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NOTES ON ASIATIC AND AUSTRALIAN COSTOIDEAE (ZINGIBERACEAE)

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SUMMARY

In continuation of the revision of the Neotropical *Costoideae* (1972 and 1977), the Old World species of *Costus* were investigated. In the Old World 4 native species of *Costus* are recognized, whereas 6 additional species are known from cultivation. A key to the species is included.

INTRODUCTION

For the last ten years I studied the genus *Costus* intensively. Most species of this genus are confined to the Neotropics (*c.* 60 species), *c.* 25 species occur in tropical Africa, and *c.* 5 in Asia. My study was mainly concentrated on the neotropical species, but I also investigated a considerable amount of material, *c.* 600 specimens from 20 different herbaria from Asia. Material was borrowed from the following herbaria: A, BRI, C, CAL, F, FI, GH, K, L, LE, M, MICH, MO, NY, P, SING, U, UC, US, and WAG. It was not intended, however, to revise the Asiatic species as this will have to be done by a botanist with field experience in Asia. Nevertheless, my work resulted in a rough concept of the taxonomy of the Asiatic species, and for this reason a key to those species is presented here. Furthermore, some additional descriptions or notes on species previously very incompletely known are also included. In the key the genus *Tapeinochilos*, which is restricted to Papuasia and Australia, also appears. In order to gain a better insight in the whole group of *Costoideae* (or *Costaceae*) additional information on this genus is badly needed. It is very poorly represented in herbaria and additional collections from all over Papuasia are required. Herbarium material alone is not sufficient, however; in order to get a good idea of the floral structure one should be able to study flowers and fruit preserved in spirit. Fresh seeds or rhizomes are urgently needed in order to study living plants in cultivation.

KEY TO ASIATIC AND AUSTRALIAN GENERA OF COSTOIDEAE

1a. Ovary trilocular. Flowers large, far exceeding the bracts; labellum large, without lateral staminodes. Plants rarely branched . . . . . **Costus**

b. Ovary bilocular. Flowers small, hardly exceeding the bracts; labellum small, provided with two small, toothlike lateral staminodes. Plants often branched toward the apex. Papuasia and NE. Australia. . . . . **Tapeinochilos**

KEY TO SPECIES OF COSTUS

1a. Inflorescence on a short, separate, leafless shoot 2
b. Inflorescence terminal on a leafy shoot (see also under *C. ? dubius*) . . 4
2a. Inflorescence few-flowered. Vegetative stems 2–4-leaved. Bracts herbaceous, triangular, 13–20 mm long; calyx 17–24 mm long; corolla greenish, 40–47 mm long; labellum yellow; capsule subglobose, 12–15 mm in diam., wall fleshy. Borneo. . . . . **1. C. paradoxus**
b. Inflorescence many-flowered. Vegetative stems many-leaved 3
3a. Bracts obtuse, greenish; corolla white; labellum white, tinged with yellow. Inflorescence occasionally terminal. Tropical West Africa. Cultivated in Hort. Bot. Singapore. . . . . **C. ? dubius** (Afz.) K. Sch.
b. Bracts pungent or spiny at the apex, reddish. . . **2. C. globosus**-complex
4a. Two bracteoles per bract. Ligule with a salient ciliate rim at the base. Calyx much exceeding the bracts. Labellum white, striped with dark purple, yellowish tinged in the middle. Tropical West Africa. Cultivated in Hort. Bot. Singapore. **C. lucanusianus** J. Braun & K. Sch.*
b. One bracteole per bract. Ligule without salient rim 5
5a. Bracts herbaceous; bracteole tubular; corolla, stamen, and labellum orange. Tropical SE. America. Cultivated, Java. **C. cuspidatus** (Nees & Mart.) Maas**
b. Bracts coriaceous to chartaceous; bracteole boat-shaped 6
6a. Apical part of bracts soon desintegrating into fibres. Calyx lobes obtuse; corolla white, 50–70 mm long, glabrous; labellum white, (40–)60–70 × (50–)60–90mm. . . . . **4. C. lacerus**
b. Apical part of bracts never desintegrating into fibres. Calyx lobes acute . 7
7a. Bracts pungent at the apex, red. Lower side of leaves sericeous to puberulous. Calyx 22–25 mm long; corolla pinkish white, 50–60 mm long, sericeous; labellum white, 60–70 × 80–100 mm. . . . . **3. C. speciosus**
b. Bracts never pungent at the apex. Lower leaf surface different. Calyx much shorter 8
8a. Ligule hardly 1 mm long. Leaves obovate to elliptic, densely hairy on both sides. Inflorescence green. Corolla yellow; labellum yellow with red venation. Central America. Cultivated in botanical gardens at Singapore, Manila, and Brisbane. . . . . **C. malortieanus** Wendl.
b. Ligule 2–15 mm long. Leaves glabrous. 9
9a. Bracts and flowers pinkish. Labellum tabular, 25–30 × 20–25 mm. Tropical South America. Cultivated in botanical garden Singapore. **C. spiralis** (Jacq.) Roscoe var. **spiralis**
b. Bracts greenish. Labellum yellow, often striped with dark purple, consisting of a small tubular part and a large, expanded limb, 50–70 × 40–55 mm. Tropical America. Cultivated, Java . . . . . **C. laevis** R. & P.***

