# A New Species of Costaceae from Borneo

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## Abstract

A new species, *Cheilocostus borneensis,* is described. Specimens were collected in Sarawak in 1987 and Kalimantan in 2000, but only intensified surveys of gingers in Sarawak in 2002–2004 provided sufficient collections to recognize the new species, which is here described and illustrated. It is closely related to the widespread *C. globosus* from which it differs by the chocolate-brown sheaths, absence of axillary shoots on vegetative stems, larger leathery leaves, and by its calyx that is not prickly.

## Introduction

Members of Bornean Costaceae were previously placed in the genus *Costus* L. (Maas, 1979), which is now circumscribed as a clade comprising only African and neotropical species based on phylogenetic analyses of morphological and molecular data (Specht and Stevenson, 2006). Following this evaluation of the generic circumscription of Costaceae, only two genera, *Cheilocostus* C. Specht and *Paracostus* C. Specht, are native to Borneo where seven species of Costaceae are presently known (Maas, 1979; Meekiong *et al.*, 2006; Meekiong *et al.*, 2008). The exact generic placement has not been established for all Bornean species and an updated revision for both *Cheilocostus* and *Paracostus* is pending and will likely include other recently discovered and described species.

The genus *Cheilocostus* is easily distinguished from *Paracostus* by consisting of larger plants (> 1.5 m high) with erect shoots, and a condensed inflorescence with conspicuous bracts, each subtending a single flower. *Paracostus,* in contrast, is characterized by smaller plants (< 1.5 m), prostrate stems with few leaves, and inflorescences with few flowers supported by inconspicuous bracts. *Cheilocostus* is closely related to the genus *Tapeinochilus* Miq. which is only found east of Sulawesi into New Guinea, Australia and the Pacific (Gideon, 1996; Poulsen *et al.* 2010).

During expeditions targeting gingers in Sarawak in 2002–2004, the

irst author collected with Malaysians collaborators new material of several species of Costaceae. One of these had already been collected several times, and specimens were deposited in several herbaria but without pickled flowers essential for its description. The material now being available, the species is described below.

***Cheilocostus borneensis*** A.D. Poulsen, *sp. nov*.
Cheilocostus borneensis *in inflorescentia radicali* C. globoso *similis est sed ab eo foliis ad apicem caulis aggregatis plerumque majoribus et calyce molliter acuto (haud pungenti nec aculeato) differt.* –**Typus**: Malaysia, Borneo, Sarawak, Batang Ai, Sungai Senkabang, small stream connecting to Sg. Delok opposite of Ng. Sumpa longhouse, 1°12'S 112°3'E, 130 m, flowering 8 Dec 2002, *A.D. Poulsen & Bakir Raymond 1964* (holo, SAR; iso, AAU, Sarawak Biodiversity Centre Flora Depository).

