The Heart of Borneo Series 17

MONOCOTYLEDON SERIES 3
THE GENUS ZINGIBER

FOREST DEPARTMENT SARAWAK

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MONOCOTYLEDONS SERIES 3: THE GENUS *ZINGIBER*

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FOREST DEPARTMENT SARAWAK

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FOREWORD

Zingiberaceae or the ginger family is the largest family of the order Zingiberales. These aromatic flowering plants are widely distributed throughout the tropics and subtropics, and are especially abundant in Southeast Asia. Many species belong to the ginger family have been widely used as spices or flavouring agents, due to its aromatic odours, pungent and spicy taste.

One way for the realisation of the potential of the rich biodiversity must surely commence with the inventory of the all plant species that occur in Sarawak. Sarawak is a fast developing state and the documentation of its flora is crucial, especially when new species and even new genera still turn up every now and then. The ginger family including the genus *Zingiber* is no exception.

The genus *Zingiber* is native to Southeast Asia which the true gingers belong to and are grown the world over for their culinary value, the most well-known being *Z. officinale.*

I would like to congratulate all the authors for the commendable efforts and a task well done.

DATU HAMDEN BIN HAJI MOHAMMED
Director of Forests
SARAWAK

PREFACE

The family Zingiberaceae in Sarawak is very diverse, with 21 genera and nearly 200 species have been recorded. This such great diversity is not surprising as Sarawak with area almost as big as Peninsular Malaysia, has a great array of habitats, from lowland areas to a highland of sub-montane forests, provides distinctive niches to host variety of gingers. Among the genera, *Zingiber* is one of the largest ginger groups in Borneo, with about 33 species have been described, and many more in the forests are awaiting to be discovered. About half of the total for Borneo are found in Sarawak, with majority are recorded from the Heart of Borneo areas. This book highlighted almost all the species recorded in Sarawak (except few species which are not discovered or unable to relocated during the study). With a great diversity and many endemic species, conservation of gingers, particularly the genera like *Borneocola, Burbidgea, Epiamomum, Sundamomum, Tamijia* and *Zingiber* for future generations is urgently needed. Currently none of the ginger species in Sarawak are protected.

Authors

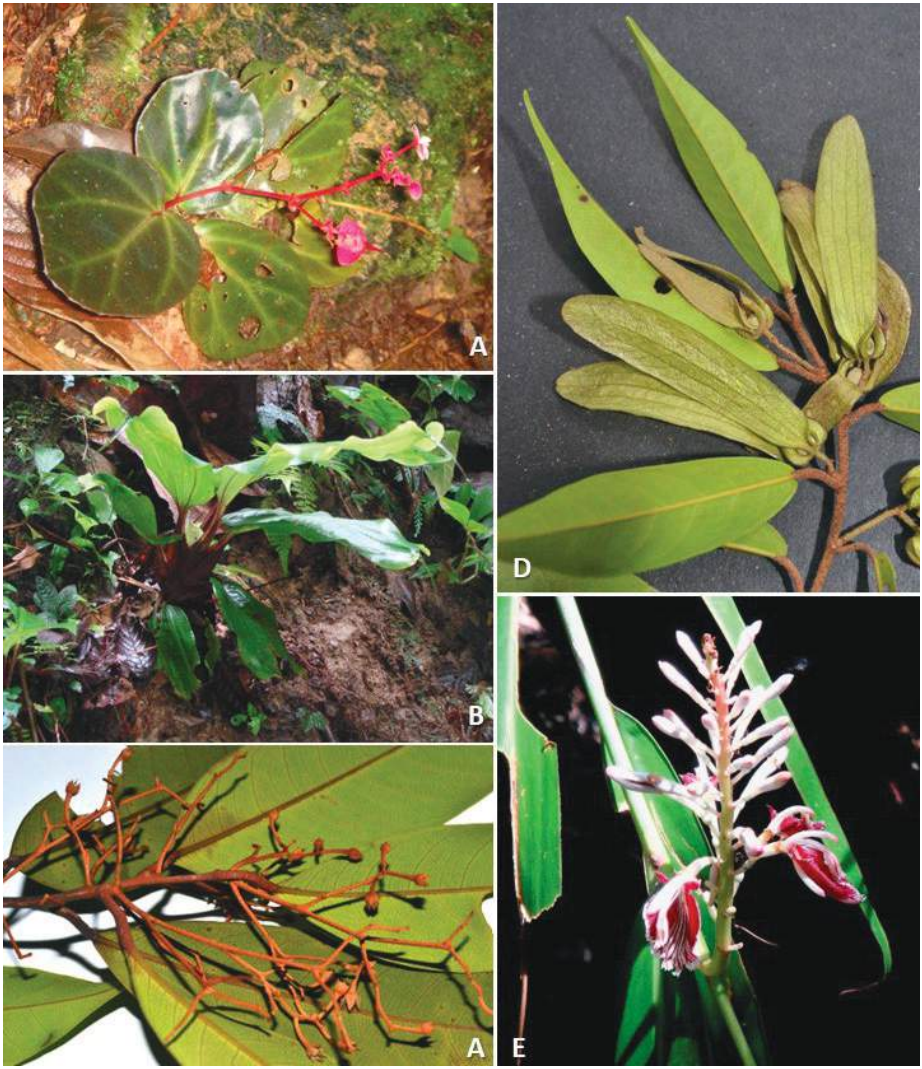
INTRODUCTION

Borneo is located on the continental Sunda Shelf. It is the third largest island in the world after Greenland and New Guinea. It presents one of the most biologically diverse collections of planets of ecosystems (MacKinnon, 1997). Borneo covers an area of approximately 745,567 square kilometres. Three countries namely Malaysia including Sabah and Sarawak, Indonesia (Kalimantan) and Brunei Darussalam shared the island.

Borneo is considered to be a centre of biodiversity in tropical Asia based on the large variety of plant species (Hazebroek & Morshidi, 2001). There are high mountains and a few types of forests that provide a variety of habitats. The main four types of forest are lowland rainforest, montane forest, inland swamp forest and mangrove forest. Most of the forest was depleted due to the development of shifting agriculture, commercial logging and clearing land for large-scale agriculture. Borneo is located on the equator and has a rainy, humid equatorial climate that receives almost 4,000 to 5,000 millimetres of rain every year.

There are 64 families, 224 genera and 1201 species that represent only a quarter of the Bornean tree flora. A total of 490 species were identified as endemics in Bornean and 102 species were identified as Sarawak endemics. The total flora endemic in Sarawak can be reached up to 400 species (Soepadmo, 1999).

Sarawak is the largest state in Malaysia. It lies between 0°50'N latitude and 109°30' to 113°40'E longitude, covering an area of approximately 124, 658 square kilometres (c. 17% of Borneo). It is located in the north and northwest of the island of Borneo with Kalimantan (Indonesian) to the south and the independent Sultanate of Brunei to the East. Besides, Sarawak lies within the humid equatorial tropics, combined with the mountainous terrain and extraordinarily diverse geology which offer habitat for a variety of terrestrial herbaceous monocotyledons (Boyce, 2006). Many reported that Sarawak has a large number of species and has been listed as one of the key areas of endemism. According to Ng (2004), there were 22% of a quarter of the Bornean tree flora that has been identified are endemic to Sarawak.



Endemic plant species to Sarawak.

A: *Begonia kurakura;*

B: *Mapania sapuaniana;*

C: *Vatica latiffii;*

D: *Vatica abang-zoharii;*

E: *Alpinia epiphytica*

Tropical gingers (Zingiberales) belong to the order of the monocotyledonous plants (Liliopsida). The order has eight families with 92 genera and approximately 2120 species. The families have been divided into two groups based on the functional stamen (Larsen *et al*., 1999). They are distinctive with many unique and highly modified morphological characteristics (Kirchoff, 1991). Gingers usually occur from the sea level to more than 2000 meters. Most of the gingers were rich in areas with high rainfall and a mixture of substrates and habitats (Boyce, 2006).

Zingiberaceae is considered among the largest families in the Plant Kingdom besides Orchidaceae, Poaceae and Bromeliaceae. It consists of more than 1500 species in 53 genera. The family was spread over tropical and subtropical areas and becomes the centre of distribution in the South East Asia region. About 80% total of known species is spread over Southeast Asia.

What is the Heart of Borneo (HoB) Initiative?

Heart of Borneo (HoB) Initiative is voluntary transboundary cooperation between Brunei, Indonesia and Malaysia to enable conservation and environment protection while enhancing sustainable minutiae 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.

Because of the global concerns and controversies well-nigh tropical forest development, the long-term objective of the HoB Initiative is as follows:
“With one conservation vision and to promote people's 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”.

5 PILLARS OF THE HEART OF BORNEO SARAWAK

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

FAMILY ZINGIBERACEAE

Terminal inflorescence

Alpinia; Boesenbergia, Burbidgea, Camptandra, Globba, Hedychium, Scaphochlamys

Breaking through pseudostem

Plagiostachys

Inflorescence from rootstock

Etlingera, Hornstedtia, Meistera, Sulettaria, Tamijia

Inflorescence from rhizome

Conamomum, Epiamomum, Geocharis, Haniffia Sundamomum, Zingiber

Family Zingiberaceae

Zingiberaceae is a comparatively advanced monocotyledonous plant and is the largest family in the order of Zingiberales. Plants of Zingiberaceae are rhizomatous, perennial and aromatic herbs. The distribution of the family is pantropical but concentrated in the Old World, especially in Southeast Asia (Lindley, 1835; Kress, 1990). Species in Zingiberaceae are the terrestrial plants of tropical forests.

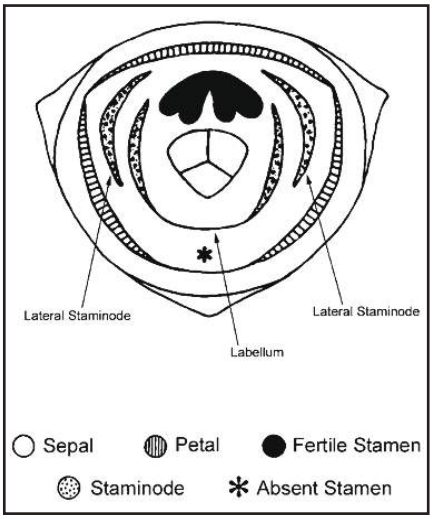
According to Larsen *et al.*, (1999), there are 50 genera and 1,500 species of gingers distributed in the Malesian region including Malaysia, Indonesia, Brunei, Singapore, Philippines and Papua New Guinea. Zingiberaceae is highest and rich in Papua New Guinea consisting of 24 genera and approximately 600 species were recorded. In the Indo-Malayan region, approximately 172 species, including varieties were reported. While Kress *et al*., (2002) state that it consists of 53 genera and over 1200 species that are widely spread over the tropics.

The study by Schumann (1904) and Petersen (1889) cited in Kress *et al*., (2002) showed that Costaceae was previously included in the family Zingiberaceae because of the broad similarities of inflorescence and floral characteristics. In later studies, Specht *et al.*, (2001) classified Costaceae as its own family due to some distinctive characteristics such as lack of aromatic oils, branched aerial stems and spiral monostichous (one-sided) phyllotaxy leaves are different compared to the Zingiberaceae.

