

## 1. CYCAS L.

Linnaeus, C., Spec. Plant., 1st ed., p. 1188 (1753), Gen. Plant., 5th ed., p. 495 (1754); Smith, J. E., Trans. Linn. Soc. 6:312 (1802); Miquel, F. A. W., Mongr. Cycad., 21-33 (1842), Prodr. Syst. Cycad. / 6-7, 16-17 (1861); De Candolle, A., Prodr. 16<sup>2</sup>:525-529 (1868); Hooker, J. D., Flora Brit. India 5:655-658 (1890); Bailey, F. M., Queensl. Flora 5:1501-1502 (1902); Schuster, J., Pflanzenreich 4<sup>v</sup>:655-658 (1932).

Stem an aerial trunk, typically unbranched, 1-7 m. tall, covered with an armor of persistent leaf bases. Leaves many in a crown, 1-3 m. long; petiole generally with two rows of spines representing reduced leaflets. Leaflets linear or linear-lanceolate, entire, with a prominent midrib but no other veins. Vernation of both rachis and leaflets strongly circinate.

Male cones solitary, ovoid or long ovoid-cylindric, short stalked. Microsporophylls closely imbricate, flat, cuneate, generally abruptly tapering to a sharp point, the microsporangia covering all the lower surface except the sterile tip. Megasporophylls at first closely imbricate and appressed into a cone-like structure, then expanding into a loose <sup>crown.</sup> Original meristem persistent in center throughout life of plant, producing successive crowns of vegetative leaves and occasionally a crown of megasporophylls. Megasporophylls long, consisting of a petiole and a rachis differentiated into a lower fertile portion bearing 1-5 ovules along each lateral margin and an upper flattened portion ("sterile blade") bearing reduced pinnae several centimeters long, or these represented by mere serrations. Seeds reddish, orange-red, or brownish.

About 20 species, some of which are highly variable. A widely distributed genus ranging from Australia, New Guinea, and other

South Pacific islands to southern Japan, southern China, Indo-China, Thailand, Malaya, East Indies, southern India, Ceylon, and Madagascar. Name from *κυκας*, a name given by Theophrastus to a kind of palm. Type species: *C. circinalis* L.

*Cycas* is unique in the venation and vernation of its leaflets, the organization of its megasporophylls to form a loose cluster rather than a compact cone, and its leaf-like megasporophylls with as many as five pairs of lateral ovules. The continued growth of the stem tip through the crown of megasporophylls is also characteristic.

Key to the Species

I. Blade of megasporophyll deeply pectinate or pinnatifid, the segments 2 cm. or more in length

A. Ovules more than 2 on each megasporophyll

1. Leaflets less than 10 mm. in width, not forked

a) Leaflet margins revolute . . . . . 1. C. *revoluta*

b) Leaflet margins flat

(1) Blade of megasporophyll broadly orbicular; stem not swollen at base

(a) Leaflets 13-18 cm. long; megasporophylls about 25 cm. long, glabrous . 2. C. *taiwaniana*

(b) Leaflets 18-25 cm. long; megasporophylls about 15 cm. long, villous . 3. C. *pectinata*

(2) Blade of megasporophyll ovate-rhomboid; stem swollen at base . . . . . 4. C. *siamensis*

2. Leaflets more than 20 mm. in width, forked . 5. C. *micholitzii*

B. Ovules 2 on each megasporophyll

1. Leaflets 4-5 mm. wide, flat; megasporophylls about 20 cm. long . . . . . 6. C. *wadei*

2. Leaflets 10-20 mm. wide, undulate; megasporophylls 6-7 cm. long . . . . . 7. C. *undulata*

II. Blade of megasporophyll laciniate, the segments less than 2 cm. long

A. Leaflets 12-18 cm. long, 3 mm. wide, their margins revolute; blade of megasporophyll 2 cm. wide . . . . . 8. C. *beddomei*

B. Leaflets 20-30 cm. long, 9-11 mm. wide, their margins flat; blade of megasporophyll 3.5-5 cm. wide . 9. C. *chamberlainii*

III. Blade of megasporophyll spinose-toothed or entire

A. Ovules more than 2 on each megasporophyll

1. Leaflets 20-30 cm. long

a) Leaflets 9-13 mm. wide; blade of megasporophyll ovate-lanceolate

(1) Blade of megasporophyll about 4 cm.

wide, short-toothed . . . . . 10. C. circinalis

(2) Blade of megasporophyll 2-3 cm. wide,

crenulate or subentire . . . . . 11. C. thouarsii

b) Leaflets 14-20 mm. wide; blade of megasporophyll ovate-rhomboid, minutely dentate . 12. C. rumphii

2. Leaflets 10-20 cm. long

a) Leaflets less than 10 mm. wide

(1) Blade of megasporophyll spinose-dentate

(a) Leaflets glabrous; megasporophylls

densely tomentose . . . . . 13. C. media

(b) Leaflets and megasporophylls

glabrous . . . . . 14. C. lane-poolei

(c) Leaflets furfuraceous below;

megasporophylls densely tomentose . 15. C. furfuracea

(2) Blade of megasporophyll entire . . . . . 16. C. basaltica

b) Leaflets 10-15 mm. wide . . . . . 17. C. kennedyana

B. Ovules 2 on each megasporophyll

1. Leaflets 4 mm. wide, their margins revolute;

megasporophylls up to 35 cm. long, the blade

rhomboid-lanceolate . . . . . 18. C. cairnsiana

2. Leaflets 5-6 mm. wide, their margins flat;

megasporophylls 15 cm. long, the blade

narrowly lanceolate . . . . . 19. C. normanbyana

1. Cycas revoluta Thunb.

Thunberg, [G. P.] Fl. Japon., p. 229 (1784); Smith, [J. E.]  
Trans. Linn. Soc. 6:312 (1802); Hooker, [W. J.] Bot. Mag. 57: t.  
2963, 2964 (1830); Miquel, [F. A. W.] Monogr. Cycad., p. 23 (1842),  
Prodr. Syst. Cycad. 6, 16 (1861).

