

## NEW POPULATION OF *CYCAS SPHAERICA* ROXB. (CYCADACEAE) DISCOVERED IN PINJARIKONDA RESERVE FOREST, ANDHRA PRADESH, INDIA

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*Cycas* is a single genus of the family Cycadaceae consisting of 100 species. It is the sole living cycad group occurring in Asia (Lindstrom & Hill 2007). Nine taxa, namely, *C. beddomei* Dyer, Trans., *C. circinalis* L., *C. indica* Lindstrom & Hill, *C. sphaerica* Roxb., *C. annakailensis* R. Singh & P. Radha, *C. nathorstii* J. Schust., *C. pectinata* Buch.-Ham. *C. zeylanica* (J. Schust.) A. Lindstrom & K.D. Hill and *C. swamyi* Singh & Radha are reported in India (Lindstrom & Hill 2007; Singh & Radha 2008; Singh & Singh 2011); two species *C. swamyi* Singh & Radha and *C. annakailensis* R. Singh & P. Radha are considered synonyms of *C. circinalis* L. and *C. sphaerica* Roxb., respectively (Ranjay et al. 2010), hence seven species are presently recognized in India. *C. sphaerica* was first mentioned by Roxburgh in 1814, and described in 1832 (Lindstrom & Hill 2007). As reported by Raju in (2006) *C. sphaerica* Roxb. is morphologically similar to *C. circinalis* L. in most respects but differs in certain characters such as megasporophyll structure.

*C. sphaerica* Roxb. is endemic and distributed along

the hilly tracts of Eastern Ghats of northern Andhra Pradesh, Odisha, Tamil Nadu and Karnataka (Reddy et al. 2007; Varghese & Krishnamurthy 2010). In Andhra Pradesh, it is found occasionally in dry deciduous forests in northernmost part of Srikakulam District and woodlands of Palakonda, Donubayi and Seetampet areas (Reddy et al. 2007). A population of more than 500 trees exists at Jalanthakota Reserve Forest in the low elevation deciduous forest in Srikakulam District (Raju et al. 2009). In Odisha, these are occasionally found in the woodlands of Gajapathi, Ganjam, Khurda, Cuttack and Dhenkanal districts; sparse in moist deciduous forests of Phulbani, Boudh, Nayagarah, Angul, Keonjhar and Mayurbhanj districts (Reddy et al. 2007). In the flora of Srikakulam District it was mentioned under the name of *C. circinalis* L. (Rao & Sreeramulu 1986). It is listed in IUCN as Data Deficient and is included in CITES Appendix II (Varghese & Krishnamurthy 2010).

In Eastern Ghats there are three *Cycas* species among which *C. beddomei*, is endangered (Rao 2010), a global endemic species and known only from Seshachalam Hills in Andhra Pradesh. *C. circinalis* L. is restricted to the Western Ghats and some parts of Eastern Ghats in Andhra Pradesh and Tamil Nadu.

Pinjarikonda Reserve Forest (2282.90ha) is located between 17°26'–17°28'N & 81°59'–82°01'E Eastern Ghats in East Godavari District, Andhra Pradesh, India (Fig. 1). The forest located in Addateegala (452.82ha) and Sudikonda (1830.08ha) forest ranges a perennial stream of the Pinjarikonda waterfall flowing along the forest. Elevation range is from 100–456 m. Red sandy soil, khondalite type rocks are present in the study area.



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Vegetation type is the tropical dry deciduous forest.

The overall population size of *C. sphaerica* Roxb. is not known (Varghese & Krishnamurthy 2010). Detailed survey and documentation of geographical distribution of the native cycad taxa, their pests and diseases is urgently needed (Muniappan & Virakatamath 2006). Endemic plants are more prone to extinction for various reasons as they are habitat specific. Because of unstable habitats, in a small area with a limited population they are extra stressed. Therefore, such endemics must be prioritized for conservation efforts (Rawat 2009). Indian cycads are threatened largely as a result of human activities (Singh & Singh 2011).