* Cited by Backer & Bakhuizen van den Brink (1968) as *C. igneus* N. E. Brown, the former name for this species.
** Cited by Holttum (1950) as *C. schlechteri* Winkl.
*** Cultivated as *C. registrator* Büsgen in botanical garden at Bogor, Java.

1. Costus paradoxus K. Schumann

C. paradoxus K. Schumann, Bot. Jahrb. 26 (1899) 345; Engler, Pflanzenreich 4, 46 (1904) 424 – Type: *Beccari 3791* (FI), Bellaga, prov. Redjang, Sarawak, Borneo.

Low plants 20 – 50 cm tall. *Rhizomes* long-creeping, 2 – 8 mm thick. *Sheaths* 2 – 6 mm wide, glabrous to rather densely puberulous, soon withering. *Ligule c.* 1 mm long, rather densely puberulous. *Leaves* 2 – 4 per shoot. Petiole 2 – 7 mm long, sparsely puberulous. Lamina narrowly ovate to narrowly obovate, cuneate at the base, mucronate at the apex, 8 – 16 cm long, (2.5 –)3.5 – 9 cm wide, upper side glabrous, lower side glabrous or sparsely puberulous, i.e. mainly in midrib region and towards the margins. *Peduncle* of inflorescence 1 – 6 cm long, 0.2 – 0.3 cm in diam., covered with 2 – 3 sheaths up to 1 – 1.7 cm long, soon withering. *Inflorescence* a 2 – 5-flowered spike, 5 – 7 cm long, 0.5 – 1 cm wide. *Bracts* greenish, herbaceous to membranaceous, triangular, 13 – 20 mm long, 8 – 12 mm wide, margins brownish punctate, slightly decaying into fibres. *Bracteole* lateral, 5 – 9 mm long, boat-shaped, glabrous. *Calyx* greenish, cylindrical, 17 – 24 mm long, *c.* 4 mm in diam., glabrous except for the puberulous base, lobes triangular to deltoid, 3.5 – 4 mm long. *Corolla* greenish white, 40 – 47 mm long, glabrous, tube 15 – 20 mm long, lobes 25 – 28 mm long, 6 – 9 mm wide, apex sometimes mucronate. *Labellum* yellow, reddish striped in the throat (*Winkler 1274*), broadly obovate when spread out, 25 – 27 mm long, 20 – 25 mm wide, limb more or less horizontally spreading. *Stamen* ovate, 15 – 18 mm long, 5 – 6 mm wide, basal part brownish dotted, apex bidentate or entire; anther 4 – 4.5 mm long, 2 mm wide, inserted on a strongly brownish punctate, cushion-like thickening *c.* 5 mm long, 1 mm high. *Basal part of labellum* and stamen joined into a slender tube 20 mm long and 3 – 4 mm in diam., the apical part of the tube densely covered with papillae (food-hairs) 0.5 – 2 mm long. *Style* 35 – 40 mm long, apical part brownish striped. Stigma bilamellate, provided with a dorsal bilobed appendage. *Ovary* densely sericeous. *Capsule* subglobose, 12 – 15 mm in diam., trilocular, wall fleshy, 2 – 3 mm thick (in living material), rather densely puberulous. *Seeds* 5 × 4 × 3 mm, provided with a rather large, white aril, reaching to about halfway the seeds.

