

SHORT NOTE

Discovery of *Cycas macrocarpa* Griff. in Penang: A new locality record for the genus and species

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Abstract: *Cycas macrocarpa* Griff. is presented here with a new distribution record in Penang, Malaysia. Morphological description and figures are provided. *Cycas macrocarpa* Griff. is classified as Vulnerable (VU) according to IUCN Red List categories and criteria.

Keywords: *Cycas*, conservation status, Penang, hill dipterocarp forest, new record

INTRODUCTION

The genus *Cycas* L. from the Cycadaceae family represents one of the most ancient extant lineages of seed plants. Cycads date back to the Mesozoic era, and retain several plesiomorphic traits, such as pachycaulous woody stems, spirally arranged pinnate leaves, and reproductive organs comprising male cones of helically arranged microsporophylls and loosely aggregated female megasporophylls which are not true cones. (Hill and Yang 1999; Jutta *et al.* 2010). Close to 120 species of *Cycas* are found worldwide, primarily across tropical and subtropical Asia, Australasia, parts of east Africa and the western Pacific. Four native *Cycas* species are currently recognised in Peninsular Malaysia: *Cycas cantafolia* Jutta, K.L. Chew & Saw, *Cycas clivicola* K.D. Hill, *Cycas edentata* de Laub., and *Cycas macrocarpa* Griff. (Jutta 2012b). These species occupy distinct ecological niches and exhibit varying degrees of endemism. While *Cycas* has been recorded throughout most of the states in Peninsular Malaysia, none of the four *Cycas* species described above have been recorded from Penang state until now. This is despite Penang—in particular Penang Island—being extensively botanised from the early colonial period. This paper reports the discovery of two populations of *Cycas macrocarpa* growing in close proximity to each other on Penang Island, constituting not only a new locality record for the species but also for the entire genus, thereby enriching the knowledge of the island's floral diversity. As *Cycas* is threatened by poaching, the exact locality of the newly discovered populations in Penang Island is not disclosed in this paper.

Cycas macrocarpa was first described by William Griffith, with the type having been collected in Tabong, Malacca (Griffith 1854). Commonly known in Malay as *Bogak*, the species is distributed in Laos, Thailand and in Peninsular Malaysia. In Peninsular Malaysia, the species was known to occur in Perak, Melaka, Kelantan, Terengganu and Pahang (Jutta 2012b) prior to this study. Although not immediately threatened by anthropogenic activities due to the rugged terrain in which they grow, the Penang *Cycas macrocarpa* population occurs in areas without special protected status (e.g. forest reserve or national park). Both populations are confined to small pockets with closely spaced individuals, making it vulnerable to poaching and habitat destruction.

MATERIALS AND METHODS

The Penang *Cycas macrocarpa* population was first discovered by the authors during a hike in 2025. Following this initial finding, several field trips were conducted between August and October 2025 in the surrounding area, focusing on similar geo-environmental locations to survey the species' distribution and document its complex growth cycles. This expanded survey led to the discovery of additional individuals. Specimens of *Cycas macrocarpa* from Peninsular Malaysia stored in the Herbarium of the Forest Research Institute Malaysia (KEP) were examined. Fresh materials collected during the field trips were processed as herbarium specimens, and fertile parts (e.g., megasporophylls and microsporophylls) were preserved in the spirit collection. Morphological characteristics described in this article were documented using high-resolution macro-photography, while measurements were taken directly on living plants. The conservation status assessment was carried out with reference to the categories and criteria of the IUCN (2023).

RESULTS

Taxonomy

With the newly collected Penang specimen, a description of *Cycas macrocarpa* is presented.

Description (measurements and morphological features updated based on specimens collected from the Penang *Cycas macrocarpa* population)

Cycas macrocarpa Griff.

Not. Pl. Asiat. 4 (1854) 11, t. 362, fig. 2; Hill, *Palms & Cycads* 46 (1995) 18, *Brittonia* 51 (1999) 66, fig. 9, 10; Jutta, *Fl. of Peninsular Malaysia* 3 (2012b) 159. **Type:** Westerhout, East India Company Herb. No. 6361, Peninsular Malaysia, Melaka [Malacca], near Tabong (holotype K). **Synonyms:** *Cycas rumphii* auct. non Miq.: Ridley, *J. Roy. As. Soc. Str. Br.* 60 (1911) 67, *Fl. Malay Pen.* 5 (1925) 284; *C. circinalis* auct. non L.: Smitinand, *Nat. Hist. Bull. Siam. Soc.* 24 (1971) 169, fig. 3c, 4e, *Fl. Thailand* 2 (1972) 186, fig. 13c, 14e.