The description of the details floral diagram of Zingiberaceae (Figure: Kress, 1990) is as followed; the fusion of the lateral staminodes of the inner stamina whorl into a labellum, the presence of two epigynous nectariferous glands at the base of the style and the occurrence of the cells containing essential or ethereal oils are apomorphies of the family. Another floral characteristic usually associated with Zingiberaceae is the presence of a single fertile tetrasporangiate anther and the slender style. It lies between two pollen sacs.

Based on Williams *et al*., (2002) study of Zingiberaceae in taxonomy still ample to be revised due to many species and new genera only described in the last several years. Besides that, a short-lived flower is one of the factors that cause taxonomic study of the family to be difficult and in some taxa, the descriptions remain incomplete.

Larsen (1996) states that, even though taxonomy and systematics studies had been focused on Southeast Asia, especially in Thailand and Burma, but still knowledge about the diversity and taxonomy of gingers elsewhere within the region is lacking. Although many local accounts of Zingiberaceae have been provided by several botanists there are stills no single updated revision for the Zingiberaceae of Borneo available today. Local botanists began to actively collect more data for the Malesian region in the hope to produce within the respective region such as Malaysia, Indonesia, the Philippines and Papua New Guinea (Boyce, 2006).



Floral diagram of the family of Zingiberaceae. (Not drawn to scale; Adopted from Kress et al., (2002, 1990).

Utilization of Zingiberaceae

Zingiberaceae acts as an important role in the ethnobotany sector. Many medicinal gingers are used in traditional cures that are related to women during confinement. Earlier research reported that one part of the ginger plant in the family Zingiberaceae rhizome was widely used as spices or condiments (Larsen *et al*., 1999). Some species of ginger rhizomes can be eaten raw or cooked as a vegetable and used as a food flavouring. For examples, *Zingiber officinale Roscoe, Curcuma longa L.* and *Alpinia galanga* (L.) Willd. are the most common commercially cultivated species (Chan *et al*., 2008).

Leaves have also been used for food flavouring and as well in traditional medicine. In Malaysia, for instance, leaves of *C. longa* are used to wrap fish before steaming or baking (Larsen *et al*., 1999). Leaves of *Kaempferia galanga L.* and *C. longa* are used as ingredients for curries. According to Lim (2003), the leaves of *Elettariopsis slahmong* C.K. Lim (now as synonym to *Amomum slahmong*) are used by some natives in Peninsular Malaysia for flavouring their wild meat and fish dishes.

Although gingers are popular in traditional medicine and spices, condiments or flavours, they are late getting popular as ornamental plants. Most of the plants in Zingiberaceae have showy inflorescence and often produce brightly coloured bracts and floral parts. For ornamental purposes, most of the species have one drawback; most of the species have very short-lived flowers and often last only a few hours. Many species cannot survive well outside the moist environment of the tropical rainforest. Therefore, only a few species are common in cultivation, e.g. *Alpinia purpurea, Etlingera elatior, Zingiber. spectabile, Z. ottensii* etc. (Larsen *et al.*, 1999).

The Genus *Zingiber* Mill.

The word "ginger" usually refers to the edible ginger of commerce known in the Malay language as *halia* and botanically as *Zingiber officinale*, while "gingers" is a general term for species of the ginger family. Zingiber always refers to the ginger group. This name had been used for centuries, but its origins are uncertain. The pronunciation of the words may provide a clue, Arabic called it 'Zenjabil', Persian 'Zengabil' or Sanskrit '*Singabera*' (meaning horn-root), then gave rise to the classical Greek name *Zingiberi* and finally *Zingiber* in Latin. All these words were used to refer to ginger rhizomes which resemble the shape of deer's antlers (Gunawardena, 1968).

'The Gardeners dictionary' is the book that was published by Miller in 1731. The name *Zinziber* is used for the first time for common ginger and broad-leaved wild ginger or zerumbet (*Zinziber latifolium sylvestre*). This prolific book later was reprinted many times. In 1771, (the six editions) Miller (1763) states Zingiber was separated from the genus *Amomum* of Linnaeus although *Zingiber* became widely used in scientific publications. This information is important to the researcher who studied *Zingiber*. However, the name *Zinziber* had been conserved spelling by the International Convention of Botanical Nomenclature (ICBN) and accepted the name *Zingiber Boehmer* as a priority following the ICBN rules.

Morphological Characteristics of *Zingiber*

Most of the *Zingiber* in Sarawak have erect candle-like inflorescences with closely-overlapping bracts and have white or pale yellow diurnal or nocturnal flowers (Boyce, 2006). It was classified as a monophyletic group, which produces radical inflorescence and is characterized by having pulvinus petiole and anther crest wrapped around the exerted style. *Zingiber* species can be divided into two types: one group produces flower with a purple or pink lip mottled cream or pale yellow; the other group produces flowers with lips entirely white or cream, not mottled at all (Kress *et al.*, 2002).

According to Sabu (2006), the genus of *Zingiber* can be distinguished from the other genus based on some basic characteristics. The features that distinguished this genus are; the genus has a long and curve anther appendage embracing the style and has the three-lobed lip and the side lobes are staminodes which are relatively broad and fused more or less to the mid lobe. *Zingiber* also has large bracts, each with a single flower and a non-tubular bracteole, more or less imbricating on a lengthening inflorescence.

Classification of Genus *Zingiber* Mill.

The genus of *Zingiber* was divided into two sections according to the earlier classification namely radical spike section and the terminal spike section (Roxburgh, 1874; Miquel, 1855; Nicolson, 1975). The former section included both the erect and procumbent peduncles. In 1792, the genus *Zingiber* was distributed into many genera. Some of *Zingiber* species were placed under *Amomum* L., Giseke (1972). The basionym including descriptions were described but were not grouped separately and still remained Amomum as an independent genus. Then, *Zingiber* was placed in the Amomeae. The section with erect peduncles is called *Lampuzium* and the name *Cryptanthium* for the section with short or long procumbent peduncles.

While, Bentham & Hooker (1883), they recognized four sections of the genus *Zingiber* by adding two more sections. For inflorescence produced directly from the rootstock with or without shortly embedded underground peduncles recognized as section *Cryptanthium*. While, Section *Lampujum* was identified by having an inflorescence with a long and erect peduncle.

For the section *Pleuranthesis* it possessed an inflorescence with a recurved peduncle and short lateral staminodes. The last section is section *Dymczewiezia* is possessed a terminal inflorescence which born on the leafy stem.

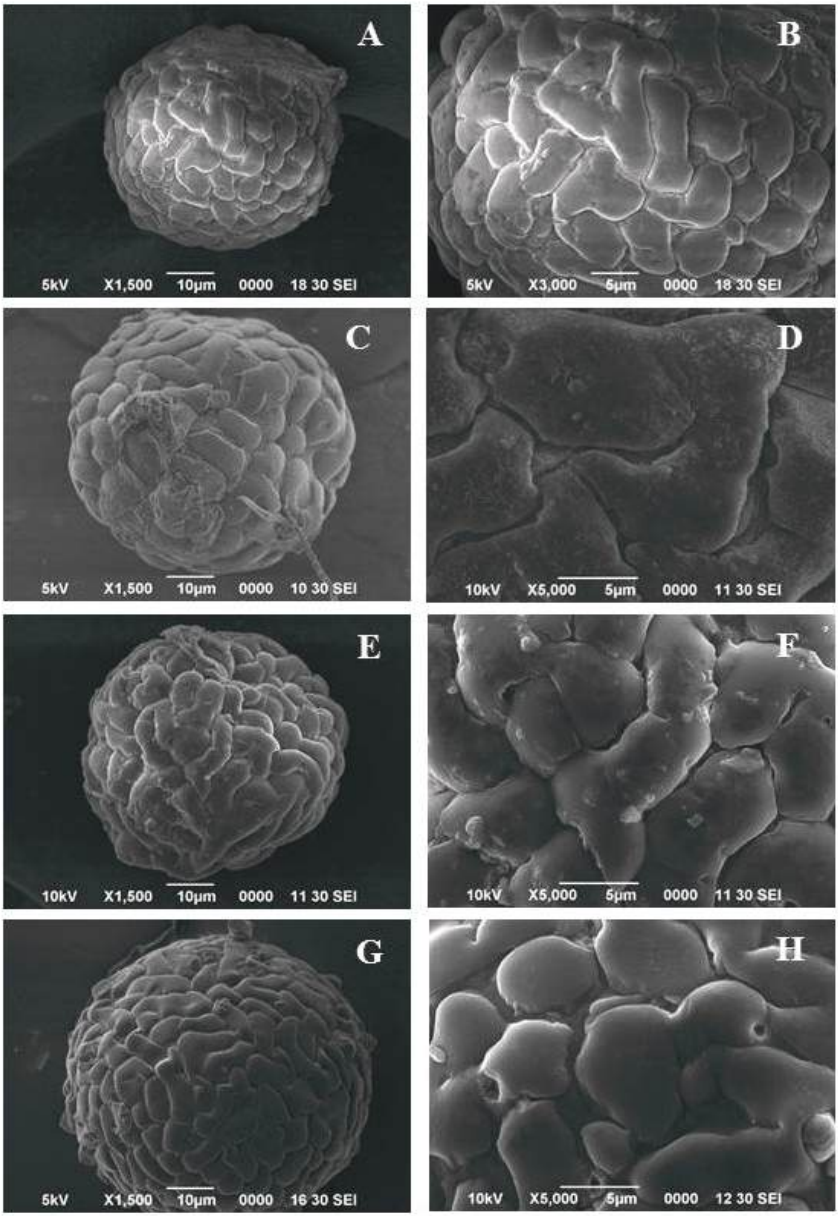
Case Study: Palynology Study on selected *Zingiber* species from Sarawak

Monocot is one of the angiosperm group characterized by monosulcate-derived pollen (Furness *et al*., 2002). According to Dahlgren et al. (1985) the morphology of pollen is important for the understanding of the taxonomy and phylogeny of the order Zingiberales. The presence of non-aperturate pollen in many monocots is related with aquatic or moist habitats such as Zingiberales which usually grow in moist rainforest. This type of pollen was also found in the genus of *Zingiber*. The results of this study was delightful, which all the selected species examined were having non-aperturate pollen.

Erdtman (1963) reported exine is the outermost layer that has many characteristic details which can be used in plant identification. Studies by Liang (1988) on Chinese *Zingiber* identified two types of pollen; ellipsoidal and ovoid shape. While, a study by Mangaly & Nayar (1990) present ovoid to sub-spheroidal and ellipsoidal with sulcus side. The sulcate was elliptical along the grain.

The morphology and internal wall structures of selected *Zingiber* species in Thailand were observed and described by using light, scanning and transmission electron microscopy (Theilade *et al*., 1993). Two types of pollen were recognized which is spherical with cerebroid sculpturing and ellipsoidal with spira-striate sculpturing. According to Theilade *et al*., (1993), palynological studies of pollen are significantly related to the sectional classification.

The results of our study were almost similar to the previous aforementioned reports.



