

## RESEARCH ARTICLE

# CYCAS ANDAMANICA (CYCADACEAE): A NEW SPECIES FROM ANDAMAN ISLANDS, INDIA

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Accepted 03<sup>rd</sup> August, 2015; Published Online 30<sup>th</sup> September, 2015

## ABSTRACT

*Cycas andamanica* is described as a new species from Andaman Islands, India and this new species belonging to subsection *Rumphiae*. Its closely affinities with *C. edentata* and *C. zeylanica* are discussed and also provides detailed description, distribution, conservation status and photographs.

**Key Words:** *Cycas*, *Rumphiae*, Andaman and Nicobar Islands, *C. zeylanica*, *C. edentata*

## INTRODUCTION

*Cycas* L., a gymnospermous genus belongs to subclass Cycadidae and order Cycadales and family Cycadaceae (Christenhusz *et al.*, 2011b; Christenhusz *et al.*, 2011). The genus *Cycas* comprises ca 100 species, distributed in Madagascar and East Africa, India, Indo-China, Malesia, Japan, extending to Micronesia and Polynesia, (De Laubenfels and Adema, 1998; Lindstrom *et al.*, 2009) and represents 10 species in India (Lindstrom and Hill, 2007; Singh and Radha, 2008; Singh *et al.*, 2015).

Part of the ongoing research project in Andaman Islands, we could locate a unique interesting population of *Cycas*, along the seacoast of the Middle and North Andaman Islands. Critical examination of the collected specimens revealed that the seed character confers its position to the subsection *Rumphiae* Hill of the section *Cycas*. A thorough perusal of literature revealed that the characters of the specimens cannot be matched with any of the known species in the subsection *Rumphiae* and hence recognised as a new species. The novel species is similar to *Cycas edentata* and *Cycas zeylanica* and differ in many respects which are tabulated here under.

## MATERIALS AND METHODS

The description is based on measurements of living plants taken within the field and examination of herbarium specimens. Field observations and specimen's examinations were conducted using a microscope with dried material or specimens preserved in FAA solution and measurements are taken carefully.

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The conservation status proposed here follows the Red List Categories and Criteria, version 11 (IUCN Standards and Petitions Subcommittee, 2014).

## RESULTS

*Cycas andamanica* K. Prasad, M. V. Ramana, Sanjappa & B. R. P. Rao, *sp. nov.* (Fig. 1 & 2)

### Type

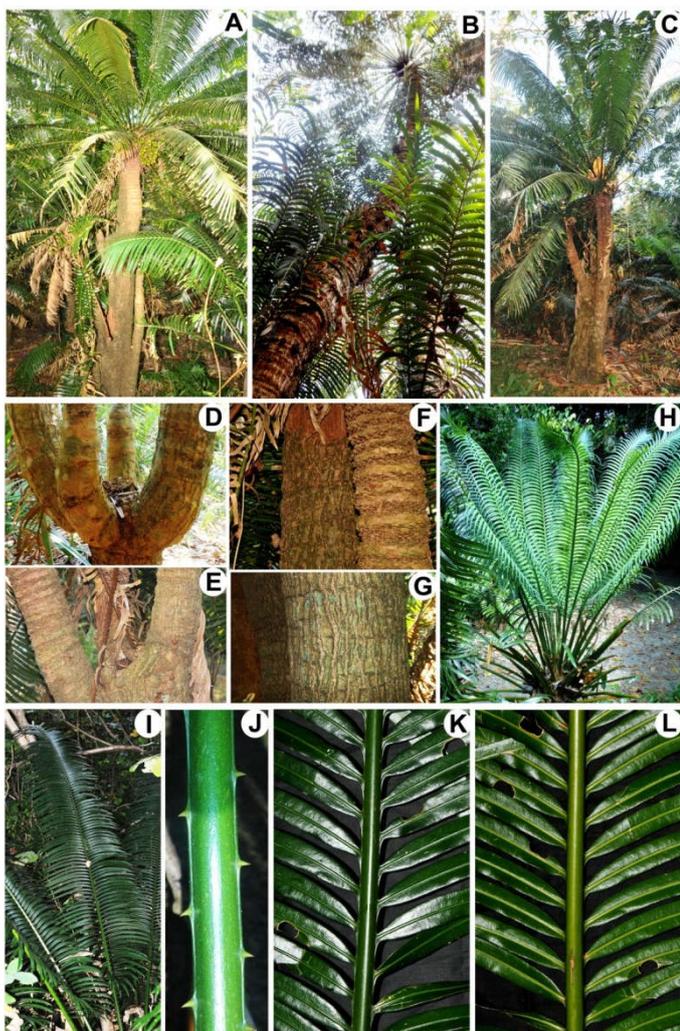
INDIA, Andaman Islands, North Andamans, Ramnagar littoral forest, sea level to 10m, 10 January 2011, K. Prasad & M.V. Ramana 1288 (holotype CAL!, isotypes SKU!)