Distribution: Borneo
Ecology: Forests, from sea level up to 300 m.

BORNEO. Sarawak: Sungei Mayeng, Tau Range, *Purseglove 5539* (L). – Sabah: Labang, *van Genderen Stort & Amdjah 303* (L) – W. Kalimantan: Sungei Malang, *Winkler 1274* (L); Sungei Raun, *Winkler 1578* (L).

Notes: This is the second species of K. Schumann's subgenus *Paracostus*, which differs from the other subgenera by an almost creeping habit and a few-flowered inflorescence. The other species of this subgenus is the West African *C. englerianus*, with one-leaved stems, a terminal inflorescence, a very pale green, *c.* 25 mm long corolla, and a white, yellowish tinged labellum *c.* 25 × 15 mm.

I am greatly indebted to Mr. Paul Chai of the Forest Department, Kuching, Sarawak, who provided me with excellent dried and pickled material as well as with living material, which unfortunately did not survive in our greenhouse. He also provided a colour photograph. On this material the main part of the present description of *C. paradoxus* is based.

2. Costus globosus Bl.-complex

In Asia there is a group of species around *C. globosus* Blume. These are characterized by the inflorescence on a separate, short, leafless shoot and by the bracts, which are mostly spiny at the apex. I would not be surprised if all these species would turn out to be mere variants of one complex species (cf. Holttum, 1950: 243–245). Before any conclusion can be drawn, however, this group needs intensive study in the field, particularly with regard to floral characters like shape and structure of the labellum and colour of the various other floral parts.

The species and variety names involved in this complex are: *C. acanthocephalus* K. Schumann (Sumatra); *C. chrysocephalus* K. Schumann (New Guinea); *C. clemensae* Ridley (Philippines); *C. dhanivatii* K. Larsen (Thailand); *C. globosus* Blume (Java); *C. kingii* Baker (Malay Peninsula) (with Holttum: *C. globosus* var. *kingii*); *C. microcephalus* K. Schumann (Borneo); *C. oligophyllus* K. Schumann (incl. *C. kunstleri* Ridl.) (Malay Peninsula); *C. ridleyi* K. Schumann (with Holttum: *C. globosus* var. *ridleyi*) (Malay Peninsula and Thailand); *C. sulfureus* K. Schumann (Celebes); *C. tonkinensis* Gagnepain (Tonkin); *C. velutinus* Ridley (with Holttum: *C. globosus* var. *velutinus*) (Malay Peninsula).

3. Costus speciosus (Koenig) J. E. Smith

C. speciosus (Koenig) J. E. Smith, Trans. Linn. Soc. 1 (1791) 249. – *Banksia speciosa* Koenig in Retzius, Observ. Bot. 3 (1784) 75. – Type: *Koenig s.n.* (C), East Indies.

C. potierae F. von Müller, Fragm. 4 (1864) 164. – Type: A collection by *Dallachy* (not seen), Rockingham Bay, Queensland, Australia.

C. lamingtonii J. M. Bailey, Queensland Agric. J. 3 (1898) 160. – Type: *Lord Lamington's Party s.n.* (BRI), Mambare River, Papua, N. Division, New Guinea, May 1898.

C. formosanus Nakai, J. Jap. Bot. 17 (1941) 199. – Type: *T. Sôma s.n.* (not seen), Takao, Heitô (Akô-)-Trail, opposite Datetu, Taiwan.

Notes: This is the commonest species of *Costus* in Asia. It is also cultivated and naturalized in the Neotropics. This beautiful species is related to *C. lacerus*, but is easily recognized by its pungent bracts and calyx-lobes and its densely hairy, pinkish white corolla. As in *C. lacerus* the indument is highly variable.

4. Costus lacerus Gagn. – **Fig. 1.**

C. lacerus Gagnepain, Bull. Soc. Bot. France 50 (1903) 261; K. Schumann in Engler, Pflanzenreich 4, 46 (1904) 400. – Type: *Unknown collector s.n.* (P), Labdah (or Labdak), alt. 5000 ft., 30 July 1884, India.