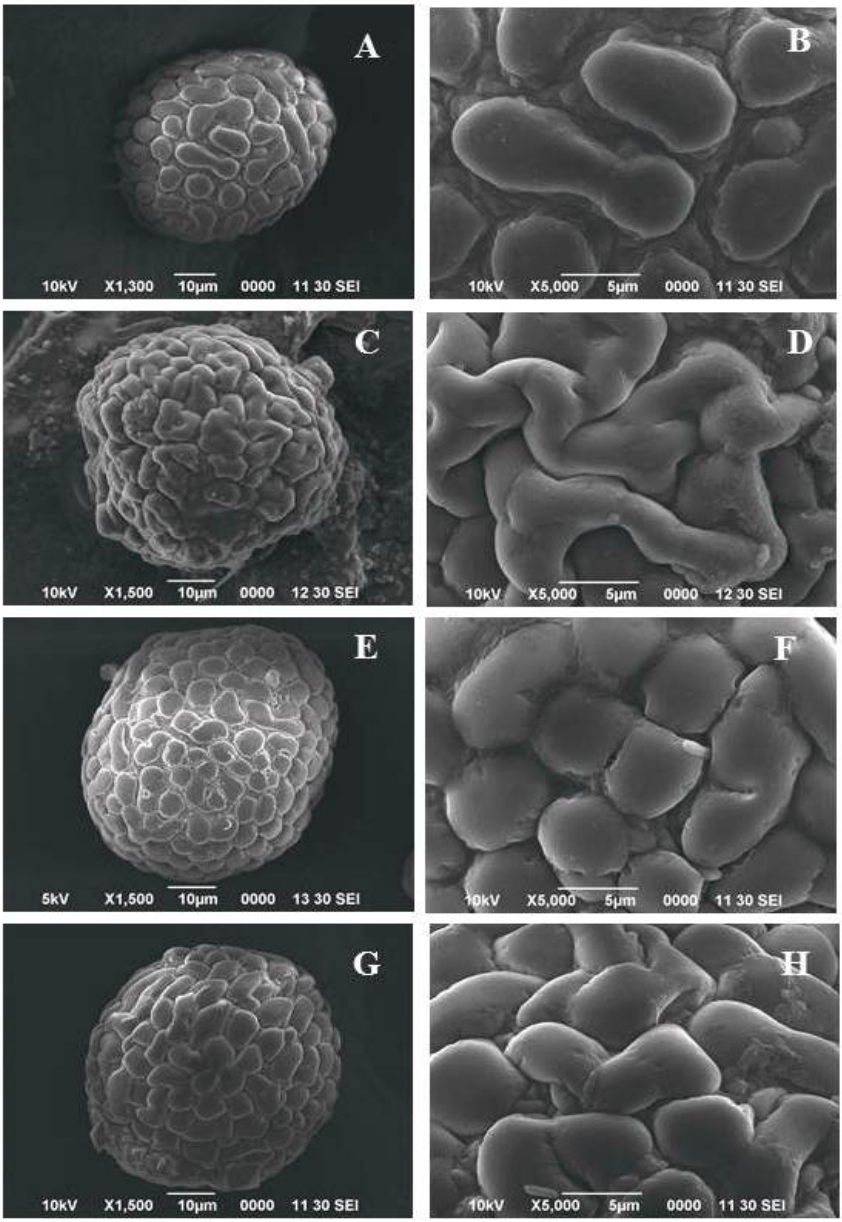
Microstructure of *Zingiber* pollen of selected *Zingiber* taxa with cerebroid-like exine ornamentation sculpturing.

A-B: *Z. incomptum;*

C-D: *Z. mawangense;*

E-F: *Z. kelabitianum;*

G-H: *Z. acuminatum var. acuminatum*



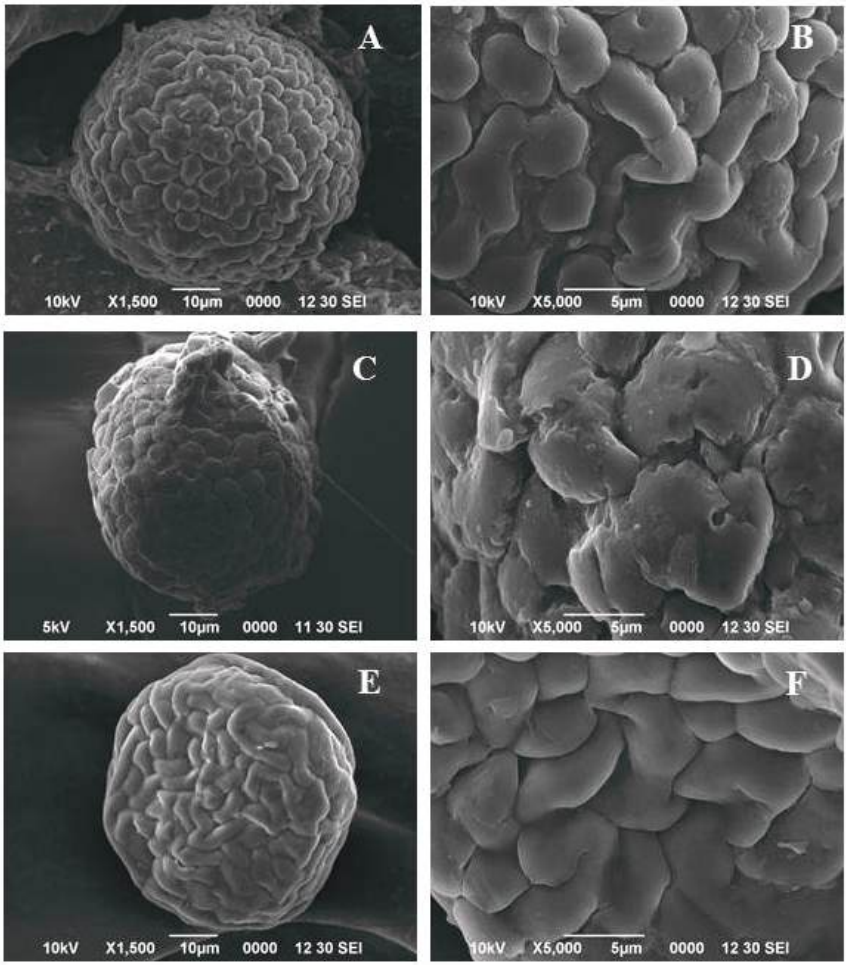
Microstructure of *Zingiber* pollen of selected *Zingiber* taxa with cerebroid-like exine ornamentation sculpturing.

A-B: *Z. longipedunculatum;*

C-D: *Z. martini;*

E-F: *Z. acuminatum var. borneense;*

G-H: *Z. longipedunculatum* var. *lambirense*



Microstructure of *Zingiber* pollen of selected *Zingiber* taxa with cerebroid-like exine ornamentation sculpturing.

A-B: *Z. ottensii;* **C-D**: *Z. pachysiphon;*

E-F: *Z. puberulum* var. *borneense*

Field key to taxa of *Zingiber* in Sarawak based on vegetative and floral parts

1a Plant height less than 1.5 m 2
1b Plant height more than 1.5 m 4
2a Ligule pubescent ..... *Z. acuminatum* var. *acuminatum*
2b Ligule glabrous 3
3a Leaves blade linear, bracts ovate, apex acute *Z.* sp.1
3b Leaves blade broadly lanceolate, bract oblong, apex rounded to mucronate ..... *Z. matangense*
4b Leaves blade broadly elliptic, lanceolate or oblong. 5
5a Ligule rounded 6
5b Ligule bilobed 8
6a Peduncle less than 10 cm long, bract obovate, brownish to green ..... *Z. martini*
6b Peduncle more than 10 cm long, bract oblong, orange to striking red 7
7a Ligule more than 1 cm, bract orange ..... *Z. flammeum*
7b Ligule less than 1 cm, bract striking red .. *Z. coloratum*
8a Peduncle procumbent 9
8b Peduncle erect 14
9a Pseudostem robust 10
9b Pseudostem slender 11
10a Inflorescence 3-5 per-clump, flower cream, labellum ovate ..... *Z. kelabitianum*
10b Inflorescence 8-10 per-clump, flower white, labellum oblong ..... *Z. pachysiphon*
11a Leaves blade lanceolate, margin wavy .... *Z. incomptum*
11b Leaves blade oblong to lanceolate, margin entire. 12
12a Inflorescence pinkish red, bracts with spine-like tips and frilled margin apex acuminate ..... *Z. pseudopungens*

12b Inflorescence dark red or deep red, bracts never as above, apex acute 14

13a Flower petals cream, anther oblong, labellum sinuate ..... *Z. longipedunculatum*

13b Flower petals white, anther elliptic, labellum entire ..... *Z. longipedunculatum* var. *lambirense*

14a Spike ovoid with incurved bract 15

14b Spike fusiform with imbricate bract 16

15a Leaf base attenuate, inflorescence red, flower petals pale yellow, labellum broadly elliptic ..... *Z. ottensii*

15b Leaf base rounded, inflorescence pink, flower petals pale cream, labellum ovate ..... *Z. acuminatum* var. *borneense*

16a Leaf sheath pubescent 17

16b Leaf sheath glabrous 18

17a Inflorescence consisting red throughout its life cycle, labellum pale yellow ..... *Z. leptostachyum*

17b Inflorescence green with red margins becoming red when flowering was ended, labellum white ..... *Z. albiflorum*

18a Leaves blade linear to lanceolate, flower petals yellowish ..... *Z. porphyrosphaerum*