### Diagnosis

Distinguishing characters of *Cycas andamanica*: stems 20–120 cm diameter; longer leaves; young leaves bluish-green; leaflets 128–170; median leaflets strongly falcate, midrib raised both surface; cataphylls linear, 8–10 cm long; pollen cones narrowly ovoid; microsporophylls dorsiventrally thickened, 4.5–6.5 cm long, with apical wings; megasporophylls with six ovules, semi-orbicular at ovule bearing area; sterile lamina triangular at apex, margins entire or obscurely undulating, with or without two lateral spines, acumen spine 4–6.2 cm long; sclerotesta apically crested.

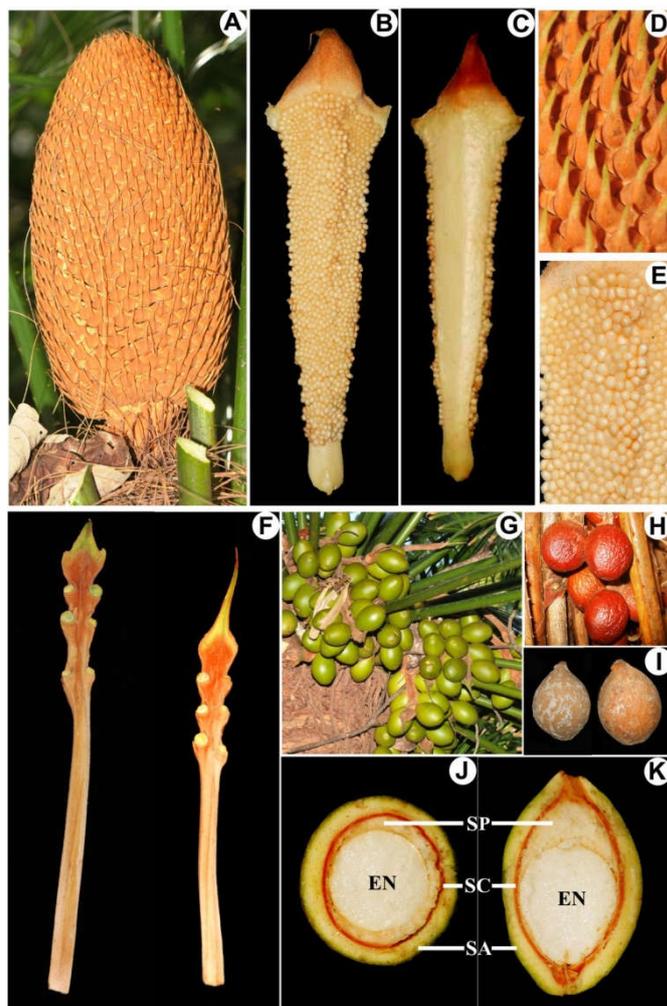
### Description

Stems arborescent, ca. 10 m high, 20-120 cm diam., branched or unbranched; bark light grey, corky or rough or smooth.



