

Synopsis of Living and Fossil Cycadaceae

Cycadaceae: represent the surviving line of Nathorst's Cycadophyta.

Usually treated as a single family, occasionally divided into two: Cycadaceae--Zamiaceae.

Last systematic treatment: Schuster (1932) in Pflanzenreich.

Last general summary: Arnold (1953) Origin and Relationships of the Cycads. (Phytomorpholo

Summary of economic uses and poisonous properties given by Thieret (1958).

Small family: extra-ordinary interest, far from being well known, new spp. still being

described; unpublished plates in Brussels, and Liebmann's plates in Copenhagen.

Much fossil material unworked or coming to light.

Chicago ms.: manuscript notes by the late C. J. Chamberlain, organized and edited by

Haupt; nomenclature critically reviewed by the late E. D. Merrill. Rev. by T.J. L

Summary of fossil Cycadaceae, by T.J.

Status of various genera uneven, Encephalartos monographed last, (Henderson 1945).

Field work: immense amount remains to be done; Melville's instructions (1957) for col-

lecting cycads should be most useful. No botanist saw them all in the field,

Chamberlain made various expeditions to Mexico, South Africa, etc. and probably

saw only half of the species in the field.

Nomenclatural problems numerous: Melville (1959) corrected one (Bowenia).

General information and summary given by Gausson (1944), pp. 94-95:

tabular summary of morphological (15 + 18) and anatomical (25 + 15) characters

and chromosome numbers; followed by chart of evolution of cycadophytes.

Greatest progress: foliage of living and fossil cycads or cycadophyte affinity studied;

epidermal and cuticular structures investigated by Nathorst (1902-1909),

Thomas and Bancroft (1913), Thomas (1930), Florin (1931, 1933), and Harris (1932).

Impact on classification of gymnosperms unequalled.

Anatomical details: shoot apex (Johnson 1945, Foster 194.), ovulate sporophylls, leaf

bundles in +Cycas circinalis (Boureau 1944), wood of living cycads (Greguss 1955),

venation types in cycad leaves (Foster, unpublished, three major types).

Pollination: "Variations of Temperature in Male Cones of *Encephalartos Altensteinii* Lehm.", reported by A. Jacot-Guillarmod (Rhodes University, Grahamstown), 1959, Jour. So. African Botany, vol. 25: 93-99. Cones cut off and measured in situ. Gausson (only other reference to this phenomenon) described it as ^V feyerish rise. J.-G. found diurnal rhythm and a connection between rise of temperature and shedding of pollen. Laboratory measurements show rise of 17°C and plants in open field show 10°C on windy days. Pollen is shed in afternoon, Three spp. of weevils common on such cones, and one tenebrionid beetle. A dimorphic weevil was common on female cones of *E. horridus*, but only when a gelatinous exudate appeared; otherwise few were present. Center of cone represents warmest third. Cones mature from late March to early May. Cones 17 in. long (average), other spp. 24 in. long. Distinctive, not particularly unpleasant, smell, present in *E. Altensteinii* and *E. villosus*, none in *E. Lehmannii*.

Populations: stands of various spp. in Australia (Carl Wilson).

E. Eugene-Maraisii Verdoorn (1945), Transvaal, 6 localities, all within short distances of one another; on one [?] from two plants are known, one a female, the other immature, "It would appear that they are relics of a now localised and almost extinct species."

Microcycas calocoma: Province Pinar del Rio, western tip of Cuba, represented by about 500 individuals, 3 lowland groups, 8 montane; A. S. Foster and Manuel R. San Pedro (1942). Microsporangiate trees taller than megaspor., 30 ft. to crown, female trees to 28 in. in diam.

Hybridization experiments carried on by Chamberlain in Chicago. Elsewhere now?

Experimental studies in evolution: unknown.

Taxonomy: Schuster treats 9 genera, 65 spp.; Chamberlain-Haupt, 9 genera, 98 spp.

Genus	Schusterr	Chamberl.-Haupt	Type species
Cycas	8 spp., 3 sect.	19 spp.	C. circinalis
Stangeria	1 sp., 1 var.	1 sp.	S. paradoxa
Bowenia	1 sp., 1 var.	2 spp.	B. spectabilis
Dioon	3 spp.	5 spp.	D. edule
Macrozamia	9 spp., 3 sect.	16 spp.	M. spiralis
Encephalartos	14 spp., 3 sect.	19 spp.	E. longifolius
Microcycas	1 sp.	1 sp.	M. calocoma
Cetatozamia	2 spp.	6 spp.	C. mexicana
Zamia	26 spp., 3 sect.	29 spp.	Z. pumila

Cycas: A. Messeri (1927): "The species of Cycas are so nearly alike that they should be considered varieties of the same species." Based on anatomical characters of leaflets.

Stangeria: no change.

Bowenia: B. serrulata, var. of spectabilis, raised to species by Chamberlain (1912), Melville (1959) corrected nomenclature.