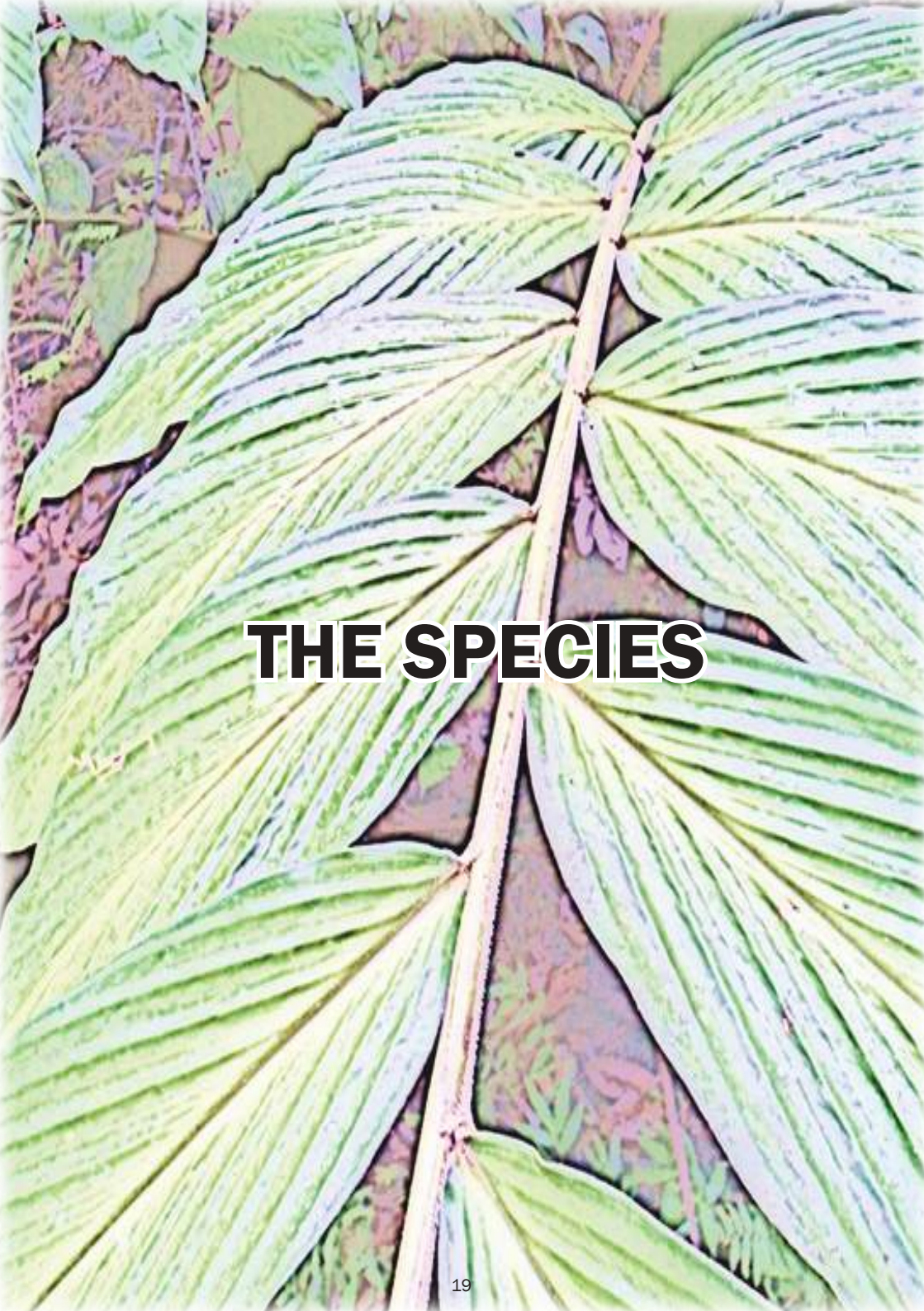
18b Leaves blade lanceolate, flower petals cream and yellowish 19

19a Ligule less than c. 5 mm, flower cream to yellow ..... *Z. mawangense*

19b Ligule more than c. 5 mm, flower cream 20

20a Inflorescence pale green, bract oblong, apex acute ..... *Z. puberulum* var. *borneense*

20b Inflorescence red, bract obovate, apex rounded ..... *Z. puberulum* var. *major*



THE SPECIES

Zingiber acuminatum Val. var. *acuminatum*

Distribution: Indo China Vietnam, Malesia Jawa, Sarawak and Kalimantan. In Sarawak: Bau, Kuching.

Ecology: Tropical moist forest, limestone foothill forest, disturbed and undisturbed secondary forest, found growing in shady areas in damp and wet places of flattens areas.

Description: Perennial herbs about 50–100 cm tall. The rhizome is whitish with adventitious roots. Leaf blade broadly ovate, 20.1-25.1 x 10-10.6 cm. Inflorescence radical from the base, red. Peduncle scarlet red and whitish towards the base 7.5 x 0.9 cm. Spike elliptic with raspberry shape, 5.0 x 3.5 cm. Bract 2.8 x 2.5 cm, pubescent, ovate, rounded apex, red and become whitish towards the base. Calyx 1.7 x 1.1 cm, translucent whitish, corolla tube 3.2 x 0.2 cm. Dorsal lobe 2.3-2.7 x 0.6-0.8 cm, translucent cream; lateral lobe 2.1 x 0.3 cm, translucent cream. Labellum 1.8 x 1.1 cm, cream to white, entire margin; mid lobe 6 x 11 mm, emarginated; side lobes 12 x 4 mm, ovate. Anthers cream, broadly elliptic, 11 x 4 mm, filament 1.0 mm long, appendage 11 mm long, yellow tip, tapering, shorter than stigma. Ovary globose, whitish, 3 x 2 mm.

Notes : The inflorescence was elliptic with a raspberry shape and peduncle scarlet red.

***Zingiber acuminatum* Val. var. *borneense* R.M. Sm.**

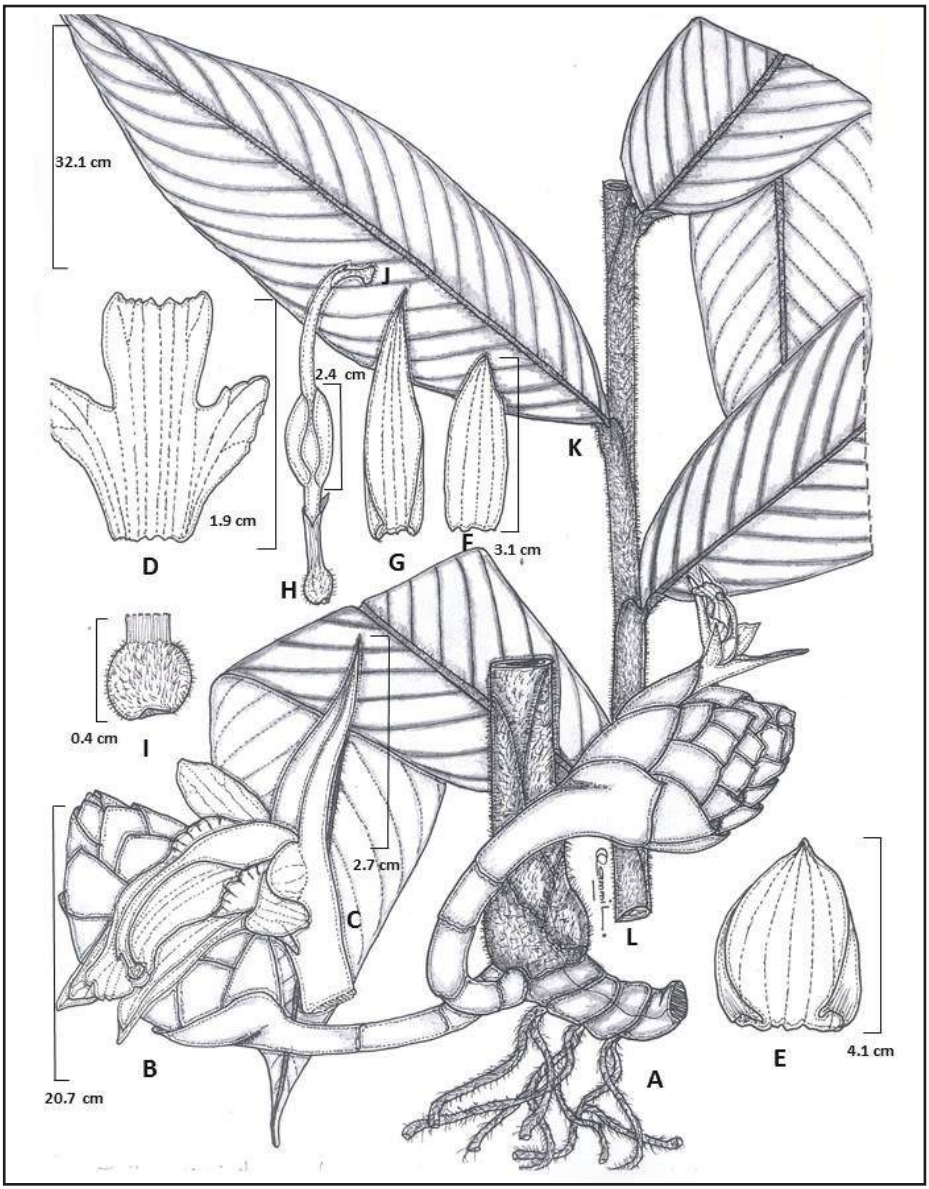
Distribution: Endemic to Borneo, known only from Kalimantan and Sarawak.

Ecology: Tropical moist forest. All secondary and primary forests, limestone foothills, near the stream or river, growing per clump in wetlands and alluvial soil.

Description:

Perennial herb with rhizome slender, trailing with long roots, yellow outside. Leafy shoots 1-2 m tall with 8-13 leaves. Leaf blade broadly elliptic to lanceolate, 2.2-32.1 x 1.1-10.5 cm. Inflorescences radical from the base, 3-5 per clump. Peduncle short, thick, 11.1-20.7 cm long with 3-5 sheath, tomentose. Spike elliptic with raspberry shape, 6.5-8.1 x 3.5-4.2 cm, pale pink or pink. Bracts obovate, 4.1 x 3.2 cm incurved at the more or less rounded tips, tomentose, pale pink on the upper half and become whitish on the lower half, brownish along apex margin. Bracteole 3.1 x 2.4 cm. Floral bract 2.1-2.4 x 0.5-0.8 cm, acute, translucent whitish, glabrous. Calyx 1.5-2.2 x 0.9-1.9 cm, glabrous, translucent whitish, bidentate. Corolla tube 35 x 2 mm, cream, glabrous. Dorsal lobe 27 x 7 mm, translucent cream, apitulate apex, lateral lobe 22-25 x 4-5 mm, translucent cream. Labellum conspicuously 3-lobed, 1.7-1.9 cm long, margin undulate, cream, ovate; mid lobe 12 x 8 mm, apex emarginated; side lobes ovate, 11 x 8 mm, apex obtuse. Ovary globose, 4 x 1 mm, sericea. Seed black covered with white aril, 8 mm in diameter.

Notes: This variety had shorter and elliptic inflorescence, densely brownish pubescence of the leaf-sheaths that were described as 'sooty' by Valeton, and shallowly bilobed ligule, instead of shortly 'winged' leaf bases. The leaves were broadly elliptic to lanceolate, often reaching 35 cm in length. The bracts were incurved at the more or less rounded tips, raspberry shape and this specific feature remained even species dried. The colour of the bracts was pink and the flower petal was white



Zingiber acuminatum var. *borneense* Valeton.

A: Rhizome; **B**: Inflorescence; **C**: Flower;

D: Labellum; **E**: Bract; **F**: Bracteole;

G: Dorsal petal; **H**: Stamen and appendage; **I**: Ovary;

J: Stigma; **K**: Leaf; **L**: Pseudostem.

Zingiber albiflorum R.M. Sm.

Vernacular name: Kamujuh (Penan); Japa (Iban).

Distribution: Endemic to Borneo (Sarawak).

Ecology: MDF, on slope of limestone hill, sub-montane primary forest, steep terrain, soil clay with rocks, disturbed peat swamp forest, moderate shade and peat soil.

Description: Terrestrial gingers at wet soil with yellow rhizome. Plant height from 1-1.8 m tall in clump up to 5 shoots, leaflets 7-8 pairs with one terminal leaflets. Leaf blade lanceolate elliptic, plicate with silvery indumentum below. Inflorescence borne on rhizome with 3 per plant, spike ovoid to fusiform, peduncle about 20-40 cm long filled with slimy liquid, lower scales reddish with greenish brown tips turning bright red when fruiting, entirely subterranean peduncle. Fertile bracts cream to brownish green, bracts pink or red, flower white. Seed black.

