



# BOTANY GLOSSARY

Hervé Rey, 2016

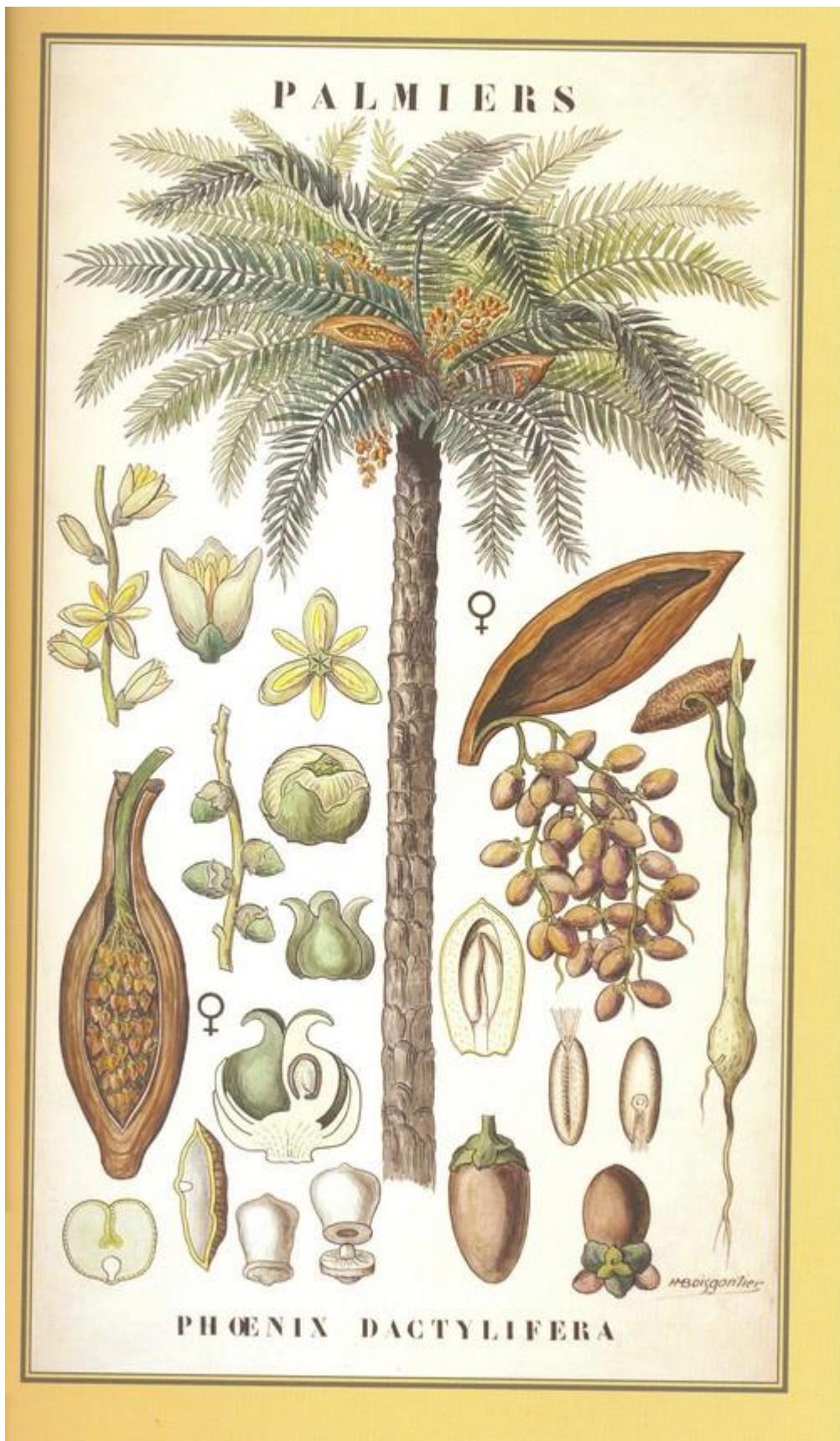
ARECACEAE



FROM :

- DRANSFIELD : GENERA PALMARUM
- D.L. JONES : PALMIERS DU MONDE  
(KÖNEMANN)