Stem in the field seldom more than 2-3 m. high and 30-40 cm.  
in diameter, generally unbranched. In temple grounds and on old  
estates ~~often~~ <sup>sometimes</sup> reaching a height of 9 m. and a diameter of 1.75 m.,  
with as many as 90 branches covering an area of 100 square meters.  
Leaves 15-30 in a crown, the larger ones 1-2 m. long, upper sur-  
face dark green and glabrous, lower surface paler and with a  
brownish pubescence when young, becoming glabrous later. Petiole  
about 20 cm. long, rounded below, somewhat ridged above between  
<sup>that are reduced leaflets,</sup>  
two rows of spines, these 2 mm. long, very densely woolly at base  
with long reddish hairs, glabrous above. Rachis 80-150 cm. long,  
rounded above and below except that the two sides are ridged by  
decurrence of the leaflets. Leaflets 75-125 on each side, crowded,  
subopposite, the upper ones alternate, arising at an angle of 35-  
40 degrees from the rachis, linear, the apex tapering and ending  
in a sharp reddish brown spine, narrowed at the base, the lower  
edge strongly decurrent on the rachis, margins strongly revolute;  
largest leaflets 12-18 cm. long and 5 mm. wide, the upper and lower  
ones much smaller; midrib prominent chiefly below.

Male cones cylindric, yellowish, 40-50 cm. long, 8-12 cm. in  
diameter, short stalked. Microsporophylls narrowly lanceolate,  
cuneate, 5 cm. long, 2 cm. wide at the broadest part, tapering to  
7 mm. at the bottom; exposed part deltoid and abruptly tapering to  
an acuminate tip up to 5 mm. long, densely woolly. As the cone  
dries, microsporophylls becoming strongly deflexed. Microsporangia  
200-450, in sori of 3 or 4, occasionally 5, covering the entire  
lower surface except a sterile notch at the top.

Megasporophylls much more numerous than the leaves in a vegetative crown, 100-200 not rare, oblong-ligulate, 20-30 cm. long, covered with a dense tomentum of long hairs which are reddish at the base of the petiole and yellowish elsewhere; entire megasporophyll reddish upon removal of the tomentum. Petiole 8-10 cm. long, rachis 14-20 cm. long and bearing 2 or 3 ovules, occasionally 4, on each side of its lower half. Rachis expanded above into a deeply pinnatifid "sterile blade" 1.5-2.5 cm. wide exclusive of the 15-20 subterete reduced pinnae on each side, which are 2-5 cm. long, naked, sharp-pointed, and reddish.

Seeds obovoid, bilateral, flattened, emarginate, yellow tomentose becoming glabrous and orange-red with age and disappearance of much of the tomentum, 3.5 cm. long, 3 cm. in larger diameter, 2.5 cm. in smaller diameter. Stony coat smooth, 3.2 cm. long, 2.2 cm. in larger diameter, often sharp-pointed at the base, apex sometimes with two points between which the stony coat splits at germination; often with two lines from apex to base along the larger diameter.

Geographic distribution: Southernmost Japan, with particularly good stands at Mitsuhamma Ito, on the Ryukyu Islands, and in a few other places. At Oshima and elsewhere in southern Japan growing as if native. Cultivated in tropical and subtropical regions all over the world. In Florida and the southern parts of the Gulf States and in southern California this species flourishes in the open, and it is a conservatory plant everywhere.

2. Cycas taiwaniana Carruth.

Carruthers, W., Jour. Bot. 31:2 (1893); Metcalf, F. P., Flora Fukien 1:18 (1942).

Leaves 1.8 m. long, glabrous, paler beneath. Leaflets numerous, subopposite, arising from the terete rachis at an angle of 60 degrees, linear-lanceolate, tapering at the base to about 3 mm., decurrent, 13-18 cm. long, about 7-8 mm. wide. Male cones subcylindric. Microsporophylls spinose acuminate. Megasporophylls about 25 cm. long, nearly glabrous, with a slender petiole and fertile portion, the latter bearing 3 or 4 ovules above the middle. Sterile blade orbicular or oval, about 10 cm. long and 5 cm. wide, deeply cut on both sides into linear acuminate spines (the reduced pinnae) up to 2 cm. long, the terminal portion somewhat longer, broad and serrate. Seeds ellipsoidal, the stony layer with 1 or 2 prominent ribs.

Geographic distribution: Formosa, South China. A little-known species closely related to C. revoluta L. and differing from it chiefly in the form of the megasporophylls.

3. Cycas pectinata Griff.

C. wallichii Miq.

Griffith, W., Notul. plant. asiat. 4:10 (1854); Miquel, F. A. W., Monogr. Cycad., p. 32 (1854); Hooker, J. D., Flora Brit. India 5:657 (1890).

Stem reaching a height of 3 m., sometimes branched at the top. Leaves 1.5-2 m. long, recurved, bright green above, paler beneath, glabrous. Petiole about 45 cm. long, subquadrangular, with a few distant spines. Leaflets opposite or alternate, narrowly linear, subfalcate, tapering to a minute apical spine, decurrent at the base, with flat margins, 18-25 cm. long, about 8 mm. wide.

Male cones cylindrical-ovoid, yellowish or reddish yellow, about 40 cm. long and 15 cm. in diameter, short stalked. Microsporophylls deltoid-clavate, abruptly acuminate, 4 cm. long, 2.5 cm. in diameter, the apex much thickened and bearing a terminal, spine-like, ascending point about 4 cm. long; the exposed parts tomentose. Megasporophylls about 15 cm. long, yellow villous, petiole and fertile portion about 7.5 cm. long, with 2 or 3 pairs of ovules above the middle; sterile blade broadly orbicular, long acuminate, about equal to the rest of the sporophyll in length, 6.5-8.5 cm. in width, the margin deeply subulate-pectinate with spiny teeth (the reduced pinnae) 2 cm. long, terminating in a point 3-4 cm. long with 1 or 2 spiny teeth. Seeds ovoid, orange-red or yellow, about 4 cm. long.