**Materials and Methods:** *C. sphaerica* Roxb. specimens were collected and observed during the period of April 2010 to June 2011 from Pinjarikonda Reserve Forest and identified with the help of the floras and literature (Lindstrom & Hill 2007; Reddy et al. 2007) at the time of our explorations in East Godavari District. The voucher specimen (AU (B.D.H.) JPR-20298) is deposited at the Herbarium of Botany Department, Andhra University.

**Results:** *Cycas sphaerica* Roxb. Fl. Ind.: 747 (1832). Type: ex hort. Calcutta, Roxburgh s.n., 1808 (lecto BM, fide Hill 1995). *C. circinalis* var. *orixensis* Haines, Bot. Bihar Odisha 6: 1228 (1924). Type: India, Odisha, Mals of Puri, Haines 5876, June 1917 (syn. K); Angul, Haines 5877, July 1917 (syn. K). *C. annakalensis* Singh & Radha, Brittonica 58.119.2006. (syn. now).

Small palm like tree up to 5m tall, dioecious (Image 1 c,j), usually female plants possess branches, stems are arborescent with a girth up to 135cm. Bark is thick with alternate bands of scars on persistent leaf bases and cataphylls. Leaves are pinnate, dark green, semiglossy, 95–160 cm, leaflets 55–215 and are generally produced in the season before cone formation. The median leaflets are simple, weakly discolored, they are 13–21 cm long and 7–12 mm wide with a soft acuminate apex. Cataphylls are narrowly triangular soft, thinly sericeous or lacking tomentum. Usually cones are formed from May to August. Male cones are orange colored, narrowly ovoid with spirally arranged numerous dorsiventral microsporophylls (Image 1 d–i). Female cones are loosely packed with megasporophylls.