# PLANT ANATOMY ARCHITECTURE

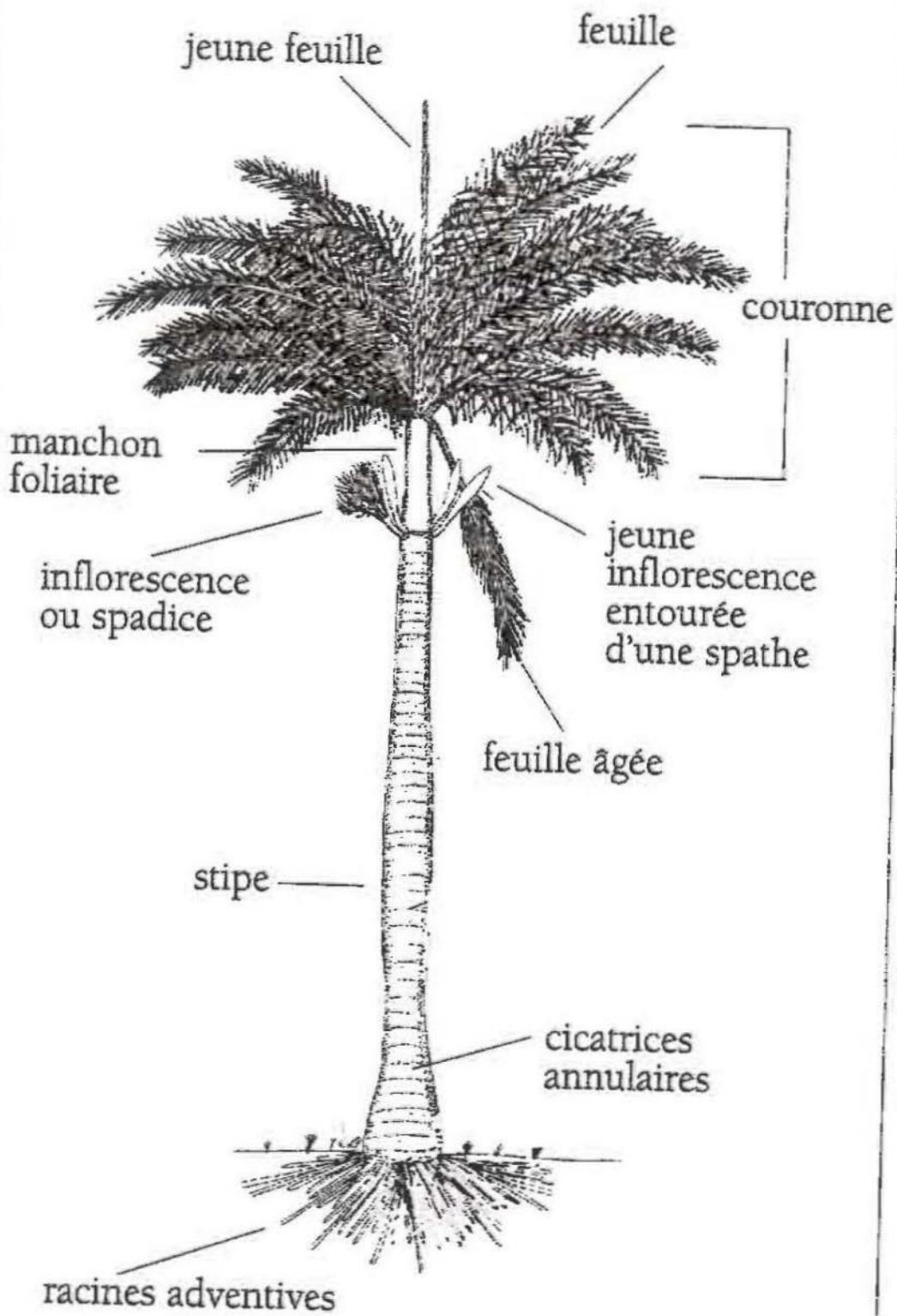


Tab. 170.

