



Taxonomy and conservation of Philippine Cycads

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Key words

cycad conservation
cycad taxonomy
Philippine threatened plants

Abstract Six species of cycads are recorded in the Philippines, three of which are endemic. The different species of cycads can be recognized by the characters of the microsporophylls, megasporophylls, and seeds. The current conservation status of the different species of *Cycas* is assessed and categorized using the IUCN criteria on basis of currently available information.

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REVIEW OF THE TAXONOMY OF PHILIPPINE CYCAS

There has been considerable confusion and difference in opinion about the recognition of taxa and the classification of species in the genus *Cycas*.

Merrill (1923) listed 4 species of cycads. He used the name *C. rumphii* Miq. for the widespread species, *C. cairnsiana* F.Muell. for a specimen from Culion Island, *C. revoluta* Thunb. for an introduced species, and retained an unnamed species based on a collection from Palawan.

Brown & Kienholz (1925) described a new species, *C. chamberlainii*, from Mt Arayat, Pampanga. This species was later reduced to a synonym of *C. riuminiana* Porté ex Regel by De Laubenfels & Adema (1998).

Schuster (1932) described *C. circinalis* subsp. *riuminiana* var. *curranii* on basis of a specimen collected by H. Curran on the river banks of Molinao river in Palawan. This was raised to a species, *Cycas curranii*, by Hill (1995). At the same time, Schuster distinguished *C. circinalis* subsp. *riuminiana* var. *curranii* forma *graminea* based on the specimen from Culion Island that was named *C. cairnsiana* by Merrill (1923). However, Merrill (1936), studying more collections from the same island, distinguished these as *C. wadei*, on basis of the unique seed characteristics.

In an account of the gymnosperms of the Philippines, Zamora & Co (1979) recognized 4 species including *C. wadei* and applied the name *C. circinalis* to the widespread *C. rumphii*.

A review of the *Cycas* of the Philippines based on vegetative and sporophyll characters was made by Amoroso (1986). In this study, he recognized 5 species and distinguished the more common mountain cycads as *C. circinalis* from the coastal cycads which he retained in *C. rumphii*.

According to De Laubenfels & Adema (1998), neither *C. rumphii* nor *C. circinalis* occur in the Philippines. They apply the name *C. silvestris* K.D.Hill (considered as endemic for Queensland by Hill 1992) to part of the widespread species, and *C. edentata* de Laub. to the remainder. They recognize *C. riuminiana* Porté ex Regel with a disjunct distribution in the Philippines and Sulawesi, and *C. wadei* Merr. as a Philippine endemic. Hill separated the specimens of *C. silvestris* from Palawan as

C. curranii (Hill 1995), the specimens of *C. riuminiana* from Sulawesi as *C. falcata* (Hill 1999) and restricts the name *C. edentata* for specimens from the Philippines (Hill 1998–2004). *Cycas riuminiana* and *C. edentata* are thus considered as Philippine endemics by Hill.

One obvious reason for the current variety opinion on the taxonomy of Philippine *Cycas* is the lack of adequate data about the morphology and biology of the species. Cycad specialists are also limited in their studies as they often base these on herbarium specimens alone and have not seen the actual plants in the field. Variations in the different vegetative characters are overlooked because these are simply not represented in the scanty or limited herbarium specimen. The specimens available for study may be incomplete or young specimens, or may just be either male or female plants. Even with more complete material, some researchers fail to examine the seed characters because this will entail damaging specimens.

It can also be noted that recent explorations of poorly known habitats, i.e. forest over limestone or ultrabasic soils have resulted in new discoveries, e.g. *C. saxatilis* K.D.Hill & A.Lindstr. (2008).

The cycads of the Philippines have been evaluated and included in the 2003 IUCN Red List of Threatened Species. Based on the 2001 Criteria (v3.1), *C. curranii*, *C. edentata*, *C. riuminiana*, and *C. wadei* were all categorized as Data Deficient (DD). *Cycas chamberlainii* was categorized as Endangered (EN) based on the limits of the extent of occurrence and area of occupancy, severe fragmentation or number of locations and continuing decline in extent of occurrence and number of populations.

Here we present an overview of the Cycads of the Philippines, based on a detailed comparison of the vegetative and sporophyll characters of cycads based on literature, herbarium specimens available at the PNH, recent collections from various localities, as well on-line herbaria digital images. The conservation status of Philippine *Cycas* species is analyzed and categorized based on land cover maps, derived extent of occurrence and estimated number of populations/subpopulations.