**Fig. 1. *Cycas andamanica*, A. Female plant habit, B, C. Male plants habit, D. Branched stems of female plant, E. Branched stem of male plant, F. Bark nature of female plants, G. Bark nature of male plant, H. Young leaves, I. Mature leaf, J. Spinescent petiole, K. Dorsal side of the median leaflets with raised midrib, L. Ventral side of the median leaflets with raised midrib**

Leaves numerous in crown, pinnate, dark green and semi-glossy above, light green below, young leaves bluish-green, 2-2.68 m long, with 128-170 leaflets, flat (not keeled) in section (opposite leaflets inserted at 180° on rachis), tomentum shedding as the leaf expands, rachis consistently terminated by a pair of leaflets; petiole 60-80 cm long, glabrous, spinescent for most part of its length; spines short, curved, to 3-4 mm long; basal leaflets not reduced to spines, slightly falcate, linear, 10-21 cm long; median leaflets fleshy, strongly falcate, linear, 28-34 × 1.6-1.8 cm, decurrent for 1-1.5 cm, narrowed to 5-6 mm at base, 1.5-1.8 cm apart on rachis; margins undulate, slightly recurved; acute or spinescent at apex; midrib raised on both surface; apical leaflets paired, never reduced into spines, straight, 16-18 × 8-9 mm. Cataphylls densely orange-brown pilose, pungent, linear, 8-10 cm long, broadest at base (7-12 mm), persistent. Male cones orange-brown or orange, shortly stalked, narrowly ovoid, 30-35 cm long, 16-20 cm wide; microsporophyll lamina firm, dorsiventrally thickened, 4.5-6.5 cm long, 1.2-1.6 cm wide, fertile zone 3.8-5.6 cm long, sterile apex 2.7-9 mm long, with apical wings; apical spine prominent, sharply upturned, 1.5-2 cm long.



**Fig. 2. *Cycas andamanica*, A. Male cone, B. Dorsal view of microsporophyll, C. Ventral view of microsporophyll, D. Upturned apical spines, E. Microspores, F. Megasporophylls with ovules, G. Megasporophylls with seeds, H. Mature seeds, I. Smooth Sclerotesta, J. T.S. of seed, K. L.S. of seed (SA. Sarcotesta, SC. Sclerotesta, SP. Spongy layer)**

Megasporophylls orange or orange-brown tomentose, tomentum persistent, 30-40.2 cm long, with 6 glabrous ovules; ovule bearing fertile lamina semiorbicular, 6.5-9 cm long; sterile lamina triangular at tip, 6.5-9.7 × 2.5-3 cm, acuminate, margins entire or obscurely undulating, with or without lateral spines; lateral spines 2, broad, flattened, ca 5 mm long; acumen spine distinct from lateral spines, 4-6.2 cm long, 1.2-1.6 cm broad at base. Seeds flattened-ovoid, 4.4-7.5 cm long, 3.5-4.6 cm broad; sarcotesta shining green when young, turning orange-red at maturity, 3-5 mm thick; fibrous layer absent; sclerotesta smooth, apically crested; spongy endotesta present.

**Phenology:** Male and female cones: December–July

**Distribution:** Endemic to Andaman Islands (North and Middle Andaman Islands).

**Habitat and distribution:** Humus-rich black soils in littoral vegetation from the sea level–20 m.

**Etymology:** The specific epithet refers to the name of the locality (Andaman Islands) from where the species is described.

Table 1. A comparison of *Cycas andamanica* with *C. edentata* and *C. zeylanica*

Characters	<i>C. edentata</i>	<i>C. zeylanica</i>	<i>C. andamanica</i>
Stem	to 7 m high and 15–30 cm diameter	to 3 m high and to 30 cm diameter	to 10 m high and 20–120 m diameter
Leaves	1–1.8 m long	1.4–1.9 m long	2–2.68 m long
Young leaves	not bluish-green	not bluish-green	bluish-green
Leaflets number	160–200	70–100	128–170
Median leaflets midrib	flat or raised above and strongly raised below	raised above and flat below	raised above and below
Cataphylls	narrowly triangular, 4–7 cm long	linear, 10–12 cm long	linear, 8–10 cm long
Pollen cones	ovoid or fusiform, 35–60 cm long	fusiform, to 70 cm long	narrowly ovoid, 30–35 cm long,
Microsporophylls	not dorsiventrally thickened, 3.5–4.4 cm long	not dorsiventrally thickened, 3.5–4.5 cm long	dorsiventrally thickened, 4.5–6.5 cm long
Microsporophylls apical wings	absent	Absent	Present
Microsporophyll apical spines	1.2–2.4 cm long	0.3–1 cm long	1.5–2 cm long
Megasporophylls	2–8 ovulate	2–5 ovulate	6 ovulate
Ovules bearing lamina	lanceolate, 4.3–12 cm long	lanceolate, 6–12 cm long	semiorbicular, 6.5–9 cm long
Megasporophylls sterile lamina margin	entire or undulating, rarely with a few weak teeth; acumen spine 3–4 cm long.	obscurely dentate with 6 to 12 lateral bumps or short spines; acumen spine 4–6 cm long.	entire or obscurely undulating, or with 2 lateral spines; acumen spine 4–6.2 cm long
Sclerotesta	not crested	not crested	apically crested