Stems erect, sometimes prostrate-pendulous, to 12 m tall, to 34 cm diameter, occasionally branching, not swollen at base. **Bark** glaucous, brown-grey. **Leaves** arching, in bud densely covered by woolly, brown hairs that are shed as the leaves uncurl, new flush with a distinctive blue-green sheen; total length to 290 cm long; petioles 25 – 100 cm long, base thickened, sparsely tomentose, always spinescent to base, spines sharp-tipped, to 3 mm long; **rachis** 50 – 150 cm long; **pinnae** 25 – 118 pairs, usually linear or linear-elliptic, to 50 × 2.2 cm, in sub-opposite pairs, inserted on the rachis at 60° – 80°, membranous, soft (in exposed locations less so), glossy dark green above, paler beneath (and not glossy), base tapering and twisted, margins often undulate, not inrolled, apex acute, soft, in both live and dry leaves; **midrib** raised, light green. **Cataphylls** to 140 × 10 mm. **Male cones** usually solitary, ovoid, sub-sessile to shortly stalked, to 32 cm long (post-anthesis). **Microsporophylls** spatulate, to 45 × 17 mm, pubescent or felty, orange, with a brittle apical spine, linear, to 28 mm long, sharply upturned; **fertile zone** firm, slightly thickened; **pollen-sacs** closely arranged, sterile apical portion to 2 mm long. **Megasporophylls** forming an open-type 'cone', to 20 cm long, arching outwards, densely reddish brown pilose, bearing 2 – 6 ovules; lamina lanceolate, margins pectinate, with 8–10 sharp spines on each side, terminal spine to 6.5 cm long, attenuate, without lateral processes. **Seeds** ripening reddish brown, obovoid, 50 – 60 mm long, 40 mm diameter, laterally flattened, base slightly stalked; **cuticle** not waxy; **sarcotesta** 4 mm thick, without a fibrous layer; **sclerotesta** apex often retuse with a spine-like tip; **endotesta** not spongy.

Specimens examined (Peninsular Malaysia only).

Griffith 6361, Tabong (K); Chew FRI 54234, Kelantan (KEP); Jutta & Azril FRI 59703, Perak (KEP); Chacko & Liew PBG 5641, Penang (PBG); Chacko *et al.* PBG 5645, Penang (PBG); Chacko & Liew PBG 5646 (PBG).

Ecology

The Penang *Cycas macrocarpa* populations were found in hill dipterocarp forest, at elevations between 200 – 250 m a.s.l. on steep west facing slopes, particularly on granite rocks where they are firmly anchored. Some plants were also observed growing on clay loam. A dried male cone was observed in February 2025 while a developing megasporophyll was observed in October 2025. The populations were found in isolated high-density clusters.

Conservation Status

According to the IUCN Red List categories and criteria (Bösenberg 2023), this species has been globally classified as Vulnerable A2cd+4cd because the population is assessed as declining due to extensive clearing of habitat, with past reductions exceeding 30% over the last 50 years (one generation c. 30 years), and an ongoing decline projected at 30 – 50% when considering the next two generations. Nationally, it has been assessed as Vulnerable B1b(iii)+c(iv) (Jutta 2012b) because its geographic range and extent of occurrence is restricted to less than 20,000 km², with a continuing decline in habitat quality due to the loss of lowland forests, and extreme fluctuations in the number of mature individuals. Within its range, threats to this species include habitat destruction due to agriculture and collection for ornamental purposes.