RESULTS

Taxonomic characters of Philippine Cycas

Taxonomic characters which are most useful in the identification of the species are the microsporophyll apical spines, megasporophyll shape, and teeth, and seed sarcotesta; size, shape, and presence of ribs. Vegetative character states such as trunk

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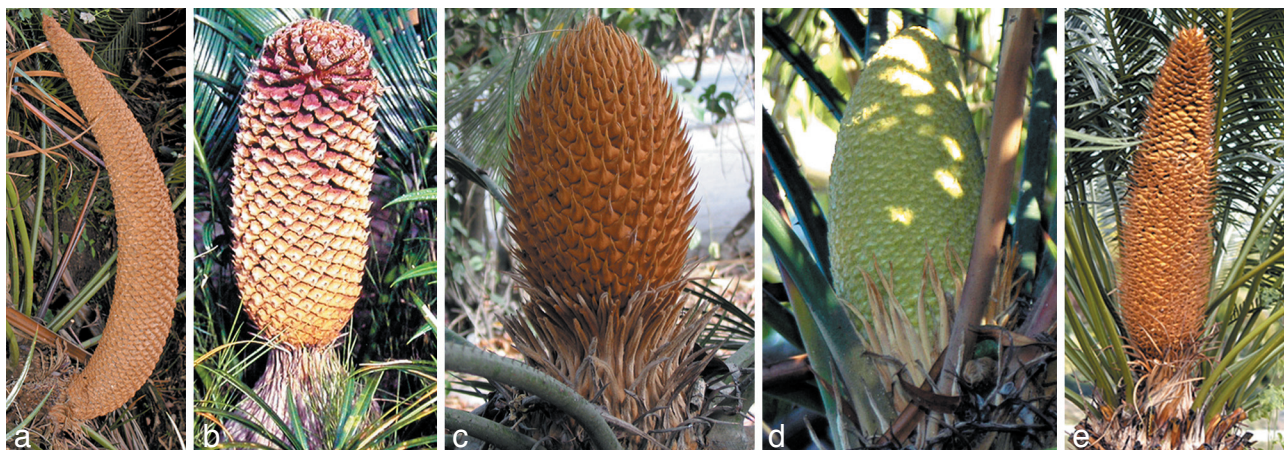


Plate 1 Microsporophylls. a. *Cycas curranii* (J.Schust.) K.D.Hill; b. *C. riuminiana* Porte ex Regel; c. *C. zambalensis* Madulid & Agoo; d. *C. wadei* Merr.; e. *C. edentata* de Laub.

height and diameter, pinnule number per side of rachis, pinnule length and width overlap in many species are of limited value for the identification of species.

We distinguish six species in the Philippines: *C. curranii*, *C. edentata*, *C. riuminiana*, *C. silvestris*, *C. wadei*, and *C. zambalensis*. Recent discoveries, e.g. *C. saxatilis*, are not included as neither a description nor a specimen was available when we prepared this account.

KEY TO THE SPECIES OF CYCAS IN THE PHILIPPINES

1. Apex of megasporophylls entire, shallowly dentate or serrate; lateral teeth up to 6 mm long 2
1. Apex of megasporophylls pectinate; lateral teeth at least 6 mm long 3
2. Apex of megasporophylls entire; spongy layer in seed present *C. edentata*
2. Apex of megasporophylls shallowly dentate or serrate; spongy layer in seed absent *C. silvestris*
3. Petiole and rachis tomentose 4
3. Petiole and rachis glabrous, smooth 5
4. Margins of pinnules revolute *C. revoluta*
4. Margins of pinnules flat *C. zambalensis*
5. Midveins of pinnules prominent on the upper side. Petioles 25–70 (mostly over 40 cm) long; seeds not ribbed *C. riuminiana*
5. Midveins of pinnules flat or slightly prominent at the upper side. Petioles to 40 (mostly less than 30) cm long; seeds ribbed 6
6. Microsporophyll with spine 5–6 mm long; seeds 5–6 ribbed, 33–37 by 28–29 mm *C. wadei*
6. Microsporophyll without spine; seeds at least 10-ribbed, 44–46 by 36–37 mm *C. curranii*

Cycas curranii (J.Schust.) K.D.Hill — Plate 1a, 2b–e, 3

Cycas curranii (J.Schust.) K.D.Hill (1995) 150.

Cycas circinalis subsp. *riuminiana* var. *curranii* J.Schust. (1932) 69.

Cycas cairnsiana auct. non F.Muell.: Merr. (1923) 1.