Geographic distribution: Nepal, eastern India, and Burma; Bengal, at 600 m. elevation; Assam; often in pine forests.



4. Cycas siamensis Miq.

Miquel, (F. A. W.), Bot. Zeit. 21:333 (1863); Regel, (E.) Illus. Hort. 28: ~~528~~<sup>157</sup> (1881); Hooker, J. D., Flora Brit. India 5:657 (1890).

Stem an erect trunk up to 2 m. high, 10-20 cm. in diameter, abruptly widened at the base to a much <sup>greater</sup> ~~size~~ diameter, surface rough and cracked in older plants. Leaves 0.6-1.2 m. long, shiny green above, paler beneath, pubescent when young. Petiole 45-65 cm. long, furrowed above, rather flat below, with distant recurved spines except in the lower part; rachis rounded below, rounded-angular above. Leaflets about 40-100 or more on each side, linear-lanceolate, subfalcate, acute, abruptly spinulose-mucronate, slightly ~~attenuated~~ <sup>attenuated</sup> at the base, decurrent, margins flat but slightly thickened, larger leaflets up to 20 cm. long and 5-7 mm. wide, upper and lower ones shorter; midrib prominent on both sides but thicker below.

Male cones oblong-oval, up to 30 cm. long, 6-8 cm. in diameter. Microsporophylls cuneate, 2-3 cm. long, about 2 cm. wide, narrowed to 5 mm. at the base; sterile area rhomboid, 6 mm. long, brown tomentose; apex fragile subulate, 10-14 mm. long, reflexed upward. Megasporophylls 5-7.5 cm. long, yellow tomentose, spatulate-obovoid below, with 1-3 ovules on each side. Sterile blade broadly ovate-rhomboid, long acuminate, equalling the rest of the sporophyll in length, up to 2.5 cm. wide, pectinate-pinnatifid, the reduced pinnae crowded, erect, up to 2 cm. long. Seeds semi-immersed in marginal pits, globose, yellowish, very smooth, 2.5-3 cm. in diameter; stony coat scarcely angled, shining yellow.

Geographic distribution: Thailand (Siam), abundant in dry woods, Pulocondor; Burma, abundant on plain beyond Ban-Meh-Wang, between Lakon and Phre, at Pang Poey; also in Cochin China.

Closely related to C. pectinata Griff.

5. Cycas micholitzii Dyer

Dyer, H. T. T., Gard. Chron. 38:142 (1905); Fedde, F.,  
Rep. Nov. Spec. 1:171 (1907); Prain, D., Bot. Mag. 135: t. 8242  
(1909).

Stem sometimes subterranean, 20-60 cm. high, 4-5 cm. in diam-  
eter or swollen at the base to 10-12 cm. Leaves 2 or 3 in a crown,  
2-5 cm. long, erect, glaucous when young, becoming bright green and  
glabrous, paler beneath. Petiole up to 1 m. long, armed with short,  
rather flat spines. Leaflets about 15-20 on each side, 4 cm. apart,  
once or twice deeply and dichotomously incised, the segments linear-  
lanceolate, acuminate, 20-30 cm. long, 20-25 <sup>m</sup>µm. wide. .

Male cones narrow cylindric, gradually tapering to an acute  
apex, yellow, glabrous, 15-18 cm. long, 4 cm. in diameter; peduncle  
3 cm. long. Microsporophylls subspatulate or broadly cuneate,  
orange at the margin, 10 mm. long, 8 mm. wide, the sterile part  
8 mm. long, very shortly acuminate. Microsporangia in sori of 3  
or 4. Megasporophylls 8 cm. long, orange at base; ovules 1-4;  
sterile blade green, <sup>ovate-rhomboid,</sup> about the same length as the rest of the sporo-  
phyll, 3 cm. wide, deeply pectinate, the reduced pinnae erect,  
subulate, 1.5-2.5 cm. long. Seeds green, becoming yellowish,  
about 2.5 cm. long.

Geographic distribution: Annam, Indo-China. Related to C.  
pectinata Griff. and C. siamensis Miq., differing from them in  
having forked leaflets and a very short or obsolete acumen on  
the microsporophylls instead of a long slender one.

6. Cycas wadei Merr.

Merrill, [F. D.] Philippine Jour. Sci. 60:233 (1936).

Stem up to 5.3 m. high, usually much shorter, in many mature plants less than 1 m. high, often branched, 30-48 cm. in diameter at the swollen base, rather rapidly and then gradually tapering to 10-20 cm. below the crown of leaves. Leaves numerous, about 75 cm. long, glabrous when mature. Petiole about 20 cm. long, with two rows of short spines about 1.5 mm. long; rachis rounded and smooth on lower surface, blunt-angled on upper surface. Leaflets about 90 on each side, rather crowded, rigid, linear to linear-lanceolate, straight or somewhat falcate, sharply acuminate, base slightly narrowed, margins flat, not at all revolute, 15-20 cm. long, 4-5 mm. wide, the uppermost and lowest 8 cm. long, with no transition into petiolar spines.

