



A new species of *Cycas* (*Cycadaceae*) from Peninsular Malaysia

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Key words

Cycadaceae
Cycas
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Abstract A new species of *Cycas*, *C. cantafolia* (*Cycadaceae*) from the southern part of Peninsular Malaysia is described and illustrated. A key to the species of *Cycas* in Peninsular Malaysia is provided.

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INTRODUCTION

Up until the closing years of the last century Peninsular Malaysia was believed to have only two native species of *Cycas*: *C. rumphii* Miq. and *C. siamensis* Miq. (Ridley 1911, 1925, Keng 1969, Jones 1980, Turner 1997). Hill in Hill & Yang (1999) assigned these names, repeatedly applied to various taxa in various revisions (Smitinand 1971, 1972, De Laubenfels & Adema 1998), to other taxa and described the Peninsular Malaysian ones as new species, *C. litoralis* K.D.Hill and *C. clivicola* K.D.Hill respectively. Hill (1995) also 'rediscovered' *C. macrocarpa* Griff., first described by Griffith in 1854, but subsequently overlooked by other workers, the plants being routinely assigned to *C. rumphii* (Hill 1995), although Ridley (1925) acknowledged the possibility that inland specimens of *C. rumphii* might represent a separate species. Until now records of inland *Cycas* were restricted to limestone outcrops in the northern half of the Peninsula (*C. clivicola*), while the southernmost record of *C. macrocarpa* was Griffith's record from Tabung, Malacca.

A chance encounter by the second author of *Cycas* plants cultivated in a local garden eventually led to the discovery of several populations of *Cycas* on an isolated chain of granite hills proximate to the base of Gunung Ledang (Mount Ophir) that proved to be a yet undescribed species. This new find is also the first confirmed record of inland *Cycas* from the state of Johor in the south of Peninsular Malaysia.

Cycas cantafolia Jutta, K.L.Chew & Saw, *sp. nov.* — Fig. 1

Inter sectionem *Indosinenses* similis *Cycadis clivicolae* foliis non carinatis, cortice crassio suberoso et strobilis feminis typo inapertae, sed foliis majoribus, megasporophyllis spinis lateralis, apicalis et habitatio in clivis saxis graniticis differt. — Typus: *Jutta & Chew FRI 59721* (holo KEP), Malaysia, Johor, Ledang, Bukit Belandang, 10 Jan. 2009.

Stems arborescent, often decumbent, to 5.5 m or more tall, diam at narrowest point to 25 cm, usually with an enlarged bulbous base, to 64 cm diam at the widest point, in the distal portion with distinct annular rings; **bark** light grey, with age becoming corky with deep polygonal fissuring. **Leaves** up to 50 or more, discolourous, dark green and semi-glossy above, to 200 cm long, flat (not keeled) in cross section (opposing pinnae inserted

at 180° on rachis), with up to 330 pinnae, the white tomentum shedding as the leaf expands; rachis terminated either by a spine, 23 mm long, or by paired pinnae; petiole 45–50 cm long (22–25 % of total leaf), glabrous, spinescent to 60 % of length; basal pinnae 130 mm long, not gradually reducing in size or becoming spinescent; median pinnae simple, linear, straight to slightly falcate, strongly discolourous, 220–275 by 8 mm, inserted at 50–60° to rachis, decurrent for 2–3 mm, narrowed to 2–3 mm at base, margins slightly rolled in, apex acute, spinescent; midrib raised above and below. **Cataphylls** narrowly triangular, pilose, in the upper half the hairs extending beyond the margin and appearing shaggy, 88–112 by 15 mm, widest at base. **Male cones** ovoid, golden yellow or orange, 33 by 13 cm (mature size, pre-anthesis measurement); **microsporophylls**: lamina firm, not dorsiventrally thickened, 40 by 13–15 mm; fertile zone 30 mm long; sterile apex 10 mm long, level; apical spine soft, sharply upturned at c. 70°, 3 mm long. **Megasporophylls** 18–22 cm long, grey to light-brown, tomentose, closely spaced with laminae overlapping each other and forming a low dome-shaped structure enclosing the apical meristem; lamina elliptic, 60–65 mm long, 40 mm wide, pectinate; lateral spines 25–30, soft, 10–18 mm long, 3 mm wide at base; apical spine distinct from lateral spines, 36–50 mm long, 6 mm wide at base; ovules 1–4, glabrous. **Seeds** subglobose, laterally flattened, 35–39 by 35–37 mm, 25–30 mm deep including the sarcotesta; sarcotesta yellow, not pruinose, 2–4 mm thick, fibrous layer present; sclerotesta smooth; spongy layer beneath sclerotesta absent.