Cycas wadei auct. non Merr.: Zamora & Co (1979) 222, f. 4.

Distribution — Philippines: Palawan, Mindoro (Oriental Mindoro).

Habitat — Lowland forests over ultrabasic soils and open grasslands.

Conservation status — The species is limited to the degraded forests in the eastern part of Mindoro Island and Southern

Palawan. The original forest cover in many parts of Mindoro has been extensively degraded and converted to grassland. The grasslands are seasonally burned to regenerate grass for cattle. Seeds of this species are also collected and used as ornaments. The (maximum) extent of occurrence is (less than) 4 100 km², with only 2 locations, and there is a continuing decline in quality of habitat. Based on these criteria, its category is Critically Endangered.

Descriptive notes — *Cycas curranii* has microsporophylls with apex not extending to a spine-like structure. The apex is instead abruptly bent and tucked downwards. The seed sarcotesta are longitudinally ribbed similar to *C. wadei*, but the ribs are more pronounced and more in number than in *C. wadei*.

Cycas edentata de Laub. — Plate 1e, 2f, 3

Cycas edentata de Laub. in de Laub. & Adema (1998) 373, f. 1.

Cycas circinalis auct. non L., Zamora & Co (1979) 219, f. 1, 2.

Cycas rumphii auct. non Miq.: Amoroso (1986) 182, f. 2, 6, 17–19, 23–26.

Distribution — Andamar Islands to Timor; throughout the Philippines

Habitat — Coastal forests and thickets.

Conservation status — *Cycas edentata* is a non-endemic widespread coastal species in the Philippines. It usually occurs on beach forest strands and rocky outcrops. There are apparently no current threats to the species or to its habitat. Its category is Not Threatened.

Descriptive notes — This species has megasporophylls with reduced teeth or almost wanting. It is also the only species with a spongy layer in the endocarp.

Cycas riuminiana Porte ex Regel — Plate 1b, 2g, 3

Cycas riuminiana Porte ex Regel (1863) 16, f. on p. 17; de Laub. & Adema (1998) 382.

Cycas circinalis L. subsp. *riuminiana* (Porte ex Regel) J.Schust. (1932) 68. *Cycas chamberlainii* W.H.Br. & R.Kienholz (1925) 47, f. 1, pl. 1–3; Zamora & Co (1979) 219; Amoroso (1986) 181–182, f. 4, 14–16, 39–41.

Cycas circinalis subsp. *riuminiana* var. *curranii* forma *chamberlainii* (W.H.Br. & R.Kienholz) J.Schust. (1932) 69.

Distribution — Philippines: Luzon; Sulawesi; Moluccas.

Habitat — Lowland forests.

Conservation status — The species is limited to the lowland mountain forests of Pampanga, Bataan, Batangas, and Isabela in Luzon Island. Though the specific localities are currently in protected areas, their natural habitats are affected by natural and anthropogenic pressures, i.e. landslides, clearing for hiking trails, as well as potential conversion of forests into agricultural plots. The (maximum) extent of occurrence is 9 500 km², with at



Plate 2 Megasporophylls. a. *Cycas wadei* Merr.; b–e. *C. curranii* (J.Schust.) K.D.Hill; f. *C. edentata* de Laub.; g. *C. riuminiana* Porte ex Regel; h. *C. zambalensis* Madulid & Agoo.

least 5 locations, continuing decline in quality of habitat, small population size: < 10 000 individuals (as per actual count of 20–25 individuals per 400 km²). Its category in the Philippines is Endangered.

Descriptive notes — *Cycas riuminiana* can be readily distinguished by the sterile part of the megasporophyll being broader than long.

***Cycas silvestris* K.D.Hill — Plate 3**

Cycas silvestris K.D.Hill (1992) 181, t. 1; de Laub. & Adema (1998) 372.
Cycas rumphii auct. non Miq.; Merr. (1918) 52; (1923) 1; Quisumb. (1951) 74; Pancho (1983) 38, f. 3.
Cycas circinalis auct. non L.: Blanco (1837) 745; Foxw. (1911) 151, pl. 26; Merr. (1912) 65; Amoroso (1986) 182, f. 5, 7–9, 27–30.

Distribution — Vietnam to Northern Australia; throughout the Philippines.

Habitat — Lowland inland, occasionally coastal forests.

Conservation status — *Cycas silvestris* is a widespread forest species. Its current conservation status can not be ascertained for lack of available field data. Its category is Data Deficient.

Descriptive notes — This species can be distinguished by its megasporophylls having teeth which are almost of the same length.