Male cones cylindrical, somewhat narrowed below, more strongly tapering above, 40-70 cm. long, 9-10 cm. in diameter. Microsporophylls somewhat rhomboid, tapering below to a narrow stalk, about 3 cm. long, 1.5-2 cm. wide, apex truncate, glabrous above, exposed portion puberulent, strongly ascending, the sterile tip 5-6 mm. long, rounded to acute or to somewhat acuminate. Megasporophylls up to 22 cm. long, rather densely ferruginous-pilose, the petiole and fertile portion about 15 cm. long, 1 cm. wide, with mostly 2 ovules. Sterile blade ovate, up to 10 cm. long and 8 cm. wide, pectinate-pinnatifid, the reduced pinnae about 15 on each side, usually ascending, linear, sharp-pointed, rather rigid, pubescent and below, glabrous above or entirely glabrous, up to 3.5 cm. long, the tip of the sterile blade usually long/acuminate, with few, gradually shorter, ascending lobes or the uppermost ones reduced to teeth only 1-2 mm. long. Seeds ovoid to ellipsoid, not flat-

tened, brown, glabrous, shining, rather obscurely and minutely apiculate, 3.2-4 cm. long, 2.5-3 cm. in diameter. Stony coat pale, somewhat shining, 9-15-ribbed.

Geographic distribution: Known only from the small island of Culion, in the Philippines. The above account is taken from Merrill's very complete description.

29. 1829 m m m  
7. Cycas undulata Desf.

C. tonkinensis Hort.

Desfontaines, R. L., Catal. Hort. Paris (1820); Gaudichaud, C., in Freycinet's Voy. Bot., p. 434 (1826); Miquel, F. A. W., Prodr. Syst. Cycad. / 7, 17 (1861); Linden, L., and Rodigas, E., Illus. Hort. 32:27 (1885).

Stem, slender, erect, cylindric. Leaves about 15 in a crown, about 2 m. long, bright green and glabrous. Petiole about 1 m. long and 2 cm. in diameter, broadened to 4.5 cm. in diameter at base; rounded below, bluntly triangular above with two grooves at the sides, bearing sharp spines throughout its length. Rachis about 1 m. long, rounded below, somewhat more sharply angled above than the petiole, with two grooves at the sides. Leaflets 100 or more on each side, opposite or nearly so, linear-lanceolate, acuminate, pungent, upper margin narrowed at the base almost to the midrib, lower margin decurrent, often twisted at the base, undulate along the margins; largest leaflets up to 36 cm. long and 18<sup>20</sup> mm. wide, the uppermost 12-14 cm. long and 10-20 mm. wide, the lowest 16-18 cm. long and 12-13 mm. wide.

Male cones not available. Megasporophylls very numerous, 6-7 cm. long, the group before spreading about 10 cm. in diameter. Petiole 2.5 cm. long; rachis bearing one ovule on each side, the terminal blade oval, tomentose, about 1.5 cm. long and 1 cm. wide exclusive of the 5-7 reduced pinnae, which are linear-lanceolate, pungent, and up to 2.5 cm. long. Seeds nearly spherical, light yellow, very smooth, about 3 cm. in diameter.

Geographic distribution: In the vicinity of Tonking, China. Said to be abundant on the Marianna Islands. Chiefly known in cultivation. Descriptions in the literature are very incomplete. The foregoing account is based on several specimens in the Phipps Conservatory, Pittsburgh, Pennsylvania, U. S. A.

8. Cycas beddomei Dyer

Dyer, W. T. T., Trans. Linn. Soc., ser. 2, Bot. 2:85 (1883);  
Hooker, J. D., Flora Brit. India 5:658 (1890).

Stem very short, only about 6 cm. or less in height. Leaves about 1 m. long. Petiole about 15 cm. long, strongly quadrangular, minutely spiny in upper one-third, tomentose at base; rachis sub-quadrangular. Leaflets linear, spinose acuminate, margins strongly revolute, 12-18 cm. long and 3 mm. wide; midrib prominent below.

Male cones oblong-ovoid, about 30 cm. long and 7 cm. in diameter, very short stalked. Microsporophylls oblong-deltoid, long acuminate, 18-20 mm. long, 10 mm. wide, the sterile tip strongly deflexed in upper half of cone, ascending near base of cone, fuscous pubescent, becoming somewhat glabrous. Megasporophylls long/ligulate, slender, 15-20 cm. long, ferruginous pubescent, bearing 2 ovules on each side above the middle. Sterile blade ovate-lanceolate, about 8 cm. long and 2 cm. wide, tapering into a long acuminate point, deeply lacinate, the reduced pinnae 7-10 mm. long and sharp-pointed. Seeds globose, sometimes slightly compressed, 4 cm. in diameter.

Geographic distribution: Southern India—Madras, abundant on the hills. Although it resembles C. revoluta in several respects, this species is regarded by Dyer as "a very reduced form of C. circinalis."

W.H.  
9. Cycas chamberlainii Brown and Kienholz

Brown, W. H., and Kienholz, R., Philippine Jour. Sci. 26:47, *Feb 1-3, 1925*  
(1925).

Trunk slender, seldom branched, reaching a height of about 8 m.; when 1 m. high, diameter of stem 9-10 cm., becoming 15-20 cm. in larger specimens. Leaves 1-1.6 m. long, nearly glabrous or sparingly brown hairy on underside, densely hairy on both sides at base of leaflets. Petiole 25-45 cm. long, with marginal spines 3 mm. long, densely brown hairy when young. Rachis 90-115 cm. long, subterete, somewhat flattened ~~slightly~~ <sup>and</sup> slightly grooved along the upper side, deeply grooved when dry, with prominent brown hairs, particularly along the sides. Leaflets 80-95 on each side, opposite or alternate, slightly oblique, falcate, gradually tapering to a sharp but not spiny point, base decurrent almost or quite to next leaflet below, margin revolute only in dried specimens; 20-30 cm. long, 9-11 mm. wide.