**Figure 1**. *Cheilocostus borneensis* photographed by A.D. Poulsen (*Poulsen 2696*, cultivated).

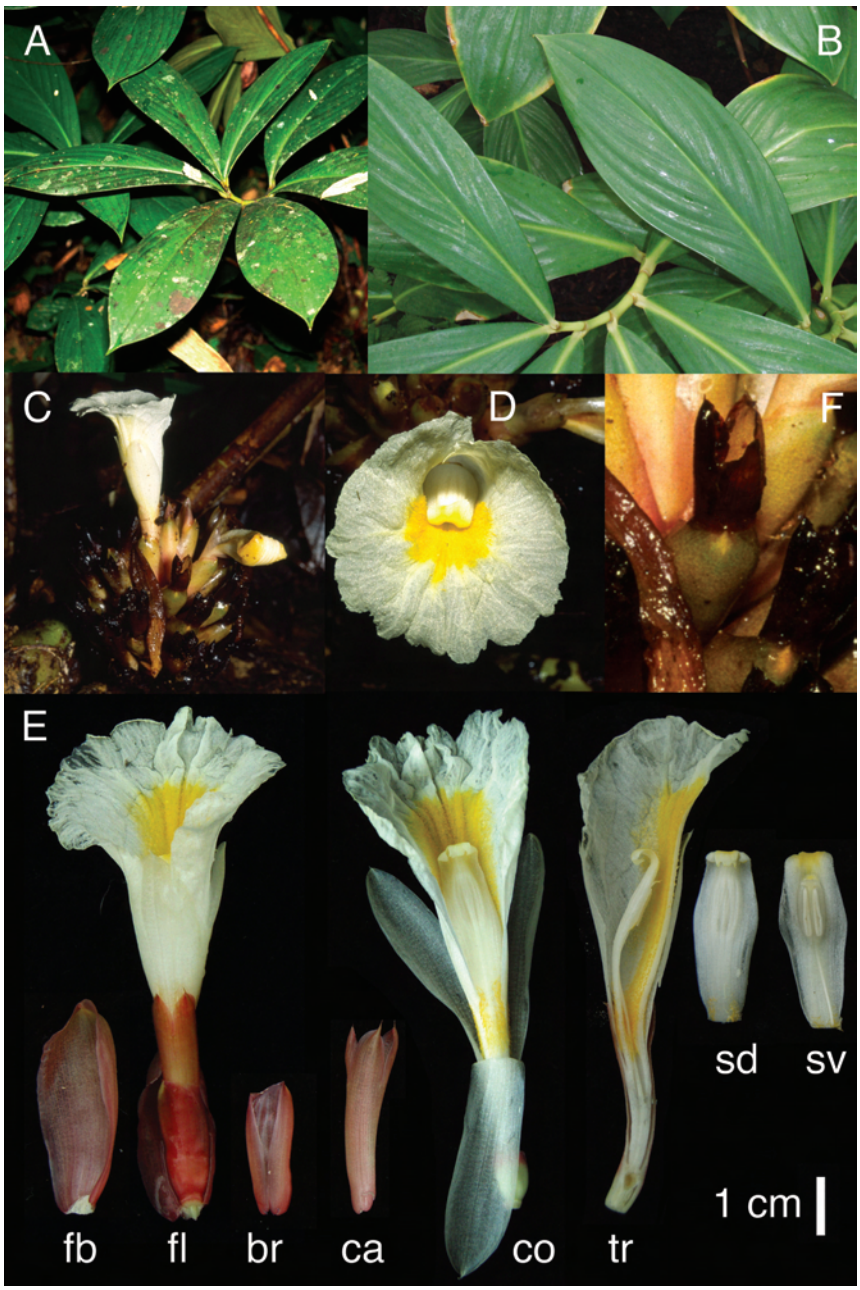


**Plate 1**. *Cheilocostus borneensis*. A. Habit; B. Leaves; C. Infructescence with flowers at apex; D. Close up of labellum and stamen; E. fb = fertile bract, fl = fertile bract with single flower, br = bracteole, ca = calyx, co = flower with bracteole and calyx removed, tr = longitudinal section of flower, sd = stamen, dorsal view, sv = stamen, ventral view. F. Fruit with semipersistent calyx. Photographs by A.D. Poulsen, A, C–D, F of *Poulsen & Bakir Raymond 1964* (the type); B, E of *Poulsen 2696* (cultivated).

Terrestrial, perennial **herb**. **Leafy shoots** in a dense clump, 1.5-2 m tall. Base of leafy shoot to 3 cm diam., pale yellow-green when fresh, covered by reddish brown sheaths. **Stem** leafless in lower *ca* 1.4 m, sheaths reddish chocolate-brown (uppermost yellow-green), glabrous, with 6-10 leaves consistently clustered toward the shoot apex. Ligule 1-2 mm long, ± truncate, slightly longer laterally to the petiole. Petiole 5-12 mm long, swollen, pale yellowish, slightly canaliculate, glabrous. Lamina to 27-42 × 9-16(-20) cm, narrowly obovate, mid-green above, pale green beneath, coriaceous, slightly plicate, glabrous throughout, base narrowly cuneate, apex acuminate, *ca* 1 cm long. **Inflorescence** radical (i.e. at the base of the plant terminating a separate leafless shoot that emerges directly from the rhizome), 12-21 cm long (bracts only), lax. Peduncle horizontal to ascending, 6-12 cm long, sheaths ± tubular, brown, glabrous, margin ragged. Spike 4-12 × 5-8 cm (bracts only). Fertile bracts to 3.2-3.5 × 2-2.5 cm, elliptic, cucullate, margin membranous, apex ± emarginate, softly mucronate, dark brown to greenish or pale reddish brown, glabrous. Rachis (distance from base of lowermost ovary to base of uppermost ovary) 2 cm long extending with age to 7(-9) cm, with 40-80 flowers, 1-2 open at a time. Bracteole 2-2.5 cm long, split to base adaxially, reddish brown, glabrous, apex rounded with one minute mucro, 1-lobed developed laterally, cucullate, not closely adhering to calyx, sometimes with a second shorter lobe without mucro. **Flower** 8.5-10 cm long, exerted *ca* 5 cm above the supporting bract. Calyx 3-3.2 cm long, tubular, dark reddish brown, glabrous, apex 3-lobed, lobes 0.7-1 cm long, slightly involute, apex acute to mucronate, soft (not pungent). Corolla tube (from apex of ovary to base of divergence of labellum and stamen) 2.5-3.2 cm long, fused solid with style in lowest 1-1.5 cm, white at base; lobes 3.5 × 1.5 cm, narrowly obovate, translucent white, glabrous, apex rounded, finely apiculate to 1 mm long. Labellum tube (from insertion of dorsal corolla tube to base of divergence of labellum and stamen) 1.1-1.3 cm long with coarse yellow hairs inside and outside. Labellum 5-5.3 × 5.2-6 cm, broadly obovate, thickened in centre with course, short hairs, white with yellow center, margin finely undulating, glabrous. Stamen *ca* 2.5 cm long (*ca* 3.2 cm when crest flattened), *ca* 1 cm wide, petaloid, white. Anther crest slightly or irregularly 3-lobed, recurved, 1.1-1.2 cm long, with yellow spot in lower centre, coarse hairs at margin. Thecae 0.7-0.8 cm long, 0.3-0.4 cm across both, dehiscing for their entire length. Ovary 1 × 0.6 cm, flattened ellipsoid, glabrous. Style 3.5-3.7 cm long (free part), glabrous. Stigma *ca* 0.3 cm wide, fan-shaped, flattened 2-lobed, lobes overlapping, one larger than the other, hairy, pale yellow. **Infructescence** head to 12 × 8 cm, often still flowering at apex, with persistent bracts, bracteoles and, calyces. **Fruit** 0.9-1 × 0.8-0.9 cm, obovoid, flattened-triangular, with an apical column (base of calyx and corolla tube), 3-locular, glabrous, cream to pale green. **Seeds** 1.5-1.7 × 1-1.2 mm, irregularly barrel-