Notes: This species was origin from Mulu National Park. The description of the species was based on material that flowered in cultivation at the Royal Botanic Garden Edinburgh. Z. *albiflorum* remains known only from the type locality. It was identified by having the green, red-edges bracts which turn pure red only when flowering has ended.

Zingiber albiflorum R.M. Sm.,
Photo source from Royal Botanic Garden Edinburgh – Herbarium Catalogue

Zingiber coloratum N.E. Br.

Distribution: Endemic to Borneo (Sarawak)

Ecology: Growing on peat soil near the trail in secondary forest, in shaded limestone crevices with soil at limestone cliff base.

Description:
Perennial herb, leafy shoot with 0.5 - 1 m tall. Leaf sheath densely pubescent at the margins, dark green, present of colourless sap. Leaf blade oblong to elliptic, 1.2-48 x 6-11.4 cm, slightly corrugated, Inflorescence arise from the base with erect peduncle, 11.6 x 1.5 cm long, 3-4 sheath, tomentose, red and white near the base. Spike narrowly fusiform, 9.5-11.4 x 1.9-3.1 cm, striking red colour, imbricate, present mucilage. Bracts ovate, 3.8 x 3.9 cm, pubescent, margin velutinous with densely brown hair, rounded with teeth apex, striking red on the upper and become whitish at the lower.

Epithet name: The name of this species refers to the brightly colour inflorescence.

Notes: The plant height up to 1 m tall. Leaf blade was oblong to elliptic which was pilose on the lower surfaces. Leaf-sheaths were densely pubescent at the margins. The inflorescence is fusiform with striking red bracts and acute at the apex. The species was very showy and it was pollinated by *Amegilla* bees (Lamb et al., 2013).

Zingiber flammeum Theilade & J. Mood

Distribution: Endemic to Borneo (Sabah and Sarawak)

Ecology: Primary forest at hilly areas, altitudes between 300 to 500 m above sea level.

Description: Perennial herb, leafy stem 40–80 cm tall; 5–8 pairs of leaf, rhizomes brownish–white. Leaves elliptic, lanceolate, 15–30 x 6–10 cm, upper surface glabrous, lower surface with a few silky hairs. Inflorescence radical, decumbent, scape 5–10 cm long, dull red. Spike fusiform to elliptic, 6–10 x 2–3.5 cm, with sharped pointed apex. Bracts obovate, 20 x 15 mm long, orange, turning dull orange as they mature, the basal bracts with a reddish colour. Bracteoles elliptic, 14 x 7 mm, calyx 12–14 mm long, corolla 4–5 mm long, orange, dorsal lobes 2 x 1 mm, lateral lobes 2 x 0.5 mm, free almost to the base. Labellum 5 mm long, bright orange; mid-lobe oblong, 1.5 x 0.8 mm, side-lobes 0.5 x 0.4 mm.

Notes: This species originally was described from Paling-Paling Hill Sabah, and thought to be hyper endemic to that area. A new record for Sarawak.

Zingiber griffithii Baker

Distribution: Borneo (Sarawak and Brunei)

Ecology: Limestone forest, growing near swampy ground; kerangas forest

Description:

Perennial herb with whitish to yellowish rhizome. Leafy shoots 50-60 cm with 7 pairs of leaf. Leaf blade lanceolate shape, 6.8-39.7 x 2.3-11.0 cm, slightly corrugated. Inflorescence borne radical from the base, 1-2 per clump. Scape erect, 55 x 11 mm, pale green and become whitish near the base. Spike spindle shape, 11.1 x 2.8 cm, pink to whitish, needle like apex. Bract ovate, imbricate, 4.1 x 3.2 cm, acute apex, glabrous on both surfaces, thinner margin, pinkish red on the upper part and become whitish towards the base. Seed 8 x 4 mm, black with white aril.

Notes: This species had ovate leaf shape, thick, petiole 4.4 cm long and glabrous on both surfaces. The inflorescence spike was spindle shape, pink and glabrous.

Zingiber incomptum B.L. Burtt & R.M. Sm.

Distribution: Endemic to Borneo (Sarawak).

Ecology: Primary and secondary forest, MDF, growing near the trail on the steep slope of peaty soil, on a steep river bank, hill slope, primary forest, alluvial soils.

Description: Perennial herb, 3-4 plants per clump with 1-2 m tall. Rhizome tubular, whitish. Leaf blade lanceolate shape 5.6-34.0 x 1.1-8.6 cm. Inflorescence radical with 7-12 inflorescence per clump, aromatic smell, scarlet red colour c. 5-6 flowers. Peduncle 7.5-41.0 x 1.2-1.3 cm, creeping on the ground, tomentose, scarlet red colour, 4-8 per sheath. Spike ovoid, 10.6 x 5.7 cm, scarlet red. Bract obovate, 4.1 x 3.7 cm, pubescent, white in underground parts and turning to scarlet red in the upper part, bracts reflexed outwards with apex mucronate, greenish on the lower parts and become scarlet red towards the apex underside; slightly wavy margin, pubescent, sticky fluid. Bracteole ovate, pubescent. Flower yellow. Corolla tube yellow, 3.7 x 0.4 cm. Calyx translucent, white, 3.3 x 1.0 cm long, pubescent. Dorsal lobe 30-31 x 7-11 mm, translucent, yellow; lateral lobes 2.4-3.0 x 0.5-0.6 cm, translucent yellow. Labellum oblong, wavy, c. 2.2-2.5 cm long; mid lobe 19-23 x 7-9 mm, Ovary globose, 5 x 3 mm, sericea.

Notes: Described in 1969 based on a flowering plant in the glasshouses in Edinburgh. This taxon was originally collected by Burtt from Poi Range in 1962. Inflorescence radical, decumbent peduncle, tomentose scarlet red colour. The green, red-tinged, bracts were acuminate and shortly recurved at the tips.

***Zingiber kelabitianum* Theilade & H. Chr.**

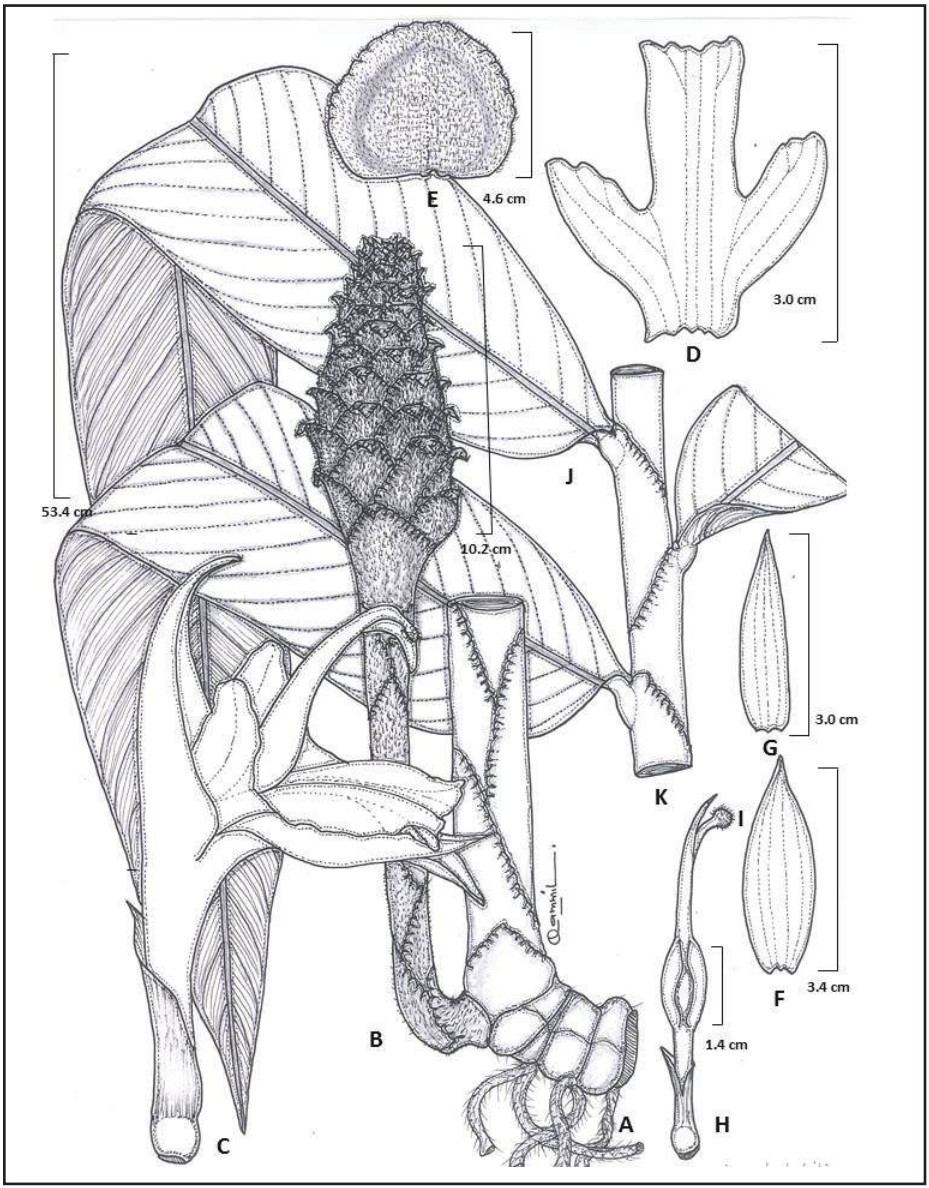
Vernacular name: Tubu kuri; Tubu berak (Kelabit)

Distribution: Endemic to Borneo (Sarawak).

Ecology: Limestone, lowland forest, growing on a wetland near the stream

Description: Perennial robust herb, tufted with 3-5 inflorescence. Leafy shoot erect, 2.5-3.0 m tall. Leaf blade oblong to lanceolate, 3.4-53.4 x 1.5-9.1 cm. slightly corrugated, petiole sub-sessile, 2 mm long. Inflorescence radical from the base, producing 1-2 cream flowers at a time. Peduncle erect, stout, 19.5-44.5 x 2.0-2.2 cm with 9-10 per sheath, green to red with distinct brown crenulate edges. Spike oblong, 10.2 x 5.4 cm, scarlet red. Aromatic scented flower. Bracts obovate, broadly wider, 46 x 69 mm, upper one scarlet red and lower ones become whitish toward the base, tomentose, wavy margin, apex acute, present mucilage. Calyx 25 x 6 mm, transparent, whitish, bidentate. Corolla tube 35 x 4 mm, cream, glabrous; dorsal lobe 34 x 10 mm, translucent whitish, apex apitulate; lateral lobes 30 x 10 mm, translucent whitish. Labellum 30 x 9 mm cream, depressed above, mid lobe 23-25 x 9-11 mm, emarginated, tip bilobed, sinuate; side lobes 20-21 x 6-7 mm, entire tips, obtuse. Ovary 5 x 4 mm, glabrous. Seed black with white aril, globose c. 5 mm in diameter.