Plants 1–3 m tall. *Rhizomes c.* 2 cm thick. *Sheaths* sparsely to rather densely puberulous to villose, 15–30 mm in diam. *Ligule* 1–3 mm long, obliquely rounded, margins strongly decaying into arachnoid fibres. *Petiole* up to 10 mm long, densely puberulous to villose. *Lamina* (uppermost leaves excluded) narrowly elliptic to narrowly obovate, 20–46 cm long, 6.5–15 cm wide, rounded to cordate at the base, acute to shortly acuminate at the apex, upper side dark brown in herbarium material, glabrous or nearly so, lower side sparsely to densely puberulous to villose. *Inflorescence* ovoid to broadly ovoid, 4.5–8 cm long (to 15 cm in fruit), 4–7 cm wide (to 10 cm in fruit). *Bracts* red, coriaceous to chartaceous, ovate, 20–55 mm long, 10–20(–40) mm wide, glabrous to densely puberulous or villose, margins often decaying into long, white, arachnoid fibres often glabrescent; apical portion of bracts soon desintegrating into fibres. *Bracteole* 8–17 mm long, glabrous to densely villose, margins strongly decaying into arachnoid fibres. *Calyx* red, 20–29

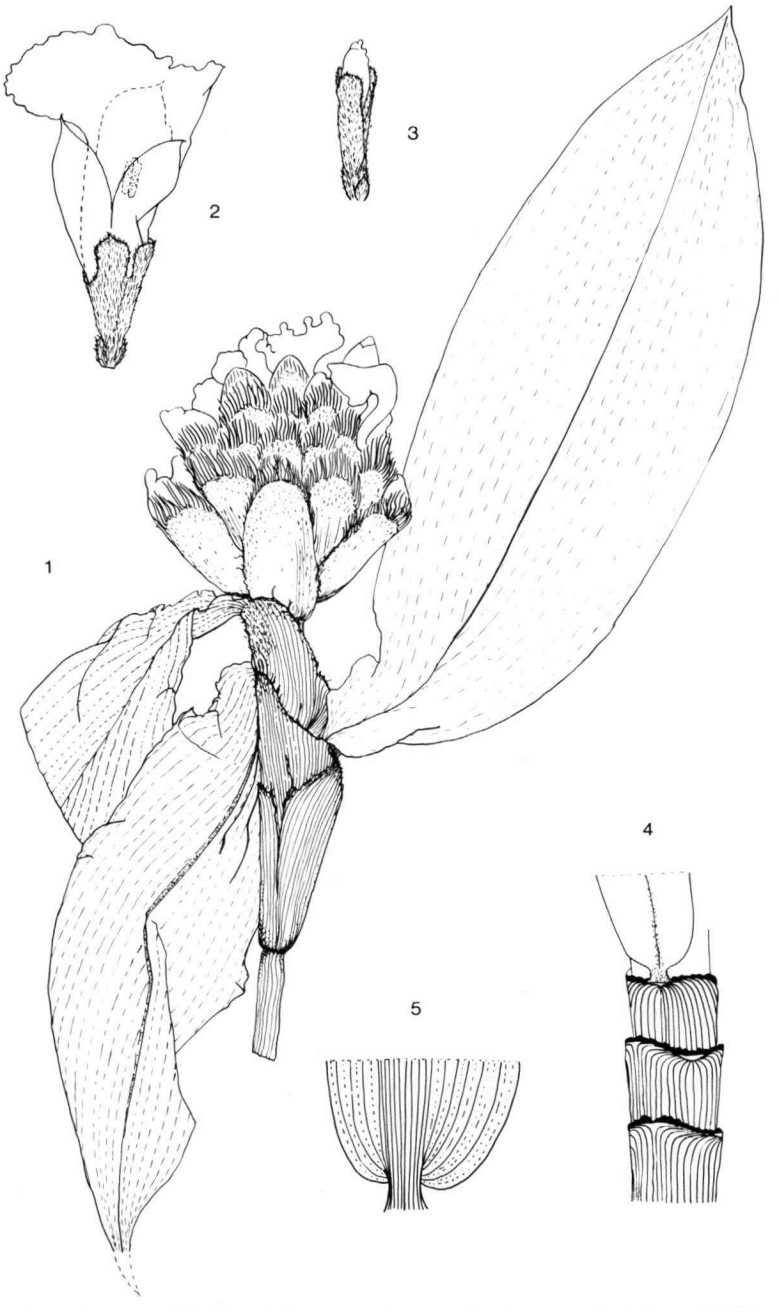

Fig. 1. *Costus lacerus* – 1. habit, × ½; 2. ovary, calyx, corolla, stamen, and labellum, × ½; 3. bracteole, ovary, calyx, and corolla bud, × ½; 4. leaf-base with petiole, ligule, and sheath, × ½; 5. leaf base, × ½. (1. from *Thakur Rup Chand 3291;* 2. from *Henry 12296;* 3. from *Henry 11265;* 4. and 5. *unknown collector s.n.*, 11–VII–1850). Drawing by H. Maas-van de Kamer.

