

Notes on the Species of *Cycas* (Cycadaceae) from Sri Lanka and Islands of the Andaman Sea

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ABSTRACT. Two cycad species, *Cycas nathorstii* endemic to Sri Lanka and *Cycas zeylanica* native to Sri Lanka and islands of the Andaman Sea, are discussed. A new combination, *Cycas zeylanica* (J. Schuster) Lindstrom & K. D. Hill, is established, elevating this taxon from subspecies status on the basis of cataphyll and leaflet characters. Both *Cycas* species are lectotypified. Distribution of the two species is investigated, and a key to the species is provided.

Key words: Andamans, Cycadaceae, *Cycas*, Sri Lanka.

The identity of the cycads native to Sri Lanka has never been clearly understood from the earliest recording of these plants in the region. The first record for this country was in *Flora Zeylanica*, published by Linnaeus in 1747. Linnaeus (1753) later treated this as one element of *Cycas circinalis* L. Schuster (1932) separated the Sri Lankan material as *C. nathorstii* J. Schuster, and de Laubenfels and Adema (1998) included some but not all Sri Lankan material in *C. sphaerica* Roxburgh.

Cycas sphaerica is endemic to southeastern India, and only *C. nathorstii* and *C. zeylanica* are therefore here recognized as being native to Sri Lanka. The latter also occurs in the Andamans and Nicobar Islands where its populations are considered vulnerable.

About 90 species are recorded for the genus *Cycas* L. worldwide. Of these, 27 species are Australian and about 35 are Indo-Chinese. *Cycas* also occurs in the Malesian region, Japan, India, and Sri Lanka extending to Micronesia and Polynesia, Madagascar, and East Africa. Plants are commonly understory shrubs in forest, woodland, or savanna habitats. Four sections have been recognized (Hill, 1995), but only one of these sections with two subsections occurs naturally in Sri Lanka. Three subsections are recognized, circumscription following

Hill (1995), with two occurring in Sri Lanka: subsection *Cycas* and subsection *Rumphiae*. The full range of the section is from India and southern Indochina south to Australia, and from East Africa east to Tonga.

KEY TO THE SPECIES OF *CYCAS* IN SRI LANKA

- 1a. Lateral spines on megasporophylls distinct; cataphylls thinly sericeous or glabrous with age, not pungent, 50–60 mm long; midrib of median leaflets raised above and below; 6–10 ovules; no spongy layer *C. nathorstii*
- 1b. Lateral spines on megasporophylls indistinct; cataphylls pilose, pungent, 100–120 mm long; midrib of median leaflets raised above and flat below; 2–5 ovules; spongy layer present *C. zeylanica*

Cycas subsect. *Cycas* (approx. 5 species) is defined by the absence of a spongy endocarp, the presence of fibers in the sarcotesta, and a narrow megasporophyll lamina. It ranges from India to Sri Lanka. A single endemic species is found in Sri Lanka.

Cycas nathorstii J. Schuster, Pflanzenr. 99: 76, fig. 10E. 1932. TYPE: Sri Lanka. Central and northern parts of the isle, 1866, G. Thwaites 3689 in *Herb. Barbey-Boisser* (lectotype, designated here, G; isoelectotypes, A, K, LE, P).

Stems arborescent, 1–4.5 m tall. Leaves bright green, semiglossy, 160–180 cm long, flat (not keeled) in cross section (opposing pinnae inserted at 180° on rachis), with 140 to 170 leaflets, tomentum shedding as leaf expands. Petiole 45–55 cm long (25–30% of total leaf), petiole glabrous, spinescent for 90–95% of length. Basal leaflets not gradually reducing to spines. Median leaflets simple, weakly discoloured, 190–310 × 9–14 mm, narrowed to 3–4 mm at base (to 25–35% of maximum width), 17–20 mm apart on rachis; median leaflets

flat; margins flat; apex softly acuminate, not spinose; midrib raised above, raised below. Cataphylls narrowly triangular, soft, sparsely sericeous or lacking tomentum, 50–60 mm long, persistent. Pollen cones narrowly ovoid, orange; microsporophyll lamina firm, not dorsiventrally thickened, $30\text{--}40 \times 15\text{--}22$ mm, apical spine prominent, gradually raised, 10 mm long. Megasporophylls 15–30 cm long; ovules 6 to 10, glabrous; lamina lanceolate, $40\text{--}65 \times 18\text{--}25$ mm, shortly dentate with 26 to 40 lateral spines 1–4 mm long; apical spine distinct from lateral spines, 10–14 mm long. Seeds flattened-ovoid; sarcotesta yellow; fibrous layer present; sclerotesta smooth; spongy layer absent.