Notes: "tubuh berak siah" (red boar ginger) was the names used by the The Kelabit people of Sarawak to identify Z. *kelabitianum*. This taxon is very useful to the Kelabit people. The young shoots were cooked or fried to eat as a vegetable. The inflorescences were boiled and pressed, so the cool liquid was given to sick or weak dogs. By having a very large and showy inflorescence it had the potential as an ornamental plant.



Zingiber kelabitianum Theilade & H. Chr.

A: Rhizome; **B**: Inflorescence; **C**: Flower;

D: Labellum; **E**: Bract; F: Dorsal lobe; **G**: Lateral lobe;

H: Stamen and appendage; **I**: Stigma; **J**: Leaf;

K: Pseudostem.

Zingiber longipedunculatum **Ridl.**

Vernacular name: Ligun (Iban); Tubu abang (Kelabit).

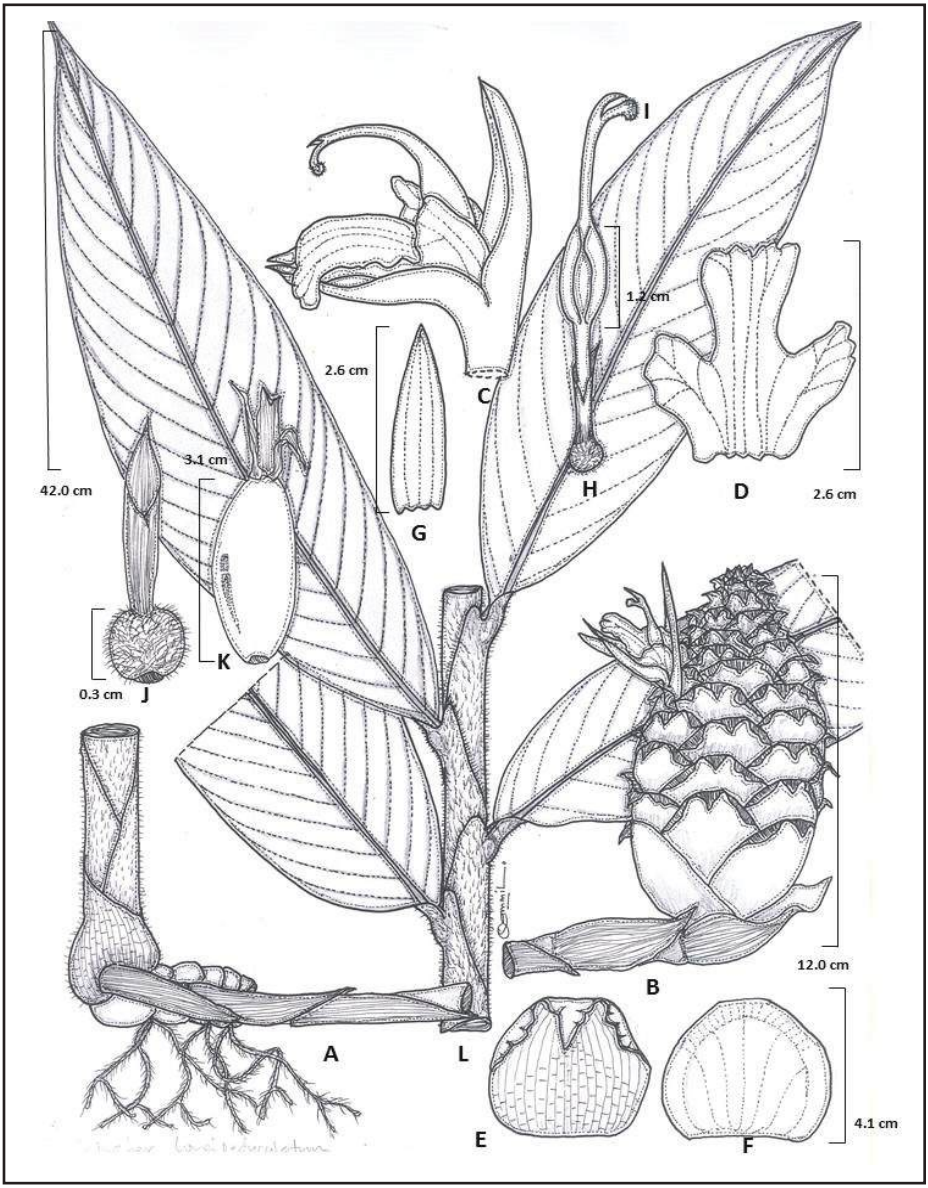
Distribution: Endemic to Borneo

Ecology: Kerangas forest, found growing in wetlands near the trail. River bank, silt sand soil, terrain steep, along widge, soil sandy loam, MDF, on dry sandy, rocky site at edge of escarpment, hill dipterocarp forest, by stream on limestone influenced soil 30 m in open secondary, lower slope of MDF.

Description: Perennial herb, 2-4 plants per clump, leafy shoots 1-2 m tall. Rhizome whitish, present of colourless sap. Leaf blade oblong to lanceolate; 3.8-42.0 x 0.8-8.0 cm, both surfaces pubescent. Inflorescence 2-4, radical with procumbent peduncle. Peduncle 57-64 x 0.9-1.5 cm creeping on the ground with 6-8 sheaths, pubescent, red and become whitish towards the base. Spike ovoid; pale pink or deep red, 9.1-12 x 5.2-7 cm with c. 2 flowers. Bract obovate, 4.1 x 3.8 cm white in underground parts and turning to pale pink or deep red in the upper part, reflexed outwards, pale yellow underside, acute apex, wavy and velutinous. Bracteoles ovate, 44 x 37 mm, cream. Flower cream. Corolla tube cream, 36 x 4 mm. Floral bracts translucent white, 22-32 x 10-12 mm. Calyx translucent white, 19-28 mm long, pubescent. Dorsal lobe 26 x 11 mm, translucent cream; lateral lobes 23-24 x 4-5 mm, translucent cream. Labellum cream, c. 18-26 mm long; slightly wavy, ovate to oblong, mid lobe 13 x 10 mm, apex emarginated; side lobes 14 x 10 mm, obtuse. Ovary 3 x 5 mm, sericea, light brown. Capsule white. Seed black with white aril.

Epithet name: The species epithet name "*longipedunculatum*" was derived from the distinct characteristic of having long peduncle.

Notes: The type specimen of this species was collected by John Hewitt, a British zoologist, who work as curator for Sarawak Museum, in 1907. This taxon was useful for the Iban and Kelabit as vegetable and use to treat for sick hunting dogs.



Zingiber longipedunculatum Ridl.

A: Rhizome; **B**: Inflorescence; **C**: Flower;

D: Labellum; **E**: Outer Bract; **F**: Inner bract;

G: Dorsal petal; **H**: Anther and appendage; **I**: Stigma;

J: Ovary; **K**: infructescence; **L**: Pseudostem and leaf.

***Zingiber matangense* Noor Ain, Tawan & Meekiong**

Distribution: Endemic to Borneo (Sarawak only).

Ecology: Kerangas forest, on thick humus layer or peaty soil. Few plants were also seen growing on rock surfaces and on the tree buttress.

Description: Perennial herbs with 87.4-116.6 cm tall, plicate with 6-16 pairs of leaves. Rhizome tubular, red and whitish towards the base with adventitious root. Leaf blade linear, 4.2-30.3 x 0.7-2.7 cm, lamina dark green on the upper surface and dull green lower surface. Peduncle arising from the rhizome, 27.7 x 0.7 cm, 3-5 sheath, prostrate from the ground, pinky red, pubescent. Spike oblong shape, 8.9 x 3.4 cm, striking pink, deflexed bract, pubescent. Bracts oblong, 3.9 x 3.7 cm, apex deflexed, wavy margin, striking pink, slightly pubescent outside and glabrous inside, become whitish towards the base, apex acute, thicker and become thinner towards pink and become whitish towards the base, oblong, apex acute, oblong, glabrous outside and inside. Calyx 17-21 x 9-12 mm, translucent whitish. Corolla tube 30-34 x 2-3 mm, cream. Dorsal lobe 27-28 x 9-17 mm, translucent cream, apex apitulate, glabrous inside and outside, lanceolate shape, thinner; lateral lobe 19-25 x 4-6 mm, translucent, cream, thinner, glabrous outside and inside, lanceolate shape, apex apitulate. Labellum 17-18 mm long, wavy margin, cream and yellow at the margin, oblong, glabrous, thinner; mid lobe 11-14 x 6-7 mm, apex rounded; side lobe ovate, 7-12 x 5-6 mm, slightly wavy margin, translucent, cream and yellow at the margin. Ovary 2 x 3 mm, sericea, cream.

Notes: The species differs from other taxa described from Sarawak by having very narrow leaves. The inflorescence has a similar deflexed bract as with Z. *incomptum* but is distinguished by flower morphology and colour.

Zingiber martini R.M. Sm.

Distribution: Endemic to Borneo.

Ecology: Found in limestone, lowland forest, growing near the rivers or streams, riparian vegetation, growing on mossy rock, riverbank, in clay of riverbank, disturbed, regenerating secondary forest, light shade, alluvial soil.

Description: Perennial herb, leafy shoot up to 1.6 m. Leaf blade oblong to lanceolate, 10.7-36.3 x 2.8-10.5 cm, Inflorescence radical arises from rhizome with erect peduncle. Peduncle short, 8.5 x 1.2 cm with 5-6 sheaths, green and become whitish at the base. Spike ovate, 12.1-18.5 x 4.5-5.8 cm. Bracts obovate, 50 x 39 mm, brown to green on the upper part and become pinkish to whitish at the lower part, margin entire, apex semi rounded with sharp teeth, pubescent. Floral bract 24 x 5 mm, translucent whitish, glabrous. Calyx, 21-28 x 6-12 mm, translucent whitish, glabrous. Corolla tube creamy, 39-53 x 3-4 mm, glabrous. Dorsal lobe creamy, translucent and pale peach at the base, apex apitulate, 23-24 x 10-11 mm long, lateral lobe 12-21 x 4-9 mm, translucent creamy. Labellum ovate, c. 19-21 mm long; mid lobe 8-12 x 6-13 mm, margin slightly undulate, creamy, apex emarginated; side lobe 7-11 x 3-7 mm. Ovary sericea 5 x 6 mm. Seed black with white aril, globose c. 7 x 5 mm.

Notes: *Zingiber martiniii* was more or less glabrous. The leaves were oblong to lanceolate, narrowly acuminate apex, attenuate base with wing petiole, 5 mm, ligule was rounded. Inflorescence was fusiform with short erect peduncle up to 8.5 cm long.