***Cycas wadei* Merr. — Plate 1d, 2a, 3**

Cycas wadei Merr. (1936) 234, pl. 1–4; Zamora & Co (1979) 222, f. 4; Amoroso (1986) 183, f. 1, 20–22, 31–34; de Laub. & Adema (1998) 385.
Cycas circinalis subsp. *riuminiana* var. *curranii* forma *graminea* J.Schust. (1932) 69.
Cycas sp. Foxw. (1911) 152, pl. 27; Merr. (1923) 2.

Distribution — Philippines: restricted to Culion Island.



Plate 3 Seeds showing woody sarcotesta. Upper row from left: *Cycas curranii* (J.Schust.) K.D.Hill, *C. wadei* Merr., *C. silvestris* K.D.Hill. Lower row from left: *C. edentata* de Laub., *C. zambalensis* Madulid & Agoo, *C. ruminiana* Porté ex Regel.

Habitat — Open grasslands.

Conservation status — The species is limited to the grasslands of Culion Island, Palawan province. It is threatened by fire which are set off seasonally to regenerate grass for cattle. The area is also threatened by expanding human settlement. The (maximum) extent of occurrence is 650 km², with only one location, continuing decline in quality of habitat, very restricted area of occupancy. Based on these criteria, its category is Critically Endangered.

Descriptive notes — This species has megasporophylls with the sterile part broad and fan-like similar to *C. curranii*. Like *C. curranii*, the sarcotesta has longitudinal ribs but these are not pronounced and fewer in number.

***Cycas zambalensis* Madulid & Agoo — Plate 1c, 2h, 3**

Cycas zambalensis Madulid & Agoo (2005) 519, f. 1.

Distribution — Philippines: Luzon (Zambales): San Antonio, Kawag, Botolan.

Habitat — Open grasslands; ultrabasic hills.

Conservation status — The species is limited to the ultrabasic hills of Zambales, particularly in San Antonio, Kawag, and Botolan. Seedlings and even mature trees are collected by the local people for the horticultural market. The grasslands are burned to regenerate grass for cattle and for hunting purposes. Some of these areas are threatened by mining operation. Some areas are also being developed as resorts and other land uses. The (maximum) extent of occurrence is (less than) 116 km², with only two adjoining locations, continuing decline in quality of habitat, and very restricted area of occupancy. Based on these criteria, its category is Critically Endangered.

Descriptive notes — This is the only Philippine species found confined to open ultrabasic hills. It has tomentose rachis and petioles. The seeds are smooth and slightly flat.

INTRODUCED SPECIES

***Cycas revoluta* Thunb.**

Cycas revoluta Thunb. (1783) 40; Merr. (1912) 65; (1923) 1; Quisumb. (1951) 74; Zamora & Co (1979) 221, f. 3; Pancho (1983) 38; Amoroso (1986) 183, f. 3, 35–38; de Laub. & Adema (1998) 384.

Habitat — In gardens.

Conservation status — *Cycas revoluta* is an introduced species and is widely distributed in the country. It is grown mainly as an ornamental in landscaped gardens. The leaves are also used as decorations and a symbol during the Lenten season.

Descriptive notes — *Cycas revoluta* is similar to *C. zambalensis* in leaf structure and in having tomentose petiole and rachis, but can be distinguished by its strongly revolute pinules.

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IDENTIFICATION LIST

The numbers after the collector numbers refer to the following species:

- 1 = *C. curranii* (J.Schust.) K.D.Hill
- 2 = *C. edentata* de Laub.
- 3 = *C. ruminiana* Porté ex Regel
- 4 = *C. silvestris* K.D.Hill
- 5 = *C. wadei* Merr.
- 6 = *C. zambalensis* Madulid & Agoo
- 7 = *C. revoluta* Thunb.

- Brown & Kienholz BS 42539: 3.
- Claustro PNH 116502: 4 – Conklin PNH 37914: 2.
- Flores et al. 1001: 3 – Fox 176: 4.
- Jolito 1005: 6.
- Kondo 32862: 2 – Kondo & Edaño 36768: 4; 38877: 2.
- Linis 001: 3; 002: 3; 003: 3; 004: 3; 005: 1; 007: 6; 008: 6.
- Madulid 7232: 3 – Madulid & Agoo PNH 173358: 6 – Madulid & Sebastian 9000: 5 – Madulid et al. 1350: 2; 1358: 2; 1367:2; 9062: 3 – Mendoza PNH 37074: 2.
- Quisumbing et al. PNH 79440: 4.
- Taleon PNH 33848: 2.