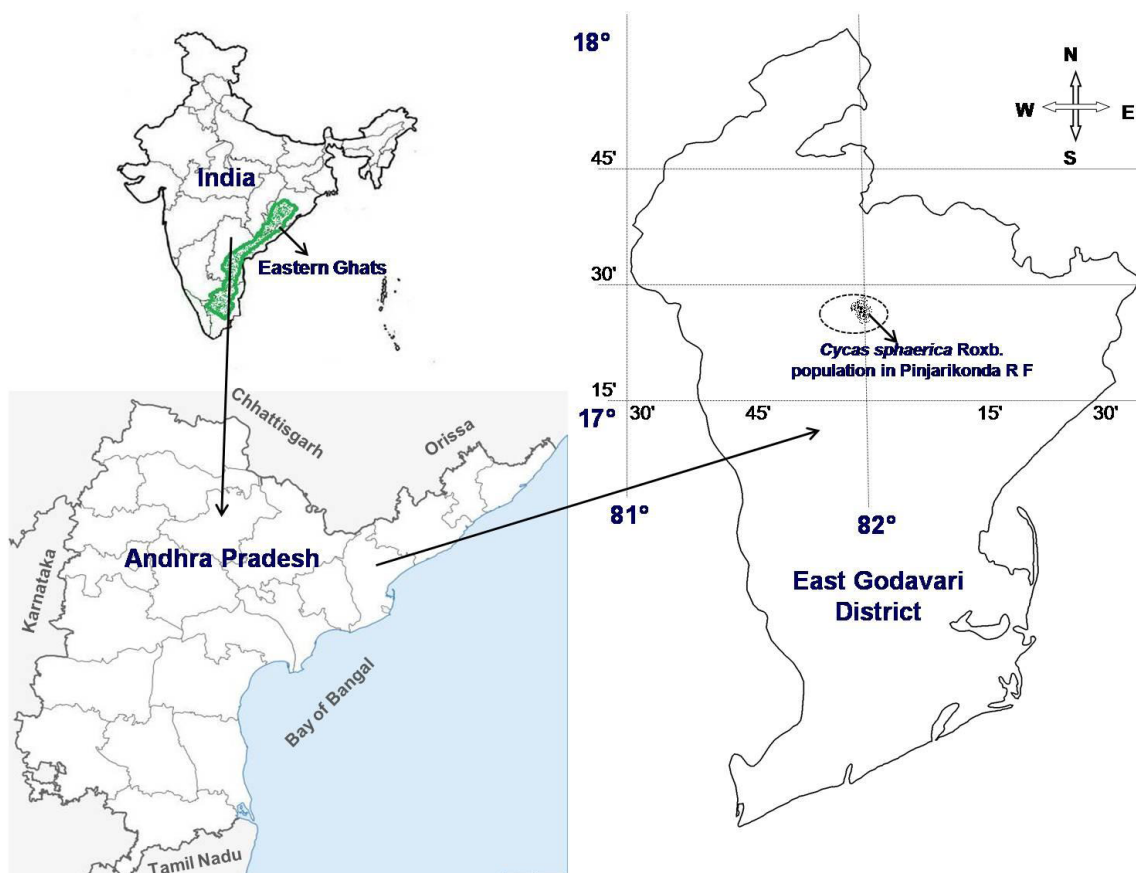


Figure 1. Location map of *Cycas sphaerica* Roxb. in the study area





**Image 1.** a–b - *Cycas sphaerica* Roxb. habitat in the study area; c - Male plant; d - Male cone; e - Opened male cone; f - Microsporophyll upper surface; g - microsporophyll lower surface with sporangia; h - Dehiscent sori; i - Pollen grain powder; j - Female plants; k - Opened female cone; l - Mega sporophyll with ovules; m - seeds on mega sporophyll; n - germinating seed. © J. Prakasa Rao

Megasporophylls are 20–25 cm long, lamina lanceolate, apical spine distinct from lateral spines, persistently orange-tomentose with four glabrous ovules (Image 1 k,l). Matured seeds are subglobose or globose (Image 1

m,n) with yellow sarcotesta, sclerotesta smooth.

Populations of 700 individuals were observed in Painjarikonda Reserve Forest at Pinjarikonda waterfall (Image 1 a,b). Aged individuals were found scattered on



the hill top of Potulakonda Hill at an altitude of 456m, while young and newly emerging individuals were found along the stream bank of Pinjarikonda waterfall beside the Potulakonda Hill. *C. sphaerica* Roxb. is locally called 'Kodada chettu', because of this reason Potulakonda Hill is also called 'Kodadakonda'. This is the second distribution record from Andhra Pradesh.

Some threats like forest fire, collection of male cones and collection of tender leaves were observed in the location. Tender leaves are used as a leafy vegetable and male cones are placed in their house, it is believed to protect their families from evil spirits.

**Discussion:** From East Godavari District one or two *Cycas* plants were observed by Rolla Seshagiri Rao in 1947 along the dense forest and reported as *C. circinalis* L. from Maredumilli and Dummakonda areas (Rao et al. 1999). There is no information on *Cycas sphaerica* Roxb. from the study area, this is the first distributional record from the East Godavari District. Distribution of this species from the Eastern Ghats of Andhra Pradesh and Odisha was reported by Singh & Singh (2011). Present exploration enhances the distributional area of this species in Andhra Pradesh (Fig. 1).

**Conclusions:** The present habitat of *C. sphaerica* Roxb. has provided extended distribution of this species in the Eastern Ghats of Andhra Pradesh. This species may be present in other localities of the East Godavari District, so further studies need to be carried out with concerns on distribution, population size and threats to the habitat in the present location as well as other areas of the Eastern Ghats where it is available. The present location Pinjarikonda Reserve Forest is the suitable for in situ conservation of this species and investigate the need to introduce this species into the botanical gardens

for ex situ conservation practices.

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