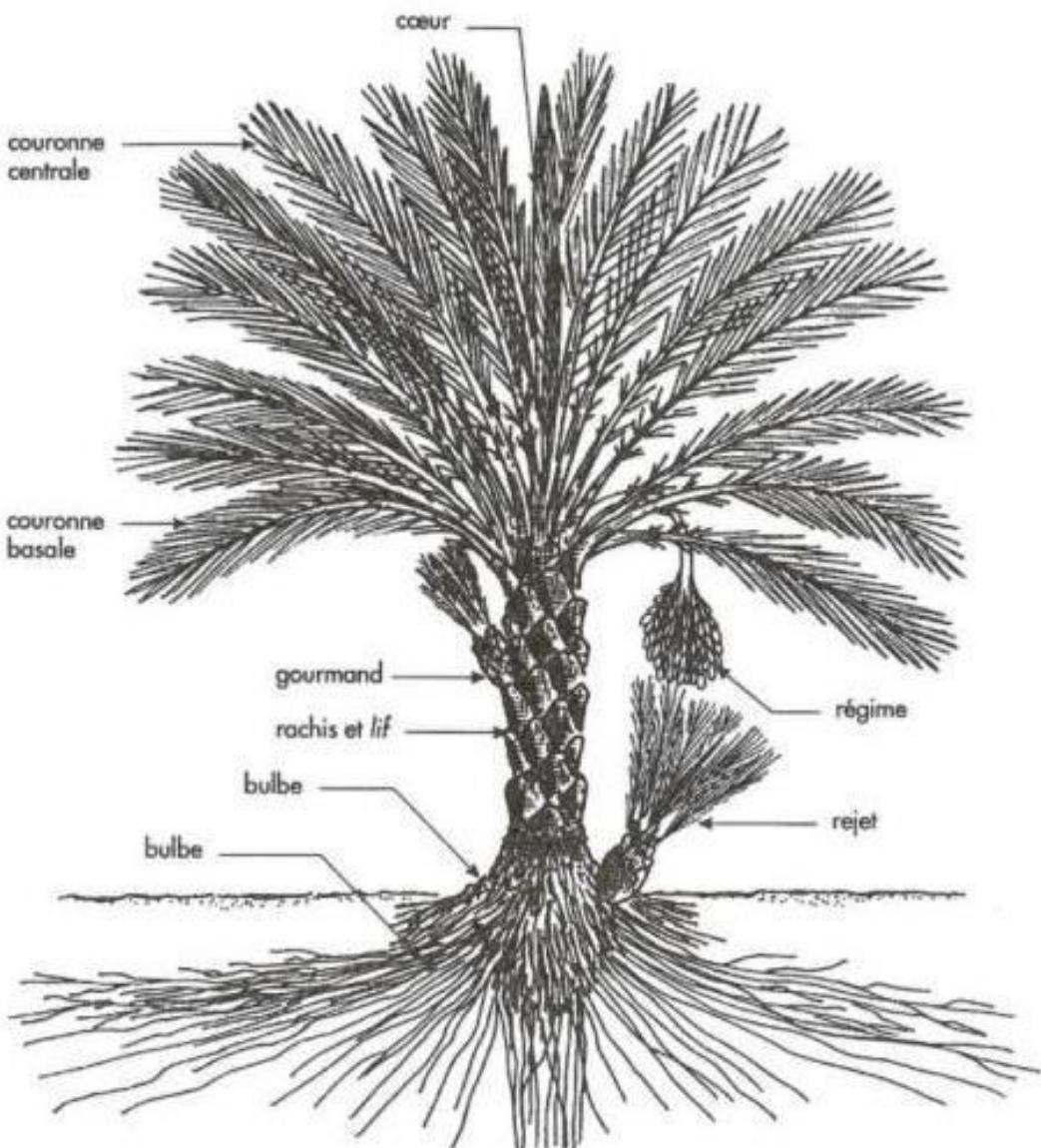


ORBIGNYA phalerata.