### Conservation status

*Cycas andamanica* is so far known only from North and Middle Andaman Islands and its extent of occurrence (EOO) is less than 100 Sq. Km and the area of occupancy (AOO) is less than 10 Sq. Km and hence categorized as Critically Endangered (B1ab(iii,v) + 2ab(iii,v)) following IUCN Version 11 (IUCN Standards and Petitions Subcommittee, 2014).

### Additional specimens examined

INDIA. Andaman Islands: North Andamans, Ramnagar littoral forest, 5–10 m, 10 January 2013, Prasad 41601 (paratype PBL!); North Andaman Islands, Ross & Smith Islands, 10 m, 1<sup>st</sup> March 2013, M.V. Ramana 1257 (CAL!); Middle Andaman, Rani Jansi Marine National Park, sea level, 16 March 2013, B.R.P. Rao & Prasad 44466 (SKU!).

### DISCUSSION

The *Cycas* subsection *Rumphiae* is characterised by the presence of a layer of spongy tissue within the seed (Hill, 1994). The spongy endotesta causes seeds to be buoyant, and this has been considered as a seed dispersal mechanism (Dehgan and Yuen, 1983). This subsection comprises about 11 species (Lindstrom and Hill, 2002), however one of the species, *C. litoralis* is reduced to a synonym. *Cycas* species of this subsection have wide distribution from Africa to Fiji and Tonga, and from New Guinea north to southern coastal Indochina (Keppel *et al.*, 2008; Lindstrom *et al.*, 2008).

The main centre for the subsection *Rumphiae* is Asia which cover about 60% of the total species, viz., *Cycas edentata* (Endemic to Philippines), *C. falcata* (Endemic to Sulawesi Islands) *C. nitida* (Endemic to Philippines), *C. sundaica* (Endemic to Timor), *C. zeylanica* (Endemic to Andaman & Nicobar Islands and Sri Lanka) and *C. rumphii* (Asia-Indonesia, Java, Borneo, Sulawesi and Moluccan Islands and Australia- Papua New Guinea). Countries of the Australia and Oceania accounts for 4 species viz., *Cycas bougainvilleana* (Endemic to New Britain and Solomom Islands), *C. micronesica* (Endemic to Micronesia) and *C. seemanni* distributed in the south-west Pacific (Tonga west to New Caledonia south). *Cycas thouarsii* is confined to Madagascar, Comoros, Tanzania and Mozambique.

The novel species, *Cycas andamanica* is similar to *C. edentata* and *C. zeylanica* but differs in the characters presented in Table 1.

### Acknowledgments

Authors gratefully acknowledge Department of Biotechnology, Ministry of Science and Technology, New Delhi (BT/PR12954/NDB/52/146/2009) for financial assistance. We Thankful to Dr. Leonie Stanberg, National Herbarium of New South Wales, Royal Botanic Gardens, Sydney for providing relevant literature, Dr. P. Singh, Director, Botanical Survey of India, Kolkata for providing facilities. The authors are also thankful to Prof. K. N. Ganeshiah, University of Agricultural Sciences, GKVK, Bangalore, DBT Project Coordinator; Dr. C. Murugan, Scientist 'C', Regional research centre, BSI, Port Blair for their help and cooperation and Andaman & Nicobar Islands Forest Department for granting permission to conduct field studies.

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