Specifically, the total number of mature *C. macrocarpa* found in these two Penang populations was small, only 15 mature plants (taller than 1.0 m) were documented, out of which only one was observed to have seeds and seedlings in its vicinity as well as a developing megasporophyll. These two populations are also in areas without special protected status making it vulnerable to both poaching and habitat destruction (*viz.* land clearing). Occasional hiking activity in the vicinity of these plants also poses a threat, as observed in September 2025, where one of the mature *C. macrocarpa* plants growing right beside a recently established hiking trail was observed to have had its leaves vigorously pruned, possibly by trail users who might have found the spinescent leaf petioles stretching over a trail as an impediment to access.

In the event of disturbances, the biology of cycads complicates its recovery: slow growth, infrequent cone production, and reliance on specialised pollinators limit their capacity to recover from disruptions and population declines. Owing to their relatively low agro-economic value, limited habitat accessibility, and conservation status, *Cycas* species are often overlooked and understudied across many regions. Globally, they face significant threats not only from collection pressure as ornamental plants but more significantly from local habitat destruction (Mankga and Yessoufou 2017). Consequently, there is a need for systematic surveys and enumeration studies to document their distribution and population sizes in natural habitats.

DISCUSSION

The discovery of this population of *Cycas macrocarpa* on Penang Island not only adds a new locality to the known distribution of the species, but also represents a significant botanical record for Penang, as the genus *Cycas* has not previously been documented there.

Cycas are of great botanical value because they are considered to be “living fossils” as their ancestors appeared well before the dinosaurs evolved, more than 200 million years ago. During the Permian and Jurassic periods, they dominated the forests and the *Cycas* species that remain today are an unbroken link to the prehistoric plants which survived major extinction events. Hence, the discovery of these plants in Penang, adds value to the natural capital of the state, which has a growing ecotourism sector and often touts itself as being home to an ancient rainforest.

Of the 15 mature plants observed during this study, only one female plant was seen to have a successful previous reproductive flush. Several seedlings of varying maturity were observed growing in the vicinity of this plant and during the field work. Sprouting seeds were observed growing in the detritus accumulated between the leaves. At the time of the study, the same female plant was also undergoing another subsequent reproductive flush. This indicates that pollination and production of seeds do happen within the population.

However, a dried male cone (PBG 5641) collected not too far away from this female plant showed an absence of live weevils, or any visible evidence of them feeding on the microsporophyll tissue (burrows). Adult weevils are known to oviposit into developing microsporophylls and spend nearly their entire lifecycle on male cycads with occasional flights to female plants which is when pollination happens (Jutta 2012a). Hence, the absence of any live weevils or evidence of weevil activity on this male cone indicates that the weevils may not be evenly spread throughout the population and warrants the question as to if this population is viable for the future.

Therefore, further studies need to be done to better understand the breeding biology of this species. While most characteristics of the Penang *Cycas macrocarpa* population fall within the size ranges described for the species by Jutta (2012b), the maximum leaf length and the number of pinnae observed in the Penang population exceed those previously reported.

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APPENDIX



Figure 1. A. Mature female plant, B. Female cone, C. Old male cone (post-anthesis), D. Mature male plant, E. Germinating seedling, F. Seedling with successive flush of leaves.



Figure 2. **G.** Bark of female and **H.** male plant, **I.** Base of female and **J.** male plant, **K.** New flush showing the distinctive bluish green colour as compared to a mature frond, **L.** Brownish cataphylls, **M.** Spinacanth petiole (almost to the base), **N.** Adaxial view of pinna, **O.** Abaxial view of pinna, and **P.** Wolly brown hairs on newer flush.



Figure 3. **1a.** Outer view and **1b.** Inner view of tomentose cataphyll, **2a.** Outer view and **2b.** inner view of immature fertile female lamina bearing megaspore, **3a.** Outer view and **3b.** inner view of sterile female lamina, **4a.** Apical view of microsporophyll, **4b.** Abaxial view of microsporophyll showing microsporangium sacs, **5.** View of male cone with the abaxial surface visibly covered in microsporophyll sacs, **6.** Overall view of male cone, and **7.** Fertile seed.



Figure 4. Plant seen in-situ in (left) February 2025 and (right) September 2025, where lower fronds were pruned vigorously by trail users (shown by white arrows) leaving the petiole bases. The slow growth cycle of *Cycas* complicates its recovery in situations like this.



Figure 5. a. shows the typical steep granitic slopes that the plants are found in situ in Penang, and b. Mature male plant with the 2nd author as scale.