



Present status of the habitat of *Cycas sphaerica* Roxb. (Cycadaceae), a data deficient IUCN red-listed species in Srikakulam District, Andhra Pradesh

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Article History

Received: 18 May 2020

Accepted: 21 June 2020

Published: June 2020

Citation

Solomon Raju AJ, Venkata Ramana K. Present status of the habitat of *Cycas sphaerica* Roxb. (Cycadaceae), a data deficient IUCN red-listed species in Srikakulam District, Andhra Pradesh. *Species*, 2020, 21(68), 232-237

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ABSTRACT

Cycas sphaerica is a data deficient red-listed medium-sized tropical dry deciduous, dioecious and anemophilous tree species distributed in the Jalantrakota Reserve Forest of northern Eastern Ghats forest of Andhra Pradesh. In this forest, it is a keystone species and provides many ecological services and also useful as a vegetable and traditional livelihood provider for locals. Until a decade ago, this forest was virgin in nature and served as an important carbon sink and water tower, but now it is a degraded forest and significant area with this plant species was cleared for carrying out plantation/agricultural practices by locals. This study

recommends that appropriate measures are needed for the conservation and management of the left over forest area with *C. sphaerica*.

Key words:

Cycas sphaerica, degraded habitat, plantation/agricultural practices.

1. INTRODUCTION

Cycas sphaerica is a data-deficient IUCN Red-listed gymnosperm species included in CITES Appendix II that permits trade in wild-cultivated seeds or plants if there is no detrimental impact on the survival of wild populations (Donaldson 2003; Hill et al. 2003). It occurs in the dry land forests and woodlands on the hills of Eastern Ghats of Eastern Peninsular India (Lindstrom and Hill 2007). It is distributed along the hilly tracts of Eastern Ghats of Northern Andhra Pradesh and Orissa at 200-1100 m altitude. In Andhra Pradesh, it occurs in deciduous forests and woodlands of Palakonda, Donubayi and Seetampeta areas of Srikakulam district. In Orissa, it is sparsely distributed in the woodlands of Gajapathi (Mahendragiri Hills), Ganjam, Khurda, Cuttack, and Dhenkanal districts; and in moist deciduous forests of Phulbani, Boudh, Nayagarah, Angul, Keonjhar and Mayurbhanj districts (Sudhakar Reddy et al. 2007). *C. sphaerica* population naturally occurs in Jalantarakota Reserve Forest of northern Eastern Ghats in Srikakulam district of Andhra Pradesh. This population was thoroughly studied for its pollination ecology by Solomon Raju and Jonathan (2010). Further, how this population was indiscriminately exploited in the most unscientific manner for food and medicine was reported by Solomon Raju et al. (2019). In Andhra Pradesh, the existence of *C. sphaerica* population in Pinjarikonda Reserve Forest located at an elevation of 100-456m in Addateegala and Sudikonda forest ranges of Eastern Ghats of East Godavari District, Andhra Pradesh has been reported for the first time by Prakasa Rao et al. (2014). These reports indicate that *C. sphaerica* is in general sparsely distributed in these areas of Eastern Ghats ranges in both Andhra Pradesh and Orissa. In this paper, the present status of *C. sphaerica* population at Jalantarakota Reserve Forest due to clear cutting of most of this population by locals for preparing land for plantation/agricultural practices is reported.

2. MATERIALS AND METHODS

A field study was conducted during March-July 2018 and 2019 on the present status of *Cycas sphaerica* population located in the dry deciduous Reserve Forest at Jalantarakota in Kanchili tehsil of Srikakulam District (Latitude 19°01'35.55" N, Longitude 84°35'06.27" E and 35 m elevation), in the northern Eastern Ghats of Andhra Pradesh. This population was previously used in the years 2008 and 2009 for the detailed study on the pollination ecology of this plant species by Solomon Raju and Jonathan (2010). During that period, the forest site was totally wild in nature and there was no human activity in the vicinity. At that time, *C. sphaerica* population was huge and distributed all over on the top and foot portion of the forest area. In continuation of field research by the authors, a field study was made to find out whether there is any change in population size and also whether there are any clear-cutting activities taking place in order to modify the area for other purposes. The field findings have been described and explained with reference to the present status and expected future status of *C. sphaerica* in this Reserve Forest.

3. OBSERVATIONS

The natural habitat of *C. sphaerica* at Jalantara Kota Reserve Forest was extremely wild in character without any human activity in the year 2008 (Figure 1a). This species had dense populations and intermingled with several flowering plant species (Figure 1b,c). The entire landscape of the area was densely covered and entry into this area was a huge task. In that year, the reproductive ecology of this species was investigated. A brief description of this information is provided here to have an idea about the sexual and asexual mode of reproduction.

C. sphaerica is a small palm-like medium-sized dioecious tree species with an erect solitary stem. The plant consists of a slightly swollen stem enclosed with thick bark bearing persistent leaf bases. The stem apex is crowned with several pinnately compound leaves. The sex of the plant is identifiable only during cone formation period which occurs during March-May. The coning plants are leafless during cone production. Male cones are shortly stalked, compact and narrowly ovoid woody structure (Figure 2a); after maturation, they shed pollen into the atmosphere which is subsequently carried away by wind to the female cones. The male cones after pollen-shedding bend gradually to one side making the way for the production of new leaves at the top of the stem (Figure 2b). Female cones consist of megasporophylls bearing sessile, creamy white ovules laterally (Figure 2c). The seeds developing from the ovules (Figure 2d) bulge out from the gaps between sporophylls and the latter wither away eventually and only seeds remain in

place until they are ripe for detachment. The new leaves emerge from the center of sporophylls following fertilization of ovules. Seeds after detachment germinate if the soil is sufficiently wet (Figure 2e). Bulbil mode representing asexual reproduction was found to be functional; the bulbils are borne from the live trunk during rainy season (Figure 2f). They detach from the plant and produce new plants, however a few bulbils remain attached to the trunk and produce new branches.