Male cones ovoid, rounded at the apex, 13 cm. long, 8 cm. in diameter. Microsporophylls cuneate, edges slightly concave, 3.5 cm. long, 1.6-2 cm. wide, short-stalked, smooth above except at the tip, which is densely brown tomentose; terminating in an erect slender spine about 1 cm. long. Megasporophylls 15-22 cm. long, densely brown tomentose. Petiole obscurely 4-6-angled, flattened, 1.5-2 cm. wide just below the basal pair of ovules. Ovules 4-6, usually 6, crowded, usually opposite. Sterile blade broadly subcleft to cleft, usually strongly curved upward, 6-8 cm. long, 3.5-5 cm. wide, deeply lacinate, with 4-10 spine-like pinnae on each side averaging 1.5-1.7 cm. long, and with a terminal spine 2-4 cm. long. Scale obovate, flattened, 4 cm. long, 3 cm. wide, 2.5 cm. thick; fleshy layer about 3 mm. thick at side; stony layer about 1 mm. thick.

Geographic distribution: Luzon, Philippine Islands--Pampanga Province, Mount Arayat. Brown and Kienholz, from whom the above account is taken, state <sup>that</sup> C. chamberlainii is very distinct from C. rumphii, the common lowland species in the Philippines, in its much shorter and differently shaped megasporophylls and in the small size of the male cone, but particularly in the slender trunk and in the seed characters. The seed of C. chamberlainii is much smaller than that of C. rumphii and is obovoid rather than ellipsoid.



10. Cycas circinalis L.

Linnaeus, C., Spec. Plant., 1st ed., p. 1188 (1753); <sup>Hooker, W. J., Bot. Mag. 55: t. 282b, 2827 (11)</sup> Miquel, F. A. W., Monogr. Cycad., p. 27 (1842), Prodr. Syst. Cycad. 7, 17 (1861); Hooker, J. D., Flora Brit. India 5:656 (1890).

Stem in largest plants 5-7 m. high and 25-40 cm. in diameter, very seldom branched. A plant 25 years old, with a stem 1 m. high and 20 cm. in diameter, will have reached the coning stage. Leaves 15-20 in a crown, 2-3 m. long, bright green above, paler beneath, glabrous. Petiole 60-70 cm. long, rounded below, bluntly triangular above between two rows of sharply deflexed spines, these 2-3 mm. <sup>unarmed below.</sup> long, Rachis 1.5-2.5 m. long, rounded below, bluntly triangular above. Leaflets 90-120 on each side, opposite or alternate, arising at a slight angle from the rachis, linear-lanceolate, usually subfalcate but often nearly straight especially in the upper part of the leaf, acuminate, narrowed at the base and strongly decurrent to the next leaflet below, margins flat or scarcely revolute; larger leaflets 20-30 cm. long and <sup>9</sup> ~~10~~-13 mm. wide, upper and lower ones about 12 cm. long and 10 mm. wide.

Male cones cylindric-ovoid, tapering above, yellowish, 60-70 cm. long, 15-18 cm. in diameter; peduncle 5-7 cm. long. Microsporophylls obovate-deltoid, long acuminate, 4-5.3 cm. long, with a <sup>slender</sup> ~~slender~~ upturned tip about 2.5 cm. long; exposed part densely tomentose with short brown hairs. Microsporangia 600-800, in sori of 3 or 4, occasionally 5, covering the entire lower surface except a sterile notch at the apex. In cones 60 cm. long from young plants, microsporangia less crowded and fewer (200-400) and in very distinct sori.

Megasporophylls 15-20 in a crown, lanceolate, 25-30 cm. long, densely tomentose with short yellowish brown hairs, green upon removal of hairs. Petiole 10-20 cm. long, tetragonal; rachis about

15 cm. long, broadly ~~triangular~~<sup>quadrangular,</sup> with 3 or sometimes 4 ovules on each side. Sterile blade above the ovules ovate-lanceolate, acuminate, about 4 cm. wide, its pinnae reduced to ~~spinose teeth~~<sup>small spinose teeth.</sup>

~~Seeds~~ Seeds ovoid, bilateral, somewhat flat, orange-red, glabrous at maturity, up to 7 cm. long, ~~(the longer diameter is the longer)~~ larger diameter up to 5.2 cm., shorter diameter up to 4.7 cm., the fleshy coat up to 4 mm. thick. Stony coat smooth, flat at the bottom, sharp-pointed, with two median ridges at the sides prominent above and less so below.

Geographic distribution: Ceylon, southern India, Sumatra, Java, Borneo, and probably on many islands north of Australia. Plants mistaken for this species or regarded as varieties of it have increased the range. Probably the most variable of all species of Cycas, with some variants described as species and some real species described as variants.

11. Cycas thouarsii R. Br.

C. madagascariensis Miq.

Brown, R., Prodr. Fl. Nov. Holl. 1:347, sine descrip. (1810);

Miquel, F. A. W., Comment. Phytogr., p. 127 (1840), Monogr. Cycad., p. 32 (1842), Linnaea 17:699 (1843), Prodr. Syst. Cycad. 7, 17 (1861); Stapf, O., Kew Bull., p. 1 (1916); Prain, D., Flora Trop. Africa 6<sup>v</sup>:345 (1917).

Stem 4-6 m. high, about 45 cm. in diameter, sometimes branched when old. Leaves 1.5-3 m. long, bright green above, paler beneath, glabrous. Petiole 1-1.5 m. long, subterete, spiny above, glabrous; rachis convex below, caniculate above. Leaflets 60-70 on each side, linear-lanceolate, subfalcate, acute, slightly narrowed and decurrent at the base, margins flat; 20-30 cm. long, 9-13 mm. wide. Male cones ovoid-cylindric, brown, 30-40 cm. long, 12-17 cm. in diameter; peduncle less than 5 cm. long, slightly pubescent. Microsporophylls obovate-deltoid, truncate, 5-7 cm. long, with a strongly upturned hook-like beak up to 2 cm. long, the exposed portion reddish tomentose. Microsporangia in sori of 3 or 4. Megasporophylls spatulate, 20-30 cm. long, covered with a rusty-yellow tomentum, ovules 4 or 5 on each side. Sterile blade flat, ovate-lanceolate, acute, 8-10 cm. long, 2-3 cm. wide, scarcely wider than the fertile portion, the margin crenulate or subentire. Seeds globose, slightly compressed, red, 5-6 cm. long, 4.5 cm. in diameter.