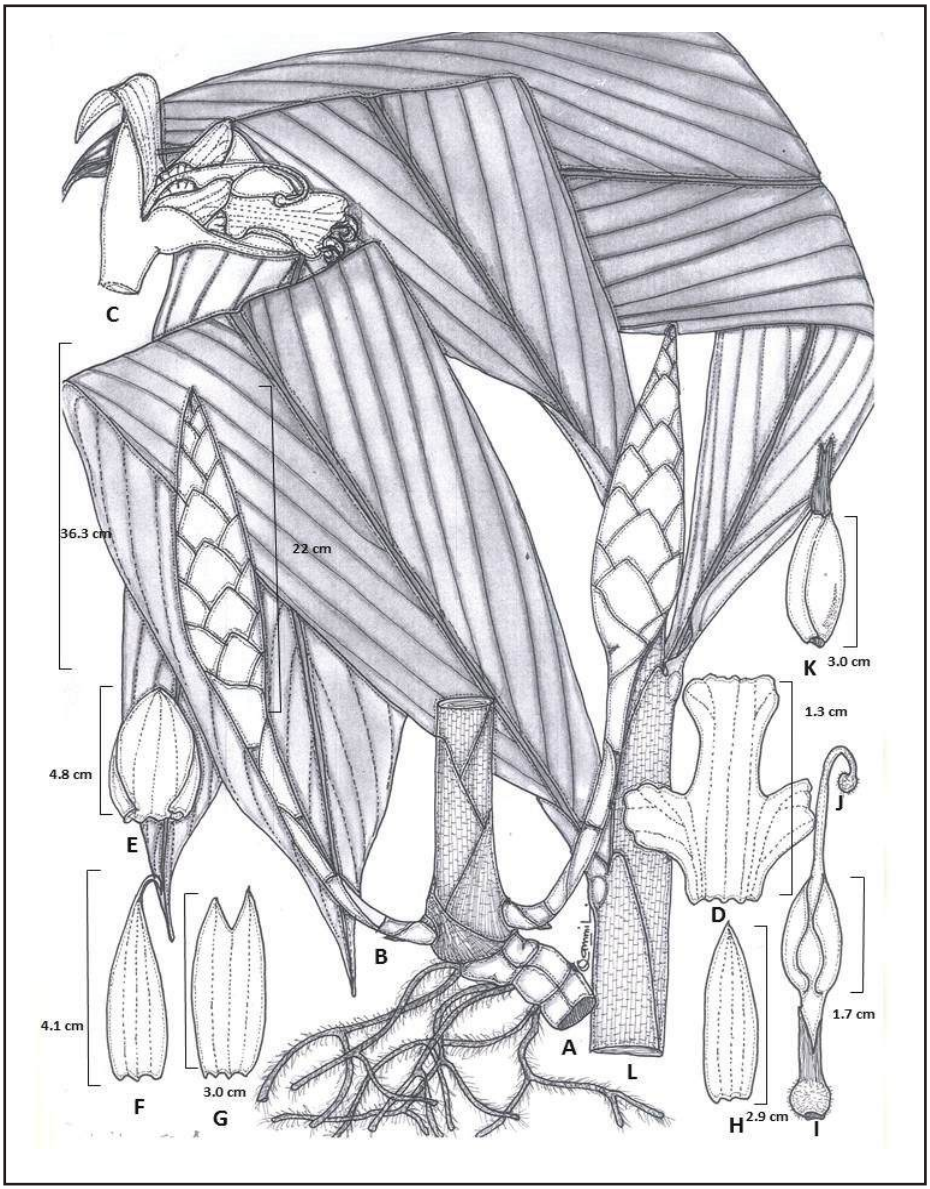
Zingiber mawangense Noor Ain, Tawan & Meekiong

Distribution: Endemic to Borneo (Sarawak only).

Ecology: Disturbed secondary forest, cultivated on orchard farm, near rivers and streams.

Description: Perennial herb with 1.0-1.5 m height. Rhizome slender, cream, aromatic smell. Leaves blade lanceolate; 3.2-36.3 x 2.1-10.2 cm, lower surface dull green, silver, present wax. Inflorescence 2-4 radical arise from the base with erect peduncle. Peduncle 9.5 cm long, slender, reddish yellow and scarlet red towards the base. Spike fusiform to oblong shape, 22 cm long, 4.1 cm wide, yellow to orange. Bracts ovate, imbricate, red at the apex and yellow along to the lower part, 4.1-4.8 x 3.7-4.5 cm, glabrous, apex acute, margin rounded. Bracteole 2.9 x 1.7 cm. Floral bracts translucent cream, about 3.5 cm long. Corolla tube yellow and become cream near the ovary, 4.9 cm long. Calyx 2.1 x 1.2 cm long, translucent cream, pubescent, apex tridentate. Flower cream; dorsal lobe cream, 4.1 x 0.9 cm, translucent, glabrous; lateral lobe cream, 3 x 6 mm, translucent, glabrous, wavy. Labellum cream, 13 x 6 mm, broadly elliptic; mid lobe cream, 16 x 6 mm, glabrous, apex rounded; side lobe cream, 16 x 5 mm, glabrous, apex obtuse. Ovary 3 x 4 mm, subglobose, sericeus. Stylode acicular 5-7 mm long.

Notes:
This species has similarities with Z. *argentea* Theilade & Mood and Z. *martinii* in appearance, but can be easily distinguished by the silvery abaxial leaves, short or almost sessil leaves.



Zingiber mawangense Noor Ain, Tawan & Meekiong

A: Rhizome; **B**: Inflorescence; **C**: Flower;

D: Labellum; **E**: Bract; **F**: Dorsal lobe;

G: Lateral lobe; **H**: Bracteole; **I**: Anther and appendage;

J: Stigma; **K**: infructescence; **L**: Pseudostem and leaf.

Zingiber ottensii Val.

Vernacular name: Lempoyang hitam; Bonglai hitam (Malay).

Distribution: Malaysia (Sabah and Sarawak), Java and Sumatra. Introduced in Indo-China and Thailand.

Ecology: Commonly cultivated in Sarawak. It prefers alluvial soil with good drainage.

Description: Perennial rhizomatous herb, 1-1.5 m tall; rhizome dark purple inside, pale purple with fibrous root, having a pungent smell. Leaf blade oblong to lanceolate, 11.4-26.2 x 4.9-7.7 cm. Inflorescence 1-3, radical arising from a rhizome. Peduncle erect, 21.1-27.9 x 1.7-1.9 cm long, with 5-7 sheath, lower half dark red. Spike evenly ellipsoid to cylindrical with a broad apex, torch shape, 3.1 x 6.9 cm, greenish to pale red, aromatic smell. Bract obovate 36 x 47 mm, pubescent, convex with incurved tips, red and become greenish towards the margin. Floral bract 34 x 19 mm, translucent, whitish, pale red at apex and cream towards the base, pubescent. Calyx 22 x 11 mm, hyaline, pale red at the apex and whitish towards the base. Corolla tube 34 x 2 mm long, pale yellow. Dorsal lobe 26 x 13 mm, translucent, pale yellow, acuminate apex, curved outwards; lateral lobe 25 x 6 mm, translucent, pale yellow. Labellum 5.3 cm long, broadly elliptic; mid lobe oblong and almost round 23 x 16 mm, apex rounded to emarginated and slightly cleft, wavy margin, pale yellow with faint-purplish markings and yellow towards the throat; side lobe ovate, 14 x 8 mm. Ovary 3 x 5 mm, pale yellow.

Notes:

This taxon was similar to Z. *zerumbet* but differs in the convex bracts with incurved tips and the pale yellow flowers with pale purple markings. It also can be differentiated by having dark purple inside in comparison to the yellow rhizome of *Z. zerumbet* and *Z. cassumunar.*

Zingiber pachysiphon B.L. Burtt & R.M. Sm.

Distribution: Endemic to Borneo (Sabah, Sarawak and West Kalimantan).

Ecology: Tropical moist forest. Limestone lowland forest, growing on wetland, MDF, in flood stream, disturbed primary forest, near stream valleys, on a gentle slope and limestone hill.

Description: Perennial robust herb, tufted with 3-10 inflorescence. Plant height 2.0-2.5 m. Leaf blade oblong, 9.1-52.5 x 4.1-8.9 cm, slightly corrugated. Inflorescence radical at base of the stem with procumbent or decumbent peduncle. Peduncle long 37.1 x 2.5 cm with 7-8 leaf sheath, red, stout. Spike oblong, 9.1-26.5 x 4.5-11.3 cm, scarlet red. Bract obovate, broadly wider, 5.9-6.2 x 3.8-4.0 cm, tomentose with brownish dense hair, wrinkle margin, apex acuminate, dark red on the upper one and becomes whitish at the lower one, recurved tips white. Bracteole ovate, 3.6-4.3 x 3.2-4.1 cm, wavy margin, apex acuminate, similar colour as a bract. Floral bract 24 x 6 mm, translucent whitish. Calyx 23 x 16 mm, hyaline whitish, toothed margin. Corolla tube cream thickened 36 x 4 mm long. Dorsal lobe 31 x 10 mm, translucent cream, apex apitulate; lateral lobe 26 x 12 mm, translucent whitish. Labellum conspicuously 3-lobed, pure white, 26 x 7 mm, scented, depressed above; mid lobe 13 x 7 mm, slightly undulate margin; side lobe 21 x 6 mm, entire, elliptic, apex obtuse. Ovary 5 x 4 mm, cream, glabrous. Seed 5 x 2 mm, black seed with white aril.

Notes: It was distinguished by the strongly recurved margins of the bracts which form almost *Curcuma*-like pounces. It had the variable colour of the bracts; livid purple in the type plant but specimens collected with scarlet red or almost white bracts have been recorded. The fully matured inflorescences are very attractive and it presents a stunning ornamental plant in tropical gardens. The cream labellum was unspotted. The bracteole, labellum and anther are shorter and connect with the corolla tube which had become thickened to a remarkable degree.

Zingiber Pseudopungens R.M. Sm.

Vernacular name: Tubu apad (Kelabit); Tubu tokong (Penan).

Distribution: Endemic to Borneo.

Ecology: Secondary forest, growing near the rock, hill slope, loamy soil by the river bank, disturbed forest, former cultivated area, medium shade, lowland mixed dipterocarp forest, growing near the trail on peat soil.

Description: Perennial herbs, leafy shoot 1.5 m tall. Leaf blade oblong to elliptic, 8.5-36.9 x 4.9-10.4 cm. Inflorescence 1-2, arising from the base with erect peduncle. Peduncle 75-81 x 12-15 mm, long with 3-4 sheaths, pubescent, pale red. Spike fusiform to oblong, 20.0 x 4.5 cm, red to pinkish, aromatic smell. Flower pale peach colour. Bracts ovate, 4.5 x 3.5 cm, pubescent, slightly wavy with apex acuminate, pinkish red and paler toward the base. Bracteole similar colour with bract, wavy on the apex, 42 x 25 mm, translucent white. Floral bract whitish, tomentose on the apex, 26 x 11 mm, bidentate apex. Calyx, 31 x 12 mm, whitish, tomentose on apex. Corolla tube whitish 34 x 3 mm. Dorsal lobe 26 x 9 mm, lateral lobes 24 x 5 mm. Labellum oblong, 22 x 13 mm, peach, margin entire, mid lobe 11 x 13 mm, emarginated, side lobe 12 x 7 mm, obtuse. Ovary 3 x 5 mm.

Notes: The inflorescences of this taxa were creeping on the ground. The bract was distinguished by having striking frilled margins and somewhat spiny tips (thus the choice of epithet). It had pinkish red bract at first but soon turned brownish. The flowers were orange-yellow.

Zingiber puberulum Ridl. var. *borneense* R.M. Sm.