Distribution — Endemic to a chain of low-elevation hills west of the southern tip of the Gunung Ledang massif (Mount Ophir) in Johor in southern Peninsular Malaysia.

Habitat — *Cycas cantafolia* is locally abundant on precipitous granite cliffs up to an elevation of 200–500 m, usually rooted directly in crevices and cracks on bare rock.

Conservation status — IUCN Red List Category (IUCN 2007): Critically Endangered (CR A3c, B2ab (iii) & C1). The species has a very narrow localized distribution, even though within its range it is abundant. The present threat is to its habitat because the entire area has been designated for quarrying activities. In future, the most serious threat is posed by potential harvesting for the ornamental trade, although at present there is no evidence of harvesting. The species is dioecious, very slow growing, with irregular reproductive activity, extended seed maturation rates, high seed and seedling mortality. Pollination is entomophilous (by weevils) and believed to be highly host-specific (Oberprieler 2004).

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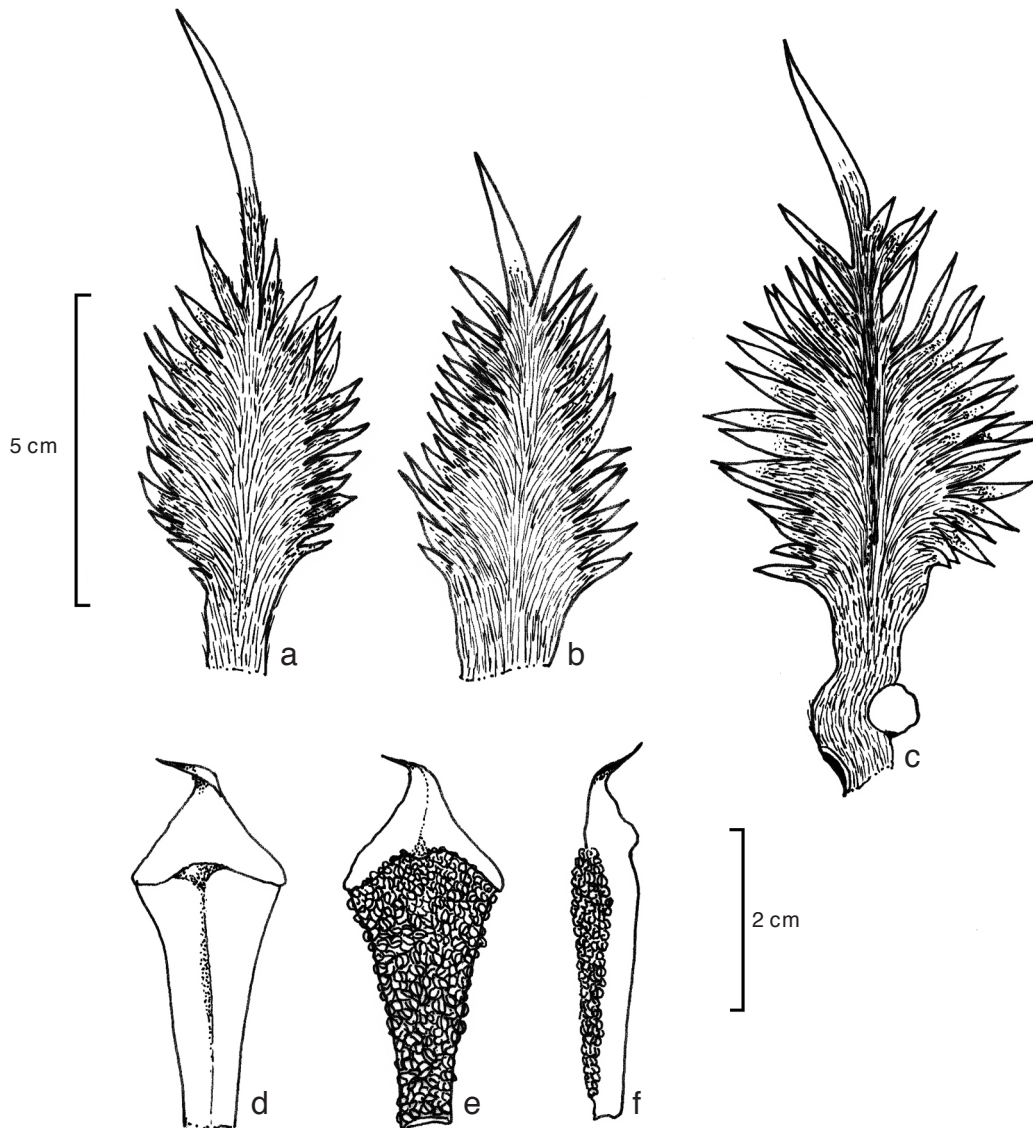


Fig. 1 *Cycas cantafolia* Jutta, K.L.Chew & Saw. Megasporophyll lamina: a–c. Microsporophyll; d. upper view; e. lower view; f. side view (a, b from FRI 59722; c from FRI 59721; d–f from FRI 59723). — Drawn by M. Jutta.