Geographic distribution: Eastern and northwestern coastal regions of Madagascar. Also in Comoro Islands and on Zambezi Delta, where its introduction was probably due to human agency. This species is doubtfully distinct from C. circinalis L. and by some authors is regarded as a variety or geographical form of it. Prain, however, regards it as more nearly allied to C. rumphii Miq.

12. Cycas rumphii Miq.

Miquel, F. A. W., Bull. Sci. Phys. et Nat. Néerl. 2:44 (1839),  
Monogr. Cycad., p. 29 (1842), Prodr. Syst. Cycad. 7, 17 (1861);  
Hooker, J. D., Flora Brit. India 5:657 (1890).

Stem up to 6 m. or more in height and often much branched.  
Leaves 1-2 m. long, dark glossy green. Petiole obtusely triangular,  
with small spines 2-3 mm. long; rachis subterete. Leaflets 50-100  
on each side, opposite, linear-lanceolate, subfalcate, with subacum-  
inate pungent apex and decurrent base, margins flat or slightly  
revolute, 20-30 cm. long, <sup>14</sup> ~~31~~-20 mm. wide, midrib prominent on both  
sides.

Male cones long ovoid, reddish tomentose, short stalked. Micro-  
sporophylls cuneate, short acuminate, 3.5-5 cm. long, thickened and  
obliquely truncate at the apex, with a short upturned and sometimes  
cauducous point about 1 cm. long. Megasporophylls long spatulate,  
about 30 cm. long, narrower than in C. circinalis, rusty tomentous,  
with 3-5 ovules; sterile blade ovoid-rhomboid, <sup>minutely</sup> spinose-toothed above,  
entire below, rather abruptly acuminate. Seeds <sup>ellipsoid</sup> ~~obovoid~~ or subglobose,  
somewhat flattened, orange, 5-7 cm. long, 4-4.5 cm. in diameter.

Geographic distribution: Moist wooded regions of Burma, Ceylon  
(possibly introduced), Andaman Islands, Nicobar Islands, Malay Archi-  
pelago, New Guinea, Amboina, Philippine Islands, and northern Australia  
(York Peninsula). <sup>closely related</sup> ~~related~~ to C. circinalis L., but distinguished by its  
shorter leaves, wider leaflets, truncate short-pointed microsporophylls,  
and narrower megasporophylls with fewer and shorter teeth. C. riuminiana  
Porte, from the Philippine Islands, has been reduced by E. R. Merrill,  
in Philippine Bur. Sci. Publ. 18, 1:1 (1921), to C. rumphii Miq., the  
common lowland species. The original description of C. riuminiana by  
Regel in Gartenfl. 12:16 (1863), based on sterile specimens, mentions no  
characters by which it may be distinguished from C. rumphii Miq. or from  
C. chamberlainii Brown and Kienholz.

13. Cycas media R. Br.

Brown, R., Prodr. Fl. Nov. Holl. 1:348 (1810); Miquel, F. A. W., Monogr. Cycad., p. 26 (1842), Prod. Syst. Cycad. 7, <sup>16</sup> (1861); Bentham, G., Flora Austral. 6:249 (1873); Mueller, F. von, Fragm. Phytog. Austral. 8:171 (1874); Bailey, F. M., Queensl. Flora 5: 1501 (1902); Gardner, C. A., Kimberley Div. West. Austral., Forests Dept. Bull. no 32:31 (1923).

Stem in large plants 2-3 m. high, 20-30 cm. in diameter, sometimes reaching a height of 4-6 m. and a diameter of 40-45 cm.; seldom branched; armor of leaf bases disappearing in very old plants. Leaves 10-15 in a crown, up to 20 in very large plants, 80-120 cm. long, pubescent at first, becoming glabrous. In plants 1-1.5 m. tall petiole about 20 cm. long, the lower 5-6 cm. free from spines, from that point to the rachis abruptly spiny, the spines 3-6 mm. long and very sharp. In plants 3 m. tall the spiny condition much reduced, and in plants 4-5 m. tall the petiole often spineless.

~~Base of petiole abruptly spreading,~~ <sup>Petiole</sup> rounded above and below, densely <sup>base abruptly spreading.</sup> tomentose with short reddish hairs which easily rub off, <sup>Rachis</sup>

60-100 cm. long, rounded above and below, tomentose in patches on the upper surface even in old leaves, glabrous below. Leaflets 60-100 on each side, occasionally more, mostly opposite or nearly so, narrowly linear-lanceolate, straight or subfalcate, pungent, upper margin narrowed at the base nearly or quite to the midrib, lower margin decurrent to the next leaflet below especially in the upper part of the leaf, margin flat; largest leaflets 10-20 cm. long and 6-7 mm. wide, the lowest pair about 4-6 cm. long and 4-5 mm. wide, often reflexed, the upper ones sometimes abortive; base tomentose below with short reddish hairs; midrib prominent on both sides.

Male cones ovoid or ovoid-cylindric, yellowish, 15-30 cm. long, 10-15 cm. in diameter. Microsporophylls cuneate, 3.5-5 cm. long, 1.5-2 cm. wide, short stalked, abruptly narrowed at the apex and ending in a sharp incurved point, covered with a dense yellow tomentum. Microsporangia 600-800, mostly in sori of 3 or 4, covering the entire lower surface except a sterile notch at the apex. Megasporophylls 20-30 cm. long, light yellowish brown, densely tomentose. Petiole usually longer than the rachis. Ovules most commonly 3 on each side, sometimes 4, rarely 2 or 5, the sterile blade above the ovules rhomboid, about 7 cm. long including the terminal spine, 3.5 cm. wide including the reduced spiny-tipped ~~bracts~~<sup>finnae</sup>, the longest of which are 15-18 mm. in length.