Distribution: Borneo (Sabah and Sarawak).

Ecology: Widely distributed in all secondary and primary forests, limestone Foothill forest, orchard farm, growing per clump on alluvial soil and peat swamp, terrain steep.

Description: Perennial herb with leafy stem 1-2 m tall. Rhizome tubular, trailing with adventitious roots, white to dark red, aromatic. Leaf blade lanceolate 2.2-44.2 x 0.5-12.9 cm. Inflorescence 3-4 radical with erect peduncle. Peduncle slender but sometimes thick, erect, 22.3 x 1.2 cm long, green to reddish. Spike fusiform to ovoid tapering upwards to a pointed apex; 11.1 x 3.1 cm, pale green. Bract oblong 5.8 x 4.1 cm, apex acute, slightly wavy margin, transparent, pubescent, pale green on the upper part and turn to yellowish light brown at the lower part (during flowering); cream on the upper part and turn to pink at the lower part (after flowering). Bracteole ovate to oblong, 4.3 x 3.2 cm, slightly wavy margin, apex acuminate, similar colour as a bract. Calyx 9 x 28 mm, translucent whitish, bidentate. Corolla tube 56 x 4 mm, pale brown to cream. Dorsal lobe 23 x 7 mm, translucent, pale peach, apex apitulate; lateral lobe 21 x 4 mm, translucent, pale peach. Labellum 20 x 19 mm, creamy yellow; mid lobe 18 x 19 mm, slightly undulated margin, slightly wavy; side lobe 12 x 4 mm. Ovary 6 x 5 mm, sericea, pale brown to cream. Capsule acrocidal, pale yellow outside and whitish glossy walled inside. Seed black with white aril, globose c. 3 mm in diameter.

Notes:

This species was recognized by having dense yellow or yellow -brown indumentum of the leaf -sheath and ligule. The inflorescence was fusiform to the ovoid and tapering towards the apex. The side lobes of the labellum were well defined.

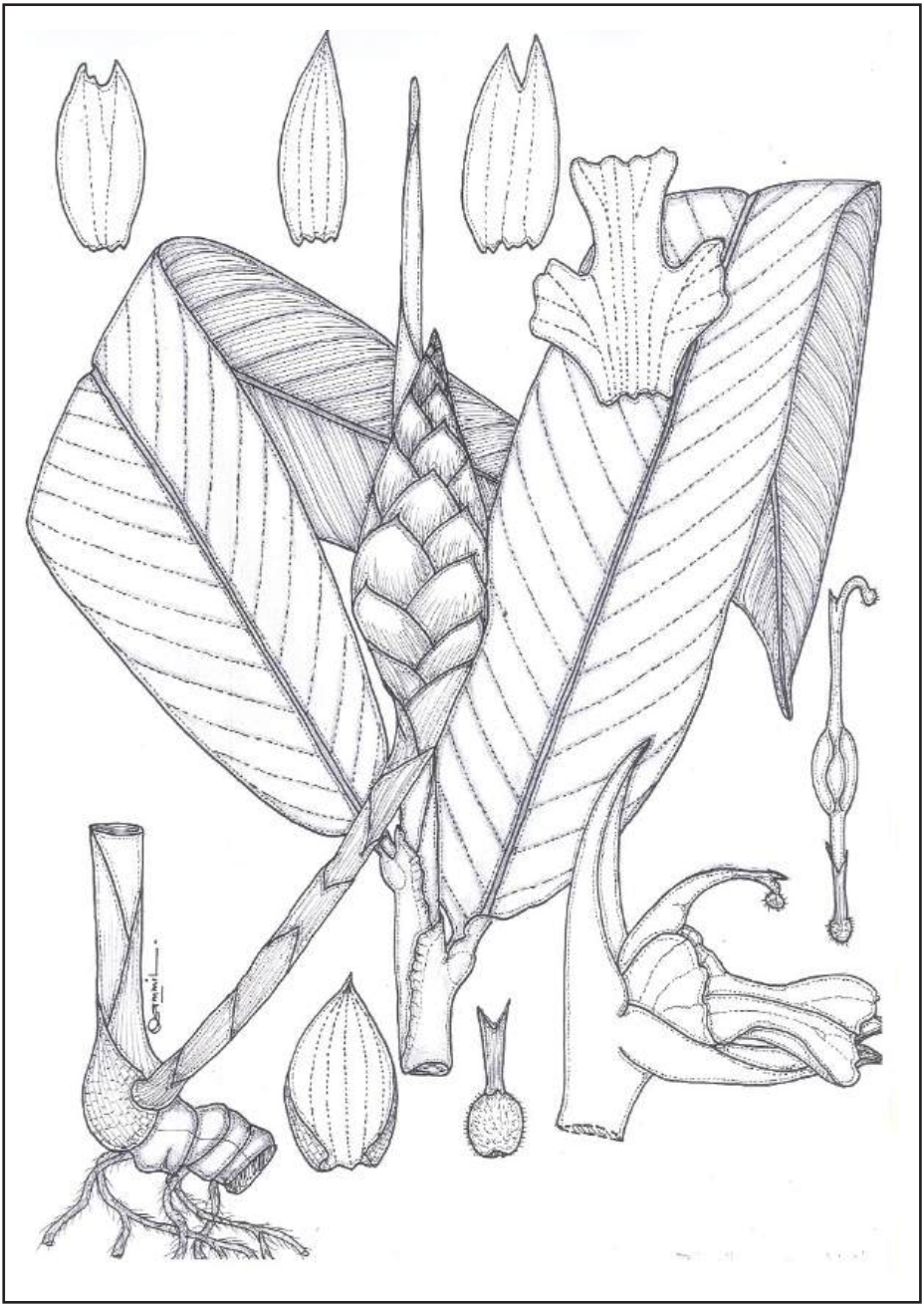
Zingiber puberulum var. *major* Ridl.

Distribution: Peninsular Malaysia and Borneo.

Ecology: Found in limestone foothill, disturbed secondary forest, growing on slope peaty soil

Description: Perennial herbs, 1–2 m tall, rhizome slender with a whitish colour. Leaf blade oblong to lanceolate shape, 1.7-45.1 x 0.4-12.1 cm, slightly corrugated. The inflorescence arises from the base with a more or less erect peduncle, 21.1 x 1.0 cm, reddish and becomes whitish at the base. Spike ovoid, spindle shape, 15.1 x 4.9 cm, pinkish red, fusiform in young and nearly evenly cylindrical when in fruit, apex acuminate. Bract obovate 5.6 x 4.2 cm, apex rounded slightly pubescent, imbricate, slightly wavy margin, pinkish red on the upper and become whitish at the lower towards the base. Seed 6 x 4 mm, black with white aril.

Notes: This taxon was easily distinguished by having a ribbed appearance in the dried state on the upper surface of the leaves. The thin bracts were densely gland-dotted. The colour of the bracts was usually red.



Zingiber puberulum* var. *major

Undescribed *Zingiber* Species from HoB Area

Zingiber sp.1

A medium size ginger, about 120–150 cm tall, 5–14 pairs of leaf. Leaves blade broadly elliptic, 30–55 x 12–18 cm. Inflorescence 1-2, radical with procumbent peduncle. Peduncle 30-54 cm creeping on the ground with 5-6 sheaths, pubescent, red and become darker colour towards the both ends. Spike ovoid; brick red or deep red and pinkish inner part of the bract. Flowers and Fruit not seen. Closely related to Z. *longipedunculatum.*

***Zingiber* sp.2**

A small ginger, about 50 – 70 cm tall, 4 – 6 pairs of leaf. Leaf blade elliptic to lanceolate, 15 – 20 x 5 – 7 cm. Inflorescence radical, decumbent, scape 3–5 cm long, bright red. Spike fusiform, 4–7 x 2–3 cm, with sharped pointed apex. Bracts lanceolate, 25 x 12 mm long, pinkish red. Flowers and fruits are not seen.

***Zingiber* sp.3**

A small ginger, about 45–50 cm tall, 2–3 pairs of leaf. Leaves blade broadly elliptic, 25–45 x 7–12 cm. Inflorescence solitary, radical with procumbent peduncle. Peduncle 10-18 cm erect, with 3-4 sheaths, pubescent, pinkish red. Spike ovoid; bracts pinkish, deflexed. Flowers and Fruit not seen.

Notes: The recent surveys by the researchers of Research, Development and Innovation (RDID) of Forest Department Sarawak (FDS) were discovered a details taxonomic features of this taxon. A manuscript is being prepare for publication.

***Zingiber* sp.4**

A medium size ginger, about 120–150 cm tall, 8–12 pairs of leaf. Leaves blade elliptic lanceolate, 55–75 x 8–14 cm. Inflorescence solitary, radical with procumbent peduncle. Peduncle 4-8 cm erect, with 10-12 sheaths, pubescent, greenish light brown. Spike spindle; bracts reddish orange, deflexed. Flowers and Fruit not seen.

***Zingiber* sp.5**

A small size ginger, about 70–100 cm tall, 8–15 pairs of leaf. Leaves blade linear, elliptic-lanceolate, 25–35 x 6–7 cm. Inflorescence 1-2, radical with procumbent peduncle. Peduncle 45-55 cm creeping on the ground with 10-15 sheaths, glabrous, bright red. Spike ovoid; brick red or deep red. Flowers and Fruit not seen.

Notes: Z. *longipedunculatum* complex

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GLOSSARY

Abaxial	- The side of an organ that faces away from the axis that bears it; e.g. lower surface of a leaf.
Acuminate	- Tapering to a long tip
Adaxial	- The side of an organ towards the axis on which it is inserted; e.g. upper surface of a leaf.
Adventitious	- Lateral roots coming from organs other than main root system, such as the stem.
Alluvial	- Of areas composed of sand or clay deposited by a river.
Anther	- The part of the stamen containing pollen.
Apomyxis	- The process of asexual reproduction.
Appendiculate	- With appendage
Basionym	- The original name or epithet that has priority when a taxon is transferred to a different group.
Bilobed	- With two lobes.
Bracteole	- A secondary bract, usually smaller than the bracts and always borne above them.
Bristle	- Bearing stiff strong hairs or bristles
Calcareous	- Containing calcium in the form of chalk or lime (of soil).
Chartaceous	- Thin and stiff, like paper
Circular	- round
Corolla	- The second whorl of floral organs, inside or above the calyx and outside the stamens, consisting of free petals or of a joined tube and petal lobes
Corrugated	- Wrinkled regularly and longitudinally.
Cymbiform	- Boat-shaped
Decurved	- Curved downwards and outwards, but not coiled.
Deflexed	- Bent abruptly downward
Dehiscent	- Splitting; opening spontaneously when ripe, as of fruits and anthers
Delimitation	- (in taxonomy) Circumscription of a taxon plus statement on its difference from nearby taxa.
Endemic	- Native or restricted to
Endophytic	- Growing within another plant
Glabrous	- Smooth and without hairs, scales or other thrichomes
Hirsute	- With rather coarse stiff hairs
Imbricate	- Overlapping like tiles
Incurved	- Bending inwards
Labellum	- The lowest petal, usually larger and different in shape from the two lateral sepals.

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