Etymology — Latin for singing leaves (canto = song, singing; folium = leaf); in reference to the name ‘paku lagu’ used by the local Temuan community that alludes to the sound created when the leaves rustle in the wind. The Temuan also know the plants as ‘paku mas’ (golden cycad) in reference to the prominent colour of the male cones.

Notes — *Cycas cantafolia* is readily distinguished from the other native Peninsular Malaysian *Cycas* species. The closed-type female cone immediately separates it from both *C. littoralis* and *C. macrocarpa* which have open-type cones. Also its new growth lacks the bluish sheen and the thick reddish brown indumentum of *C. macrocarpa*. Seed, megasporophyll and midrib morphology are also distinct in *C. cantafolia*. *Cycas clivicola* and *C. cantafolia* share the closed-type female cone. In dry material there are clear differences in the midrib (Fig. 2) and megasporophyll morphology (lamina shape, length and number of the lateral spines) (Table 1). In addition, its habitat is different. Among South East Asian *Cycas*, *C. cantafolia* keys out close to *C. tansachana* K.D.Hill & S.L.Yang and *C. chamaoensis* K.D. Hill, both native to Thailand (Hill 1998–2004, Hill & Yang 1999, Jones 2002) and having closed-type cones, but differing in habitat and in details of leaf and mega- and microsporophyll morphology (Table 1). Despite the similarities between *C. cantafolia*, *C. clivicola*, *C. chamaoensis* and *C. tansachana*, *C. cantafolia*

separates easily from these three by the ovate megasporophyll lamina opposed to the orbicular lamina shape in the others; it further separates in choice of habitat from *C. chamaoensis* and *C. clivicola* which are both restricted to limestone, and from *C. tansachana*, despite similarities in habitat, in the former having larger seeds.

Despite Gunung Ledang (previously known as Mount Ophir) being among the best collected locations in Peninsular Malaysia, this large and highly visible plant was until now overlooked by both botanists and collectors. This and many other new discoveries, both of flora and fauna, illustrate the need for continued and increased field work to document the rich diversity in Malaysia. Comparison of the beetle pollinators collected from male cones of each of the Peninsular Malaysian species of *Cycas* shows distinct morphological differences between the specimens collected from *C. cantafolia* and weevil specimens collected from other Peninsular Malaysia *Cycas* (Azmi Mahyuddin & S.P. Ong pers. comm.), another indication that this new *Cycas* species is distinct from the other Malaysian species.

Specimens examined. MALAYSIA, Johor, Ledang, Bukit Belading, 10 Jan. 2009, female plant, Jutta & Chew FRI 59721 (KEP), FRI 59722 (KEP), male plant, FRI 59723 (KEP); 21 May 2009, female plant, Saw, Chew & Chua FRI 48220 (K, KEP, L, SING), male plant, FRI 48221 (K, KEP, L, SING).

Table 1 Characters separating *Cycas cantatolia* from other Peninsular Malaysian *Cycas* and two closely related species in Section *Indosinenses* (differences with *C. cantatolia* are in **bold**).