Historical notes. This upland cycad from Sri Lanka has been generally known as *C. circinalis* (Trimen, 1898) and was in fact one element of the protologue of the latter (Linnaeus, 1747). German historian and sometime botanist Julius Schuster distinguished *C. nathorstii* from *C. circinalis* in 1932 on the basis of specimens collected by George Thwaites and distributed to European herbaria by Swiss botanist and philanthropist William Barbey-Boissier (1842–1914). Thwaites (1812–1882) was superintendent of the Royal Botanic Garden at Peradeniya in Ceylon from 1849 to 1880. Collection detail cited (Schuster, 1932: 76) was “Ceylon: Thwaites 1866 n. 3689 in Herb. Barbey-Boissier.” The Barbey-Boissier herbarium and types are in G, including Thwaites’s specimen. This may not have been the specimen examined by Schuster, as it has no annotation by him and was filed as undetermined. Schuster’s types were mainly in B and were destroyed during World War II. This sheet at G includes both leaflets and megasporophylls, and is here designated the lectotype. De Laubenfels and Adema (1998) included *C. nathorstii* in the synonymy of *C. sphaerica*, but also placed some Sri Lankan collections of the same taxon in *C. circinalis*.

Distinguishing features. *Cycas nathorstii* is distinguished from *C. circinalis* and *C. sphaerica* of the Indian mainland by its more robust habit, wider leaflets, and larger male cones with longer and more curved apical spines on microsporophylls. Megasporophyll apices of *C. nathorstii* are narrowly triangular with numerous fine lateral spines extending almost to the very tip, whereas the Indian species possess broader apices with a distinct extended apical spine that is free from lateral teeth. *Cycas nathorstii* is distinguished from *C. zeylanica* by the more closely spaced and more chartaceous leaflets, the shorter, softer and less pubescent cataphylls, and lack of a spongy layer in the seeds.

Distribution and habitat. Known only from Sri Lanka, where it occurs in inland and upland forests in the north of the island, usually in somewhat dry sites.

Reproductive biology. No confirmed or potential pollinator has been recorded for *Cycas nathorstii*.

Conservation status. Still locally frequent, although not in great numbers, this species is regarded as vulnerable (IUCN, 1998, Red List category VU).

Vernacular. Madu.

Etymology. Honoring Swedish palaeobotanist Alfred Gabriel Nathorst (1850–1921), professor at the Natural History Museum in Stockholm.

Specimens examined. SRI LANKA. Ceylon, herb. P. Herm. s.n. (L); hort. Kew. ex Ceylon, 1875, Thwaites 4230 (K); between Kuda Patessa and Maha Patessa, 15 July 1969, Cooray & Wirawan 1145 (A, K, L, NY); ridge S of Na-Ulpota, 8 Aug. 1973, Jayasuriya 1278 (K); Manerangata district, Bibile, 18 July 1972, Hepper & de Silva 4723 (K); Manerangata district, 3.2 km E of Bibile, 28 Nov. 1970, Fosberg & Sachet 53148 (K, NY); Mandae, Oldmanas 53 (L); Moraragale district, Nilgala, Gal Oya National park, 1 May 1975, Jayasuriya 1951 (L); NW Province, Puttalam district, Wilpattu National Park, Kudu patassa, 1 Nov. 1974, Davidse 8237 & Sumithraarachi (BRI, K, L).

Cycas subsect. *Rumphiae* K. D. Hill is uniquely defined by the presence of a layer of spongy tissue within the seed. Its distribution is very wide, extending from Africa to Fiji and Tonga, and from New Guinea north to southern coastal Indochina. One species, *Cycas zeylanica*, occurs in Sri Lanka and islands in the Andaman Sea. This subsection contains approximately 11 species, but the taxonomy of the group is difficult and unclear. All species in the *C. rumphii* complex have appeared in the literature erroneously as *C. circinalis* at some stage (see Hill, 1994). A spongy layer causes seeds to be buoyant, and this has been proposed as a dispersal mechanism (Dehgan & Yuen, 1983). This dispersal mode has been interpreted as a cause of the taxonomic complexity of this group (for discussion, see Hill, 1994; Fosberg & Sachet, 1975).

Cycas zeylanica (J. Schuster) A. Lindstrom & K. D. Hill, comb. et stat. nov. Basionym: *Cycas rumphii* subsp. *zeylanica* J. Schuster, Pflanzenr. 99: 75, figs. 10C–D, 11K–M. 1932. TYPE: Sri Lanka, 1866, Thwaites 3862 in Herb. Barbey-Boissier (lectotype, designated here, G; isolectotypes, A, K, LE).