mm long, glabrous to densely villose, mostly bicarinate on the adaxial side, lobes irregularly obovate, 9–15 mm long, 5–10 mm wide, apex obtuse, sometimes shortly acuminate, the apical portion (like the bracts) often desintegrating into fibres. *Corolla* white, 50–70 mm long, glabrous or nearly so, tube 15–20 mm long, lobes 35–50 mm long, 10–25 mm wide. *Labellum* white, tinged with yellow in the middle and toward the apex, broadly obovate when spread out, (40–)60–70 mm long, (50–)60–90 mm wide. *Stamen* white, narrowly elliptic, 30–35 mm long, 6–10 mm wide, anther 7–13 mm long. *Ovary* densely puberulous to villose. *Capsule* ellipsoid, woody, 15–30 × 10–16 mm, longitudinally dehiscing; *seeds* black.

Distribution: China (Yunnan), Thailand, Tibet, Sikkim, and India.

Ecology: Forests (open forest, evergreen forest, pine forest) or in marshes; (500–)800–1700(–2000) m. alt.

CHINA. Yunnan: Ping-Pien Hsien, *Tsai 61176* (GH); Mengtsze, *Henry 11265* (K, US); Szemao, *Henry 12296* (K, MO, NY, US); Nan-Chiao, *Wang 75367* (A); Meng-ban, Shan-Shien (Fo-hai Hsien), *Wang 76212* (A).

THAILAND. Kao Luang, Brachuep, *Kerr 10830* (K); Doi Sutep, *Sörensen et al. 3216* (C, U).

TIBET. Raiotdong (or Rawtdong) to Santok, *Younghusband s.n.* (CAL); Valley of the Law Tawai, *Wan 7306* (K).

SIKKIM. *Hooker & Thomson s.n.* (GH, K, NY).

INDIA. Umwai, Rhasiyas, *Clarke 5272* (K). – Rishap, Darjeeling, *Clarke 8698* (K). – Khasia, *Griffith 5626* (K), *Hooker & Thomson 13 p.p.* (P). – Nunklou, *Hooker & Thomson s.n.*, 11 July 1850 (K). – Cherrapunjee, Khasi Hills, *Koelz 30249, 30908* (MICH). – Naga Hills, Kohima, *Thakur Rup Chand 3291* (MICH). – Khasi Hills, Mawryngkneng, *Thakur Rup Chand 4738* (MICH). – Shillong, *Thakur Rup Chand 8264* (MICH). – Rongsong, *unknown collector s.n.*, 27 July 1912 (K). – Farsong, *unknown collector s.n.*, 24 September 1912 (K). – Labdah (or Labdak), *unknown coll. s.n.*, 10 October 1912 (K). – Testa, *unknown collector s.n.*, 10 October 1912 (K).

Notes: It is not clear why this species has always been misidentified as *C. speciosus*. Although it is related to that species because of its almost woody fruit, it differs by the following characters: 1. upper side of lamina dark brown; 2. margins of bracts, bracteole, and ligule decaying into arachnoid fibres; 3. apical portion of bracts and calyx very soon decaying and desintegrating in more or less loose fibres (hence the specific epithet '*lacerus*'); 4. calyx-lobes obtuse; 5. corolla glabrous.

During a visit to the Kew herbarium, I investigated large series of material identified as *C. speciosus*. The specimens belonging to *C. lacerus* could be segregated at first glance and without any problem. *C. lacerus* is rather variable with regard to the indumentum of bracts, bracteole, and calyx, like many other species of *Costus* (cf. the neotropical *C. pulverulentus*). However, as this variation is rather continuous, i.e. showing many transitional forms, it cannot be used for distinguishing varieties or subspecies.

Future collectors in eastern Asia should try to locate this species and collect, in addition to herbarium material (preferably with pickled flowers), the living specimens (seeds and/or rhizomes) for observations during cultivation.

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