Species Section/subsection	Distribution	Female cone type	Megasporophyll	Seeds	Habitat
<i>C. cantatolia</i> Sect. <i>Indosinenses</i>	Only in Ledang, Johor, Malaysia	Closed	Lamina elliptic, margins shallowly pectinate, lateral spines 25–30, to 18 mm long	Flattened-ovoid, 35–39 by 35–37 mm, sarcotesta yellow, drying brown, surface smooth, fibrous layer present	Granite, on bare rock on steep inclines, cliffs
<i>C. chamaeensis</i> Sect. <i>Indosinenses</i>	Only known from Khao Chamao, northeast of Ban Nam Sae, Rayong province, Thailand	Closed	Lamina orbicular, margins deeply pectinate, lateral spines 30–40, to 30 mm long	Flattened ovoid, 35–40 by 30–40 mm, sarcotesta yellow, fibrous layer present	Granite, on bare rock on slopes and cliffs
<i>C. clivicola</i> Sect. <i>Indosinenses</i>	Northern half of Peninsular Malaysia, Southern Peninsular Thailand	Closed	Lamina orbicular, margins deeply pectinate, lateral spines 26–54, to 40 mm long	Flattened-ovoid, 33–39 by 26–35 mm, sarcotesta yellow, drying light brown, surface smooth, fibrous layer present	Limestone, on bare rock, cliffs
<i>C. litoralis</i> Sect. <i>Cycas</i> , subsect. <i>Rumphiae</i>	From southern Vietnam and southern Myanmar to southern Thailand, Peninsular Malaysia and the northern coast of Borneo	Open	Lamina lanceolate, margins entire to more or less dentate, lateral spines up to 10, 1–2 mm long	Subglobose, 60–80 by up to 50 mm, sarcotesta orange-brown, drying reddish brown, surface with a few shallow, widely spaced wrinkles, fibrous layer absent	Beach forest, over granite or limestone
<i>C. macrocarpa</i> Sect. <i>Cycas</i> , subsect. <i>Cycas</i>	Peninsular Malaysia and southern Peninsular Thailand	Open	Lamina lanceolate, margins shallowly pectinate, lateral spines 10–22, to 17 mm long	Oblong, 45–53 by 35–42 mm, sarcotesta yellow, drying black, with surface in very fine closely spaced wrinkles, fibrous layer absent	Primary ridge forest, in well-drained soil accumulations over granite or limestone, also on flat land in the lowlands
<i>C. tansachana</i> Sect. <i>Indosinenses</i>	Only known from hills northeast of Khong Kht Sua, Saraburi Province, Thailand	Closed	Lamina orbicular, margins deeply pectinate, lateral spines 40–60, 18–25 mm long	Flattened ovoid, 45–50 by 35–40 mm, sarcotesta yellow, fibrous layer present	Limestone, on bare rock and cliffs

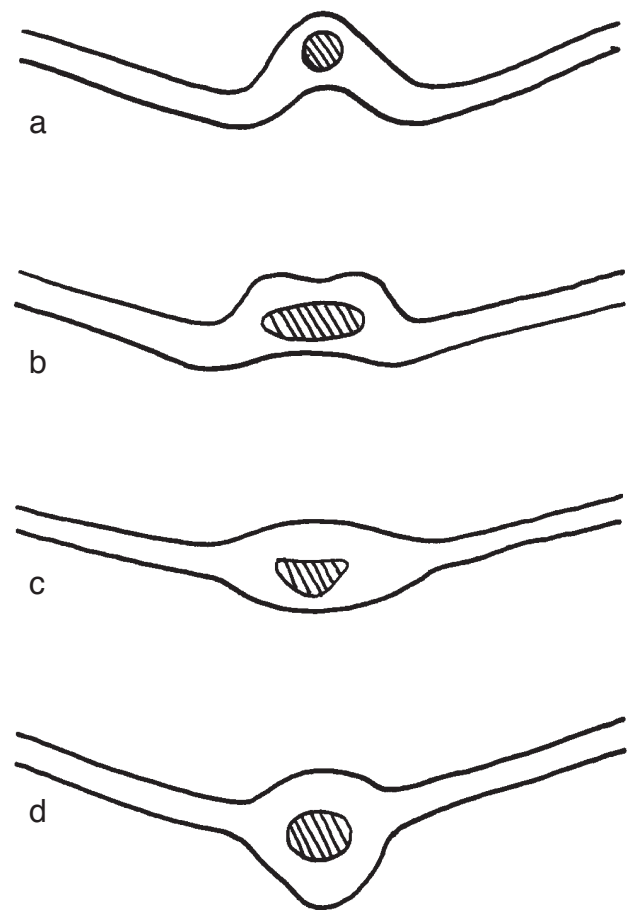


Fig. 2 Transverse sections of the leaflet midribs of Peninsular Malaysian *Cycas* species. a. *Cycas macrocarpa*; b. *C. litoralis*; c. *C. clivicola*; d. *C. cantatolia*. — Drawn by M. Jutta.

KEY TO THE PENINSULAR MALAYSIA SPECIES OF CYCAS

1. Open type female cone, trunks not conspicuously swollen at base 2
1. Closed type female cone, trunks conspicuously swollen at base 3
2. Seeds subglobose, ripening orange-red. Midrib in dry material raised above in a low, broad keel. Restricted to seashore environments *C. litoralis*
2. Seeds flattened, ripening yellow. Midrib in dry material raised above in a sharp narrow keel. Understorey primary forest plant *C. macrocarpa*
3. Megasporophylls deeply pectinate, lateral spines up to 54, to 40 mm long, midrib in dry material raised only below. Restricted to limestone *C. clivicola*
3. Megasporophylls shallowly pectinate, lateral spines up to 30, to 18 mm long, midrib in dry material raised above and below. Only on granite ***C. cantatolia***

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