shaped, black, aril white, basal and not enclosing the seed.

*Local names and uses*: *Pa'bu* (Iban language; *Poulsen & Bakir Raymond 1964*). The plant was used in the past by Iban people but it is not certain for what purpose; *pasat baju* (Iban; *Othman et al. S.56077*).

*Etymology*: The epithet refers to the species being endemic to Borneo.

*Ecology and habitat*: Lowland primary or secondary (logged) mixed dipterocarp forest, along riverbanks, at 130-200 m.

*Distribution*: Endemic to Borneo where it is known from three main areas in Sarawak (one being three collections from the Kapit area) and one in Kalimantan. The furthest localities are about 450 km apart.

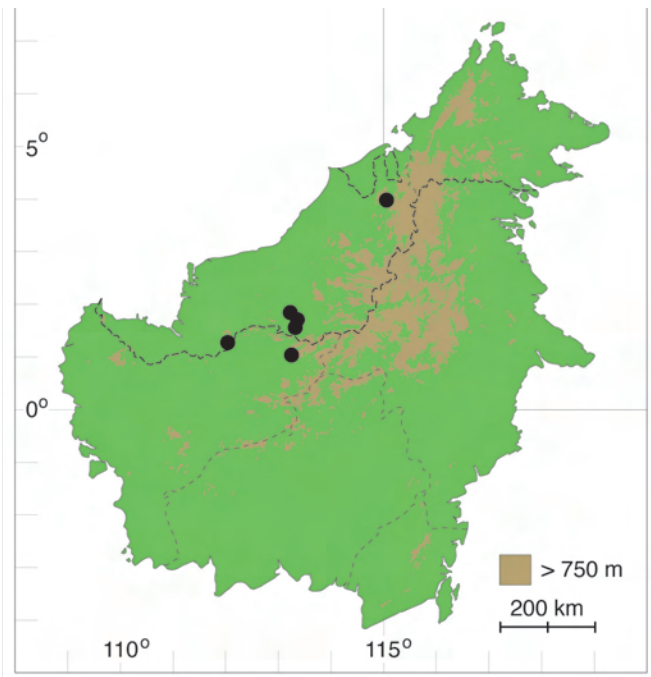


**Figure 2**. Distribution of *Cheilocostus borneensis* presently known from Sarawak (Malaysia) and West Kalimantan (Indonesia).