Figure 1. *Cycas sphaerica* location at Jalantara Kota Reserve Forest: a. Landscape with dense forest cover, b. & c. Dense population of *C. sphaerica* in 2008. @Prof. A.J. Solomon Raju



Figure 2. *Cycas sphaerica*: a. Mature male cones, b. Leaf flushing after male cone pollen shedding, c. Female cone, d. Female tree with seed set, e. Seed germination, f. Bulbil production from the trunk of the tree. @Prof. A.J. Solomon Raju



Figure 3. *Cycas sphaerica*: a. The forest area showing *C. sphaerica* trees left nearly untouched till today, b. *C. sphaerica* trees cut and the habitat cleared by burning the entire foothill area, c. & d. Land preparation for plantation/agricultural practices. @Prof. A.J. Solomon Raju & Dr. K. Venkata Ramana.



Figure 4. *Cycas sphaerica*: a. & b. Re-growth from the fire-affected trunk, c. & d. Seedlings from seeds in fire-affected area. @Prof. A.J. Solomon Raju & Dr. K. Venkata Ramana.

In 2018 and 2019, the landscape of the same forest area presented a different look in structure and function. A portion of the hill with *C. sphaerica* trees remained intact (Figure 3a) while the remaining top and foot portion of the hill consisting of dense populations of *C. sphaerica* was completely cleared by burning the entire vegetation including *C. sphaerica* trees (Figure 3b). Partially burned trees showed leaf-flushing from the tip of the trunk (Figure 4a,b) while partially burned seeds showed germination and seedling formation (Figure 4c,d). The entire burned area with interspersed rocks was found to be totally free from any plant cover and it was being prepared for the cultivation of plantations/agricultural species by local people (Figure 3c,d). After 11 years, the landscape of the forest area looked totally different and a major area of *C. sphaerica* was modified for introducing plantation/agricultural practices. The still intact hill area with *C. sphaerica* trees was found to be degraded as there are many open gaps within the area due to disappearance of several plant species.

4. DISCUSSION

Jalantra Kota Reserve Forest with rich heritage of *C. sphaerica* population was virgin in nature up to 2008 as depicted in Figure 2. At that time, its reproductive biology was investigated in detail by Solomon Raju and Jonathan (2010) due to lack of information on this subject and also due to this species status as Data Deficient IUCN Red-listed species (Donaldson 2003; Hill et al. 2003). Solomon Raju and Jonathan (2010) reported that *C. sphaerica* is a dioecious and anemophilous species. In sexual reproduction, coning and seed production events occur during dry season while seed dispersal and germination events occur during rainy season. In asexual reproduction, the plant produces bulbils which sprout from the live stem and form new branches on the same plant or detach to produce new plants. These authors also stated that the sex of the plant can be identified only during coning period. In seed production, only female plants are involved since male plants act as exclusive pollen donors. Solomon Raju (2009) reported that in the same forest, the Baya Weaver Bird, *Ploceus philippinus* utilizes the tip of well developed leaves of *C. sphaerica* for nest construction and offspring production. Further, the Plains Cupid Butterfly, *Chilades pandava* utilizes the newly emerging leaflets as larval host plant to raise its offspring and acquire certain toxins from the plant to develop defensive mechanisms against its predators. Solomon Raju et al. (2009) reported that *C. sphaerica* occurring in the same forest is used by the Indian Stingless Bee, *Trigona iridipennis* for nesting place, protection against predators and acquire defensive chemicals to fight diseases. Further, Solomon Raju and Jonathan (2010) reported that *Derelomus* weevils use the terminal portion of the interior of the microsporophyll of this plant for brood shelter and larval food source. All these reports indicate that *C. sphaerica* in the Jalantrakota Reserve Forest is a keystone species for bird, butterfly, bee and weevil species, and provides different services such as nesting place, brood shelter, larval food source and defensive chemicals. Apart from these ecological services, the plant is traditionally used for different purposes, stem and seeds as sources of flour for making "dosas", leaf as a vegetable and in making bouquets, and male cones as mosquito repellents due to their strong foetid odour (Solomon Raju et al. 2009; 2019). Despite this information being publicly available since a decade ago, the concerned authority did not take any measures to protect the virgin state of this forest in order to maintain *C. sphaerica* population intact and instead it simply maintained a silent spectator when this area was being cleared for plantations/agricultural purposes. The present state of the forest indicates that a major part of *C. sphaerica* population is cleared and it is now in degraded state paving the way for clearing the total forest area in the near future for extending plantation or agricultural practices. Therefore, it is recommended that a detailed survey is to be carried out to record the ratio of female to male plants and accordingly take appropriate measures for the restoration, conservation and management of *C. sphaerica* population at least in the still existing forest area.

5. CONCLUSION

Cycas sphaerica naturally growing at Jalantara Kota Reserve Forest is a keystone species because it provides several ecological services. In addition, it also has food value and is a livelihood provider for locals. A decade ago, this forest was a virgin one without any visible human activities but now it is in degraded state and not in a position to provide either ecological or other services to humans because a significant portion of the area was cleared by burning for introducing plantation/agricultural practices by locals. The existing trees of this species may disappear if restoration, conservation and management measures are not implemented.

Acknowledgement

We thank the Andhra University, Visakhapatnam, for providing physical facilities to carry out this research work.

Authors' contributions: Both authors contributed equally.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

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