Dioon Dohenyi E. A. Howard (1933), Guatemala, not in Chamberlain-Haupt ms. Nomen nudum?

Macrozamia: no change.

Encephalartos: nine new spp. and 2 new vars.; E. Eugene-Maraisii Verdoorn (1945), Transvaal; E. lebomboensis Verdoorn (1949) Swaziland; E. ngoyanus Verdoorn (1949), E. eximias, Verdoorn (1954), Cape Province; E. natalensis Dyer & Verdoorn (1951), Natal; E. arenarius Dyer (1956), Cape Province; E. tegulaneus Melville (1957), Zululand; E. bubulinus Melville (1957), E. marunguensis Devred (1958), Belgian Congo; Henderson (1945) recognized 22 spp., no difference in their pollen; 18 with names, others without. -- Melville (1957, 1958) points out that male cones have fewer taxonomic characters than to female cones; treated nine spp. from Central Africa, 2 being new. Detailed descriptions of cone characters.

Microcycas: most detailed field observations by A. S. Foster & M. R. San Pedro (1942).

Ceratozamia: *matudai* Lundell (1939), southern Mexico.

Zamia: other genus with novelties.

Z. Guggenheimiana Carrabia, Cuba (1941).

Z. jirijirimensis Schultes (1953), Amazonia.

Z. madida Schultes (1958) ?, Amazonia.

Undescribed, large tree sp., vegetative stages known, no cones.

Z. Allison-Armourii Millspaugh (1912 ?)

Fossil Members: listed in Schuster, Florin, Gausson, and Arnold; none complete.

Paleozoic: mostly doubtful:

Stems: Cycadoxylon, Ptychoxylon, Permian.

Leaves: Dicoonites, Permian of China.--Pterophyllum, Upper Carboniferous, France,

cuticle is Nilssonia-like; Plagiozamites, Sphenozamites.

Additional doubtful forms in Schuster.

Pollen: Carboniferous, France, Dounbinger 1957 (Ann. Assoc. Géol. du Nord).

Entylissa, Permian, Naumova.

Mesozoic: best known fossils belong here.

1) Dicoonitocarpidium pennaeforme, Triassic, western Germany; D. keuperianum
D. liliensterni, Triassic, Austria, Megasporophylls, up to 8 in. long,
2 or more seeds near base.

2) Bjuvia simplex: Rhaetic of Sweden, consists of Macrotaeniopteris gigantea
(leaves) and Palaeocycas integer (megasporophylls).

These two fossils are Cycad-like.

3) Androstrobus, A. manis and A. wonnacotti, Jurassic, Yorkshire coast of England
male fructifications, like male cones of living cycads. Microsporophylls
look most like those of Encephalartos.

4) Beania, several spp., Jurassic female fructifications, same locality as A.
BN gracilis, loose spike, 4 inches long, 2 seeds per peltate sporophyll,
A. manis and B. gracilis are conspecific (cf. epidermal structures).
Associated with Nilssonia-like leaves. Both genera belong to Zamia alliance.

Both types of cycads are about of equal geological age.

- 5) Enygmastrobos Dokturowskyi, Jurassic, Amurland, Kryshtofovich (1915).

Cones. Cycadales ? Never entered the literature other than original publ.

- 6) Almargemia, Cretaceous, Portugal, sterile pinnate leaves, 4 in. long, 2 1/2 wide;

Probably belongs to Zamioideae.

- 7) Leaf genera: pinnate Nilssonia types, associated with Androstrobos and Beania, Ctenis, Pseudoctenis (including Pseudopterophyllum), Doratophyllum, and the giant, long obovate, entire Macrotaeniopteris.

Pleiotrichium commelinoides Weyland & Greifeld, western Germany, most like

Doratophyllum. Fragments, hairs most like those of Commelinaceae.

Tertiary material:

- 8) Macrozamia hopeites, Cookson (1953), leaf fragments, Oligocene brown coal, Bacchus Marsh, Victoria, Australia. Only Tertiary cycad, whose epidermal structure was studied like that of Mesozoic cycads. Resembles closely M. hopei, tallest living cycad, northernmost representative (near Cairns, 16 - 18 °S). M. hopeites occurs 38°S.

Impression material summarized by Hollick.

- 9) Cycadopites and Dioonipites, pollen from Eocene Green River formation (U.S.). C. follicularis, Paleocene, FortUnion series. Cycadopites resembles grains of Cycas. Dioonipites resembles those of D. spinulosum, but is it cycadaceous?

Phylogeny: review of various views in Arnold. Mention here Greguss and Gausson.

Triassic: both lines (Cycadoideae and Zamioideae) about equally old. Origin no doubt Paleozoic. Some living members very old, others actively speciating. Van der Hammen mentioned only dichotomous rootlets of Dioon edule as an example of dichotomous branching when presenting evidence for Prof. Lam's views on phyllosporous and strobiliferous groups. Three main lines according to Greguss: monopodial, dichotomous, and verticillate. See charts on slides for quick review.