Seeds bilateral, nearly round in broader diameter, oval in shorter diameter, brownish yellow, glabrous, 4.5-5 cm. long, 4.2-4.5 cm. in longer diameter, 3.5-4.2 cm. in shorter diameter. Stony coat smooth, obovoid, 4.5 cm. long, longer diameter 3 cm., shorter diameter 2.7 cm., tapered abruptly at the bottom to a stalk-like thickening about 2 mm. long, with a sharp point about 1 mm. long at the apex, and with a groove along each side where the stony coat splits at germination.

Geographic distribution: Queensland and Western Australia. In Queensland very abundant at Frenchman's Creek, near Rockhampton; Burnett and Dawson Rivers; Cape Upstart; Rockingham Bay and Mount Elliott. In Western Australia, common around Camden Sound in the Kimberley district, where it forms a conspicuous feature of the woolly-butt forest. At a short distance, three other Australian species of Cycas—C. kennedyana, C. normanbyana, and C. cairnsiana—look like C. media.

14. Cycas lane-poolei Gardner

Gardner, C. A., Kimberley Div. West. Austral., Forests Dept.  
Bull. no. 32:30 (1923).

Stem an erect trunk 3-3.6 m. high, 15-23 cm. in diameter.  
Leaves 60-75 cm. long, drooping, dark green above, paler beneath,  
glabrous. Petiole 23-30 cm. long, 6-8 mm. in diameter, armed with  
stout spines 4 mm. long, arranged alternately through their entire  
length. Leaflets numerous, linear, straight, acuminate with yellow-  
ish brown tips, upper ones decurrent to next leaflet below, lower  
not at all or only slightly decurrent, flat, 10-13 cm. long, 6-11  
mm. wide, the midrib very conspicuous.

Male cones not available. Megasporophylls about 20 cm. long  
and 13 mm. wide, petiolate, flattened, quite glabrous, usually  
bearing 2 ovules on each side above the middle; sterile blade ovate-  
triangular, 4.4 cm. wide, with two auricles or basal lobes, the  
margin and apex toothed with sharp pungent spines; apex 5 cm. long.  
Seeds ovoid-globular, yellowish green, hard and glabrous, covered  
with a glaucous powder when young, 5.7 cm. long, 5 cm. in diameter.

Geographic distribution: Kimberley district of Western Australia,  
northeast of Mount Hann, near the source of the Moran River; on  
rising ground in sandy soil, forming open forests with Eucalyptus  
latifolia and E. spenceriana.

15. Cycas furfuracea Fitzgerald

Fitzgerald, W. V., Jour. and Proc. Roy. Soc. West. Austral.  
3:108 (1916-17); ~~Kimberley, G. A., Kimberley, Div., West. Austral.,  
Pap. Bull. 20, 1918 (1918).~~

Stem an erect trunk 1.2-1.8 m. high. Leaves 60-75 <sup>cm.</sup> long,  
glabrous above, furfuraceous below: Petiole spiny in upper half;  
rachis glabrous. Leaflets numerous, rigid, linear, straight,  
pungent, not decurrent, margin somewhat revolute, occasionally  
bifid; up to 15 cm. long, 6 mm. wide, the lowest gradually smaller  
and passing into spines. Male cones narrow ovoid-deltoid, about  
38 cm. long and 7.5 cm. in diameter, short stalked. Microsporophylls  
up to 2.5 cm. long and 1.2 cm. wide, terminating in stout, obtuse,  
upward curved point 8 mm. long, the lower surface tomentose. Mega-  
sporophylls 15-20 cm. long, densely ferruginous-tomentose. Ovules  
1 or 2 on each side above the middle, the sterile blade ovate, 2.5-  
3 cm. wide, prominently spinose-toothed and terminating in a slender,  
obtuse, glabrous apex 2.5-4 cm. long. Seeds globose, yellow, about  
3 cm. in diameter.

Geographic distribution: Kimberley Division, Western Australia--  
top of King Leopold Range; Mts. Herbert, Broome, and Bold Eluff; in  
sandy soil among sandstone and quartzite rocks. Related to C. media  
R. Br.



16. Cycas basaltica Gardner

Gardner, C. A., Kimberley Div. West. Austral., Forests Dept.  
Bull. no. 32:31 (1923).

Stem a stout erect trunk 1-2.5 m. high, swollen at the base to 60 cm., otherwise 45 cm. in diameter, rough and dark gray. Leaves up to 1.2 m. long, hoary tomentose when young, becoming glabrous with age. Petiole up to 20 cm. long with a ~~convex~~<sup>concave</sup> base, spines not evident on mature leaves but a few on young leaves. Rachis convex or with a prominent ridge or angle above, narrower than the lower side, which is quite invisible from above. Leaflets numerous, linear, rigid, mucronate, the upper ones decurrent to the next leaflet below, the lower ones distant and scarcely or not at all decurrent, margins sometimes slightly revolute.

♀ Male cones narrow conical, the microsporophylls narrow cuneate with incurved points; microsporangia covering the sporophyll from the base to its incurved portion. Megasporophylls petiolate, densely ferruginous tomentose, usually with 4 ovules; sterile blade lanceolate, entire, with an acuminate apex ending in a rigid glabrous pungent point. Seeds globular, very slightly depressed, hard and glabrous, glaucous when young.

Geographic distribution: Western Australia—basalt hills near the Lawley River; in open forests of Eucalyptus foelscheana and E. spenceriana. Closely related to C. media, but the leaflets and megasporophylls are different; also related to C. cairnsiana, from which it differs chiefly in the number of ovules.

17. Cycas kennedyana F. Muell.

Mueller, F. von, Melbourne Chemist and Druggist (1882);

Bailey, F. M., Queensl. Flora 5:1502 (1902).

