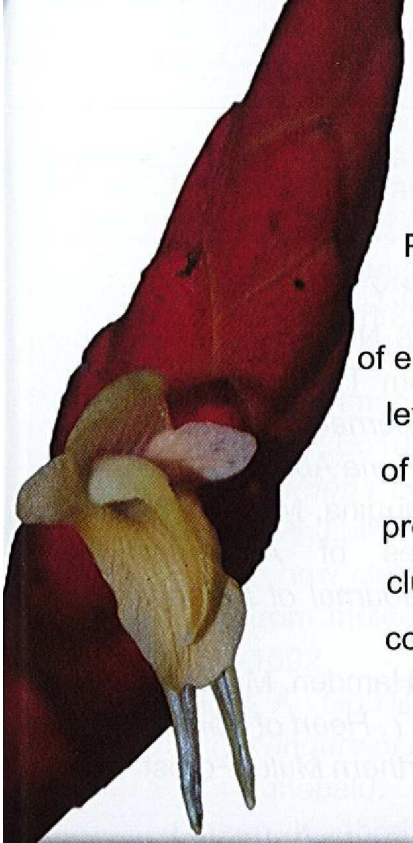




Zingiber kelabitianum, is one of many Bornean gingers endemic. The kelabit call it, *"Tubuh berak siah"*, was first discovered in the Kelabit highlands, but also recorded from Kalimantan and Sabah.



Zingiber pachysiphon, is endemic to Borneo. This species has robust inflorescences that are similar to *Z. kelabitianum,* but differ by several characteristics. The inflorescences are large, probably the largest and heaviest (up to 1.4 kg!) among all *Zingiber* species in Borneo.



Zingiber flammeum Theilade & Mood Previously recorded only from Tenom and Crocker Range of Sabah. This species has specific ranges of elevation, only recorded from 300–600 m above sea level in the hill MDF. This species forms small clumps of few leafy shoots to 80 cm high, sometimes produces up to 20 short peduncle inflorescences per clump. The species epithet refers to the bright orange coloured inflorescence. A new geographical record for Sarawak.

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Acknowledgement

Our gratitude to:-

Ministry of Energy and Natural Resources (KeTSA)
Universiti Malaysia Sarawak (UNIMAS)
The Director of Forest Department Sarawak (FDS)
Datuk Seri Lim Chong Keat
Prof. Emeritus Dato Dr Abdul Latiff Mohamed

Thanks to:-

Staffs of Plant Resource Science and Management Program (UNIMAS); Mohd Effendi Wasli, Hafsah Nahrawi, Hashimas Elias, Mogeret Sidi, Sekudan Tedong, Hidir Marzuki

Staffs of Research, Development and Innovation Division (FDS); Noorhana Mohd Sapawi, Nur Shafinas Jelani, Yazid Kalbi, Yahud Wat

Postgraduate students:-

Aimi Syazana Sedek, Nur Syauqina Syasya Mohd Yusoff, Salasiah Mohamed, Christina Petrus

Photos credit

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Lim Chong Keat
Mas Izzaty Bt. Mazlan
Miraadila Bt. Mohd Isa
Noor Ain Bt. Che Ahmad
Nur Syauqina Bt Mohd Yusoff
Ooi Im Hin
Salasiah Mohamad
Wong Sin Yeng
Yazid Kalbi

Glossary

Anther	- The pollen-bearing organ of a flower
Apex	- tip of organ
Aril	- an additional covering of a seed, growing out from the seed-stalk, and which may be pulpy or fleshy
Bract	- a much-reduced or modified leaf in whose axil a flower or partial inflorescence arises.
Bulbil	- A small fleshy bud formed in the axil of a leaf or bract, which may fall and produce a new plant, as a vegetative (non-sexual) method of reproduction. The new plant will not vary but have all the features of the parent plant
Calyx	- The outer circle of floral envelopes, composed of the sepals which may be free or fused together into a calyx cup or tube
Capsule	- a dry fruit that usually split when ripe
Cincinnus	- coiled monochasium, bearing its branches on one side only
Corolla	-The inner circle of floral envelopes, consisting of the petals of a flower as a whole. The petals may be free or fused together to form a corolla tube with their upper free ends as lobes
Cyme	- Inflorescence in which the apex differentiates with the result that lateral branches differentiate later to produce younger flower
Dehiscing	- Splitting or opening (of the fruit)
Distichous	- In two rows
Elliptic	- Oval in outline, being of the same breadth at equal distances from the base and the apex
Epiphyte	- A plant growing on the surface of another (usually trees) but does not derive water or nourishment from the tissue of the supporting plant.
Fruit	- A mature ovary

Fusiform - Spindle-shaped

Glabrous - Without hairs, smooth as in some leaf sirfaces
Glaucous - Smooth and having a waxy bloom
Globose - Spherical or globular
Herbaceous - Soft, green and containing little woody tissue
Humus - Organic matter in the soil derived from the decomposition of plant and animal remains
Imbricate - Overlapping as in a tiled roof
Inflorescence – A flower cluster or flowering branch
Infructescence – Cluster of fruits derived from an inflorescence
Involucre - Structure which protects or encloses another organ, bracts enclosing the developing inflorescence
Labellum - A petaloid staminode
Lamina - Blade, the flat part of the leaf
Lateral - At the side
Leaf sheath - The lower part of a leaf enveloping the stem
Ligule - Membranous projection from the top of the leaf sheath
Lip = Labellum
Lithophyte - plant growing on rock
Lobed - leaf that is devided into curved or rounded parts connected to each other by an undivided central area
Monocot - A member of a subclass of Angiosperm characterized by the presence of one cotyledon in the seeds.
Mucilage - A mixture of saccharides widely occuring in plants, caple of absorbing water, swelling and becoming slimy
Oblong - Spores long, wide and having somewhat truncate ends
Oblong-ellisoid - Spore rounded oblong, having long sides parallel and ends almost hemispherical
Ovate - With the outline of an egg
Ovoid - Egg-shaped
Panicle - Inflorescence somewhat like a raceme in which the pedicels have branched, the branching being somewhat irregular

Papilate	- covered with papillae
Papilla	- small, niple like eminence
Pedicel	- Flower stalk
Peduncle	- Inflorescence stalk
Persistent	- Not falling off
Petiole	- A leaf stalk
Pilose	- Having long, soft hairs
Pseudostem	- A false stem comprising of overlapping leaf-sheaths surrounding a slender core of tender stem tissue
Pubescent	- covered with downy hairs
Receptacle	- The enlarged end of a flower stalk to which the flower parts are attached
Rhizome	- An underground, horizontal stem
Seed	- A reproductive structure formed from the maturation of an ovule and containing an embryo and store food
Scape	- The leafless stalk of a flower cluster (or inflorescence) arising from the ground
Stem	- The leaf- and flower-bearing part of a plant
Stigma	- The part of a pistil or female reproductive organ of a flower which receives the pollen
Stilt root	- A supportive root growing from an above ground stem
Tomentose	- Densely woolly



The Sarawak's Monocotyledon Plant Series

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ISBN 978-967-26032-2-1