*Conservation status*: *C. borneensis* is found at the foot hills of the central mountain range of Borneo in an area covering at least 2200 km$^2$ but with fewer than 10 localities. Also its sexual reproduction seems dependent on natural pollinators that may not persist in degraded habitats (see Notes

below). Currently we propose the category of Vulnerable (Vu B1ab(iii); IUCN, 2001), but because of the logging activities and land use is changing rapidly in Borneo, this category could soon change to "Endangered".
*Additional materials examined*: INDONESIA. **Borneo**. West Kalimantan, Camp Betung Kerihun NP, Putussibau, 0°56'N 113°19'E, 150 m, fruiting 28 Feb 2000, *Ambriansyah, Kade Sidiyasa & Albertus AA 2238* (BO, L, WAN). MALAYSIA. **Borneo**, Sarawak: Batang Ai, Sungai Senkabang, small stream connecting to Sg. Delok opposite of Ng. Sumpa longhouse, 1°12'S 112°3'E, 130 m, flowering 3 Jun 1993, *Christensen & Poulsen 1997* (AAU); Gunung Mulu National Park, R. Ubong, between Mulu N.P. and logging concession, near Base Camp, 200 m, flowering, 7 Nov 1990, *Warwick MW177* (E bar code E00128356); Kapit, Balleh, Ulu Sungai Mengiong, Wong Kijang, flowering 26 Oct 1988, *Othman et al. S.56077* (SAR); Kapit, Balleh, Ulu Sungai Mengiong, Nanga Sebaning, 1°25'N 113°25'E (indicated approximately on map on rear side of label), flowering 1 Nov 1988, *Othman et al. S.56464* (AAU, E, K n.v.); Kapit, Batang Baleh, Sungai Mengiong, Sungai Entulu, 18 Jul 1987, *Bernard Lee. S. 54624* (AAU, E (bar code E00320502; bar code E00304605), K n.v.); Cultivated at Royal Botanic Garden Edinburgh, *Accession number and qualifier:* 20040728*A, collected 16 Aug 2007, *Poulsen 2596* (E), origin *Poulsen & Bakir Raymond 1964* (the type).

*Notes*: *Cheilocostus borneensis* deviates from the generic description (Specht and Stevenson, 2006) by not having axillary branching of the vegetative shoots. Vegetative branching is shared by *Cheilocostus* and *Tapeinochilos* but is lost in some *Tapeinochilos* species and, similarly, may have been lost in *C. borneensis*. Molecular evidence using four gene regions (ITS, ETS, rpb2 and trnL-F) and samples from a single accession (the type) places this species in *Cheilocostus*, sister to *C. globosus* (Blume) C. Specht.

*Cheilocostus borneensis* is similar to *C. globosus* in having a radical inflorescence, but is easily distinguished by having distinctly chocolate-brown sheaths on the stem (also obvious in herbarium specimens), having few larger leaves congested at the top of the stem, the leathery almost plastic-like texture of the leaves, and by not having axillary branching. As the flowers of *C. globosus* vary in colour of the labellum from white to yellow, dark orange to red, this character by itself is not always conclusive in separating the two. A more useful floral character to separate the two species is the apex of the calyx: *C. borneensis* is soft, whereas *C. globosus* has rigid points that, if touched, will easily make you bleed (i.e. pungent).

Recently, *Costus mulus* Meekiong, Ipor & Tawan was described from Sarawak (Meekiong *et al.*, 2008). This species also has a radical inflorescence containing flowers with a white labellum but the yellow patch is confined to

a dot at the terminal margin of the labellum. Even though the description leaves many questions open and we have not been able to examine the type material, this species has smaller leaves (13-21 × 6.5-9.5 cm vs. 27-42 × 9-15 cm) with a rounded to cordate base (not narrowly cuneate) and thus is clearly distinct from *Cheilocostus borneensis*.

The northernmost locality presently known of *C. borneensis* is Mulu National Park in Sarawak. Despite Smith's inventory (1984) on the richness of gingers of this area, no material was collected during her studies. Thus, she only reported *Paracostus paradoxus* (K. Schum) C. Specht and *Cheilocostus speciosus* (J. König) C. Specht from this area. The collection from Mulu, *Warwick MW177*, is a convincing match to the other collections, but the mucro on the bracts are exceptionally prominent.

In nature, the spike of *Cheilocostus borneensis* may have mature fruits in the lower bracts while simultaneously flowering towards the apex (Plate 1C). In cultivation mature fruits were never observed to develop and it is likely that manual pollination is needed to produce seeds. This may indicate that *C. borneensis* is only able to set fruits in habitats where the natural pollinator is present.

On 11 Dec 2002, at Sungai Rirang near the type locality, a plant of *Cheilocostus borneensis* with normal leafy shoots was seen bearing an erect, 54 cm long peduncle that was similar in appearance to the chocolate-brown sheathed stem of a leafy shoot, but instead of bearing leaves it terminated in a spike. This aberrant inflorescence has only been seen this once, never occurred in cultivation, and is apparently a rare phenomenon.

## Acknowledgements

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