Stem an erect trunk up to 4.5 m. high and 30 cm. in diameter, rarely branched in older plants. Leaves 20-30 in a crown, the larger ones 1-2 m. long, somewhat flexuous in the upper part, bright green above, somewhat paler below, glabrous. Petiole smooth or with a few spines in the upper part; rachis keeled below. Leaflets 100 or more on each side, opposite or alternate, broadly linear, acute and somewhat pungent, lower margin of upper ones decurrent, nearly flat, the larger ones 15-20 cm. long and 10-15 mm. wide, the lowest only one-half as long.

Male cones ovoid-ellipsoid, brownish yellow or somewhat fuscous woolly, up to 30 cm. long and 12 cm. in diameter, the peduncle about 3 cm. long. Microsporophylls narrowly cuneate, about 3.5 cm. long, 13-20 mm. wide, truncate, velvety downy. Microsporangia very numerous, in sori of 3 or 4, covering the entire unexposed lower surface of the sporophyll. Megasporophylls 20-25 in a cluster, 10-25 cm. long, velvety downy. Petiole rather long, ovules nearly always 2 on each side, the sterile blade above the ovules rhomboid, 10-18 mm. wide, with leaflets reduced to little more than serrations. Seeds globular, brown slightly tinged with orange, glabrous, 3.5-4.5 cm. long, 2.5-2.7 cm. in diameter. Stony coat bilateral with a strong line from apex to base on each side along which the coat splits at germination, 3.3-4 cm. long.

Geographic distribution: Queensland, Australia—Normanby Ranges near Port Denison.

*Thymococcus* F. V. Muell. <sup>(English oak)</sup> *chem.* and *comp.* with  
*Intercalacion Subvolamen* 5 (47): 85 (1882); Bailey, F. M.,  
*Univ. Florida* 5: 1502 (1902).

Reference consulted through the assistance of Mr. A. W. Joseph,  
Director and Government Botanist, Melbourne Botanic Gardens  
and National Herbarium, South Yarra, S. E. I., Australia.

revised Feb. 8th, 1949.

18. Cycas cairnsiana F. Muell.

Mueller, F. von, *Fragm. Phytogr. Austral.* 10:63, 121 (1876);  
Bailey, F. M., *Queensl. Flora* 5:1502 (1902).

Stem stout, often 4-5 m. high and 40-50 cm. in diameter,  
frequently spreading somewhat at the base. ✓ Branching plants

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✓ Among many large specimens south of Cairns, Queensland, I  
did not see any which even approached the 1.5 m. base <sup>diameter and the</sup> ~~base~~ 90 cm.  
<sup>diameter</sup>  
~~at the~~ top cited in Schuster's monograph in *Das Pflanzenreich*. *Mueller gives*  
the circumference at the base as 5 feet and at the summit as 3 feet.

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are not rare. Leaves 1-1.5 m. long, pale glaucous green on both  
sides. Base of petiole slightly pubescent, sparingly spinescent  
in upper part. Leaflets narrowly linear, narrowed at the apex to  
a pungent point, the lower margin decurrent, the upper scarcely  
narrowed, margins revolute; 16-18 cm. long, 4 mm. wide; midrib  
strongly prominent beneath. In seedlings lowest leaflets only  
slightly smaller than the rest, rachis often ending in a terminal  
leaflet; longest leaflets 12.5 cm. in length and 8 mm. in width.

Male cones up to 38 cm. long and 8 cm. in diameter; peduncle  
about 2 cm. long. Microsporophylls cuneate, truncate, 2.5 cm. long,  
8.5 mm. wide, the fertile part scarcely longer than the sterile,  
ending in an upturned triangular apex tipped by a beak about 4 mm.  
long. Microsporangia small and nearly covered by tomentum. Mega-  
sporophylls up to 35 cm. long, the petiole about 20 cm. long.  
Middle portion bearing one ovule on each side, the <sup>sterile</sup> ~~sterile~~ blade  
rhomboid-lanceolate, 4 or 5 times as long as wide, the margin  
slightly dentate. Seeds bilateral, ellipsoid, shiny brown, 3.7  
cm. long; stony coat 3.5-3.8 cm. long, larger diameter 2.6-2.7 cm.,  
smaller diameter 2.4-2.5 cm., narrowed to a stalk-like base 4-5 mm.  
long, with a small spine up to 1 mm. long at the apex and with two

strong lines at the sides along which the seed splits at germination.

Geographic distribution: Queensland, Australia; abundant near Cairns, Newcastle Range, Robinson and Percy Rivers.

19. Cycas normanbyana F. Muell.

Mueller, F. von, *Fragm. Phytogr. Austral.* 8:169 (1874);

Bailey, F. M., *Queensl. Flora* 5:1502 (1902).

Stem an erect trunk 1.8-3 m. high, occasionally up to 4 m., often conspicuously thickened at the base. Leaves in a dense crown, 1-1.7 m. long, shiny green on the upper side, dull below. Petiole with short distant spines about 2.5 cm. long; rachis tetragonal in the lower portion, becoming semi-terete higher up. Leaflets numerous, opposite, mucronate, the larger ones 20 cm. long, 5-6 mm. wide, gradually shorter toward the apex and base; midrib prominent beneath.

Male cones ellipsoid-cylindric, 30-35 cm. long, 12 cm. in diameter; peduncle about 2 cm. long. Microsporophylls narrowly cuneate, 2-6 cm. long, 10-12 mm. wide, the upper sterile part deltoid, about 1 cm. long, ending abruptly in a thickened beak 2-6 mm. long, tomentose below. Megasporophylls 15 cm. long, nearly always with 2 ovules. Sterile blade scarcely wider than the fertile part, narrowly lanceolate, 4-7 cm. long, 8 mm. wide, with a crenate-serrate margin. Seeds orange, 2.5-3.7 cm. long; stony coat slightly carinate above.

Geographic distribution: Queensland, Australia; near Port Denison and Port Darwin.