Stems arborescent, to 3 m tall. Leaves bright to deep green, semiglossy, 140–190 cm long, flat (not keeled) in cross section (opposing pinnae inserted

at 180° on rachis), 70 to 100 leaflets, with white or orange tomentum shedding as leaf expands; rachis consistently terminated by paired leaflets. Petiole 50–70 cm long (30–40% of total leaf), petiole glabrous, spinescent for 30–100% of length. Basal leaflets not gradually reducing to spines. Median leaflets simple, strongly discolorous, 180–300 × 12–15 mm, narrowed to 6–7 mm at base (to 40–50% of maximum width), 22–27 mm apart on rachis; median leaflets flat; margins slightly recurved; apex acute, not spinescent; midrib raised above, flat below. Cataphylls linear, pungent, pilose, 100–120 mm long, persistent. Pollen cones fusiform; microsporophyll lamina firm, not dorsiventrally thickened, 35–45 × 17–19 mm, apical spine prominent, sharply upturned, 3–10 mm long. Megasporophylls 17–30 cm long; ovules 2 to 5, glabrous; lamina lanceolate, 60–120 × 10–17 mm, obscurely dentate with 6 to 12 lateral bumps or short spines to 2 mm long; apical spine distinct from lateral spines, 40–60 mm long. Seeds flattened-ovoid; sarcotesta orange-brown; fibrous layer absent; sclerotesta smooth; spongy layer present.

Historical notes. Collection detail cited (Schuster, 1932: 75) was “Ceylon: Thwaites 1866 n. 3862 in Herbar. Barbey-Boissier.” Schuster’s herbarium and types were in B, and were destroyed in World War II. The Barbey-Boissier herbarium and types are in G, including this collection. Three sheets exist, with microsporophylls, megasporophylls, and leaflets, each on a separate sheet. More than one plant is clearly involved, and it is impossible at this stage to associate the leaf specimen with either of the fertile specimens. These may not have been the specimens examined by Schuster, as they have no annotations. The sheet bearing the megasporophylls is here designated the lectotype.

Distinguishing features. *Cycas zeylanica* is allied to both *C. thouarsii* Desfontaines ex Gaudichaud and *C. edentata* de Laubenfels, sharing the character lacking an apical wing and microsporophylls with an apical spine. The numerous, long and pungent cataphylls, an exceptionally long and drawn out megasporophyll tip, and the widely spaced leaflets distinguish *C. zeylanica*.

Distribution and habitat. Known from Sri Lanka, in southern coastal regions, and the Andamans and Nicobar Island group. The habitat is in littoral forest near the sea in sandy soil.

Reproductive biology. Surprisingly little is known about the pollinators of *Cycas* subsect. *Rumphiae*. Weevils (*Curculionidae*, *Tychiodes*) have been found in male cones both in the Andamans and Nicobar Islands (Tang et al., 1999). Two male

cones collected in the South Andamans were found full of these weevils (*Lindstrom 357*, *Lindstrom 358*), but they are apparently of a different species than those found on *Cycas edentata* on the eastern coast of peninsular Thailand (Tang et al., 1999).

Conservation status. SRI LANKA. Populations have been totally decimated, and a survey done by the first author failed to find any viable regenerating populations. Only widely scattered, large, old specimens remain. No plants were found within any protected areas. The correct IUCN Red List category for the species on Sri Lanka should be Critically Endangered (CR) (IUCN, 1998). INDIA. The species is widespread and common on the Andamans and Nicobar Islands. However, although still growing in large populations at several locations, severe damage has been done by repeated strong cyclones. The recent development of seaside resorts on the islands has also had an impact on some populations, and several previously large populations have been eradicated to make space for tourist accommodations. There are populations within protected areas as well as in off-limit, military areas. The recommended IUCN Red List category would be Vulnerable (VU) (IUCN, 1998).

Vernacular. Maha-madu (Sri Lanka).

Etymology. From Zeylona, the Latinized rendering of Ceylon (Sri Lanka), from where the type of this species was collected.

Specimens examined. INDIA. **South Andamans:** Kurz s.n. (K, P); Havelock Island, E coast, beach No. 5, 2 m ASL, tall evergreen littoral forest, app. 50 m from the beach, 2 Dec. 2000, *Lindstrom 357* (NSW, SING); cult. near the jetty, 5 m ASL, 2 Dec. 2000, *Lindstrom 359* (NSW, SING); W coast, beach No. 7, 3 m ASL, tall secondary evergreen littoral forest, 3 Dec. 2000, *Lindstrom 365* (NSW, SING); Kodiaghat, beach vegetation, sandy soil, sea level, few plants, 25 Sep. 1973, *Bulakrishnan 382* (SING); hort. Kew, raised from seed coll. Nicobars by Col. Nan in 1875, 1881 *leg. ign.* (K). SRI LANKA. Araiya Mawtha, Maddawatha, Mataya, wild near the seashore along a stream, 27 m ASL, 10 June 2000, *Lindstrom 287* (NSW, SING); cultivated along the road, 31 m ASL, 10 June 2000, *Lindstrom 288* (NSW, SING); Hikkaduwa, Dewadalla, Wauleguda, cult. 11 June 2000, *Lindstrom 289* (NSW, SING); Wtage, Alangama, cult., 11 June 2000, *Lindstrom 290* (NSW, SING).

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