Figure 1  
**Anatomie d'un palmier**



## Cultiver le palmier-dattier

**La couronne, ou frondaison**

le feuillage de l'arbre

- les palmes

couronne basale, formée des palmes les plus âgées

couronne centrale, formée des palmes en pleine activité

palmes du cœur, dont celles en pinceau

- les inflorescences et les régimes

**Le tronc, ou stipe**

- les rachis des palmes

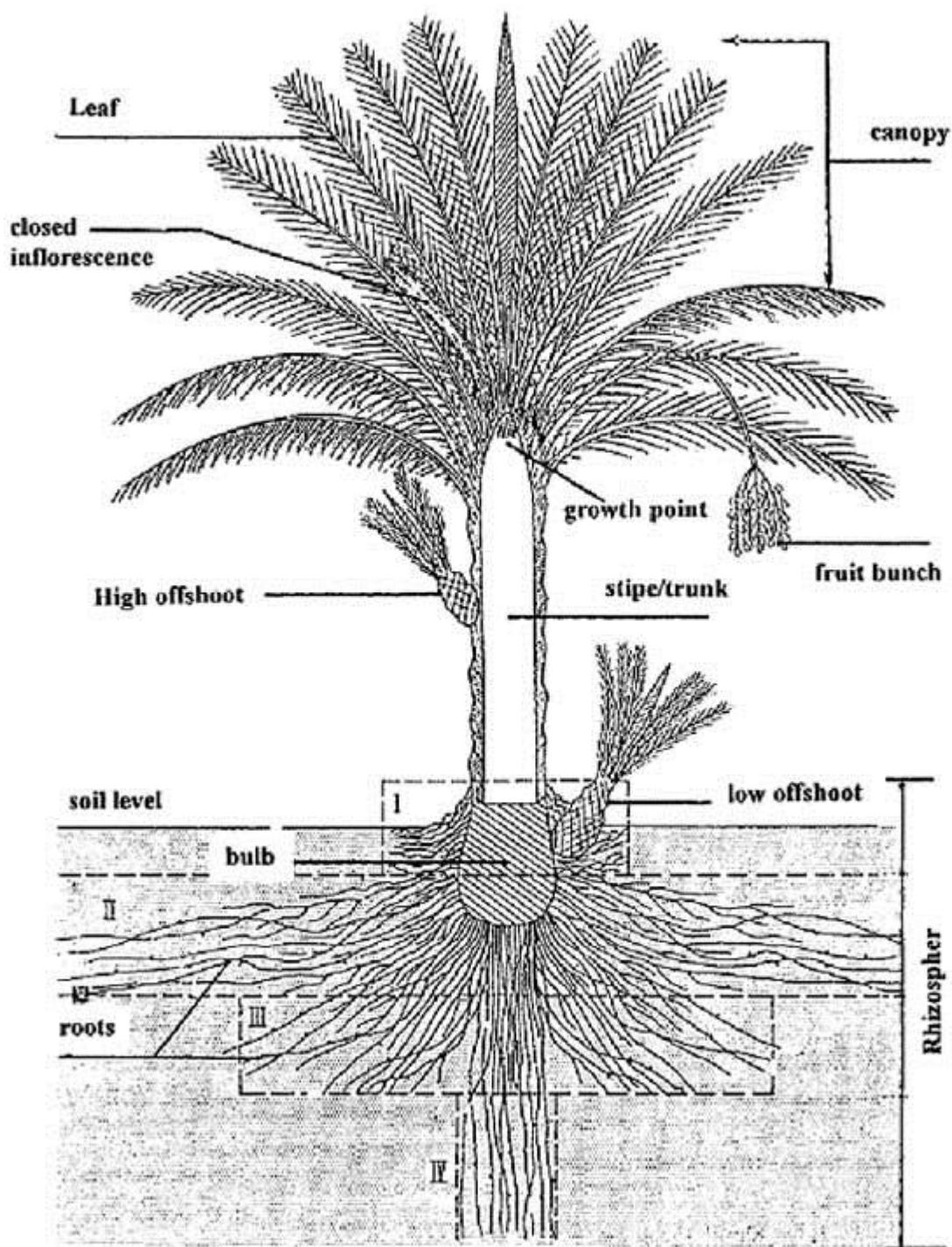
• le fibrillum, ou lif

- les gourmands et les rejets

**Les racines, ou système radiculaire**

- le bulbe

- les racines



## Les inflorescences

### LES ORGANES FLORAUX

Le palmier-dattier est une plante dioïque, c'est-à-dire que les organes mâles et les organes femelles sont sur des individus différents, palmiers mâles ou palmiers femelles. Chaque individu ne porte que des inflorescences d'un même sexe.

Les inflorescences du dattier naissent du développement de bourgeons axillaires situés à l'aisselle des palmes dans la région coronaire du tronc. L'inflorescence est caractéristique : c'est une grappe d'épis (figure 6).

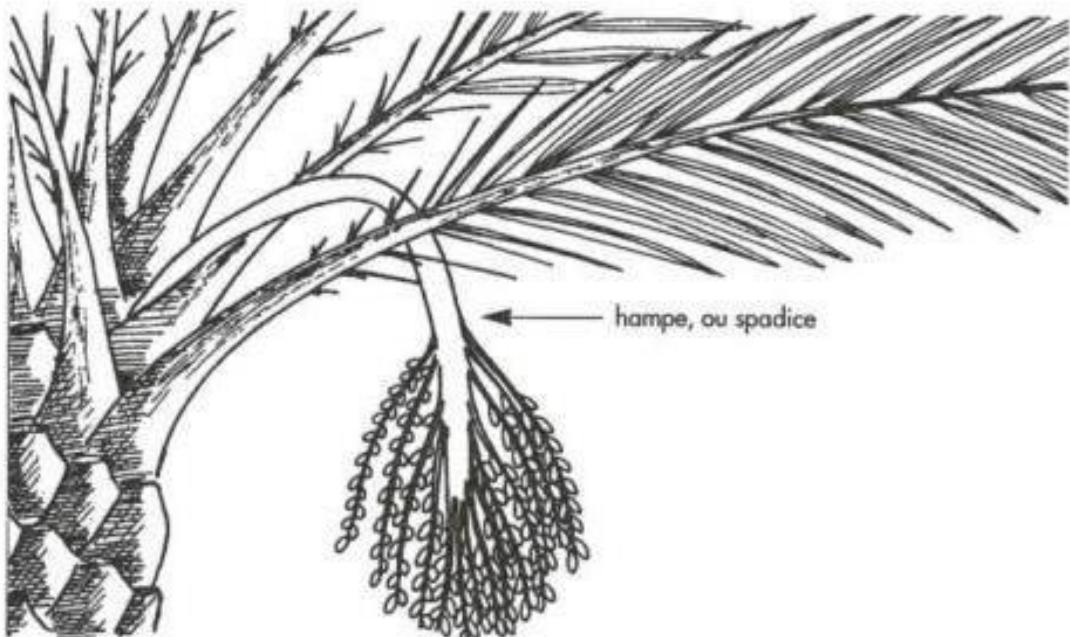
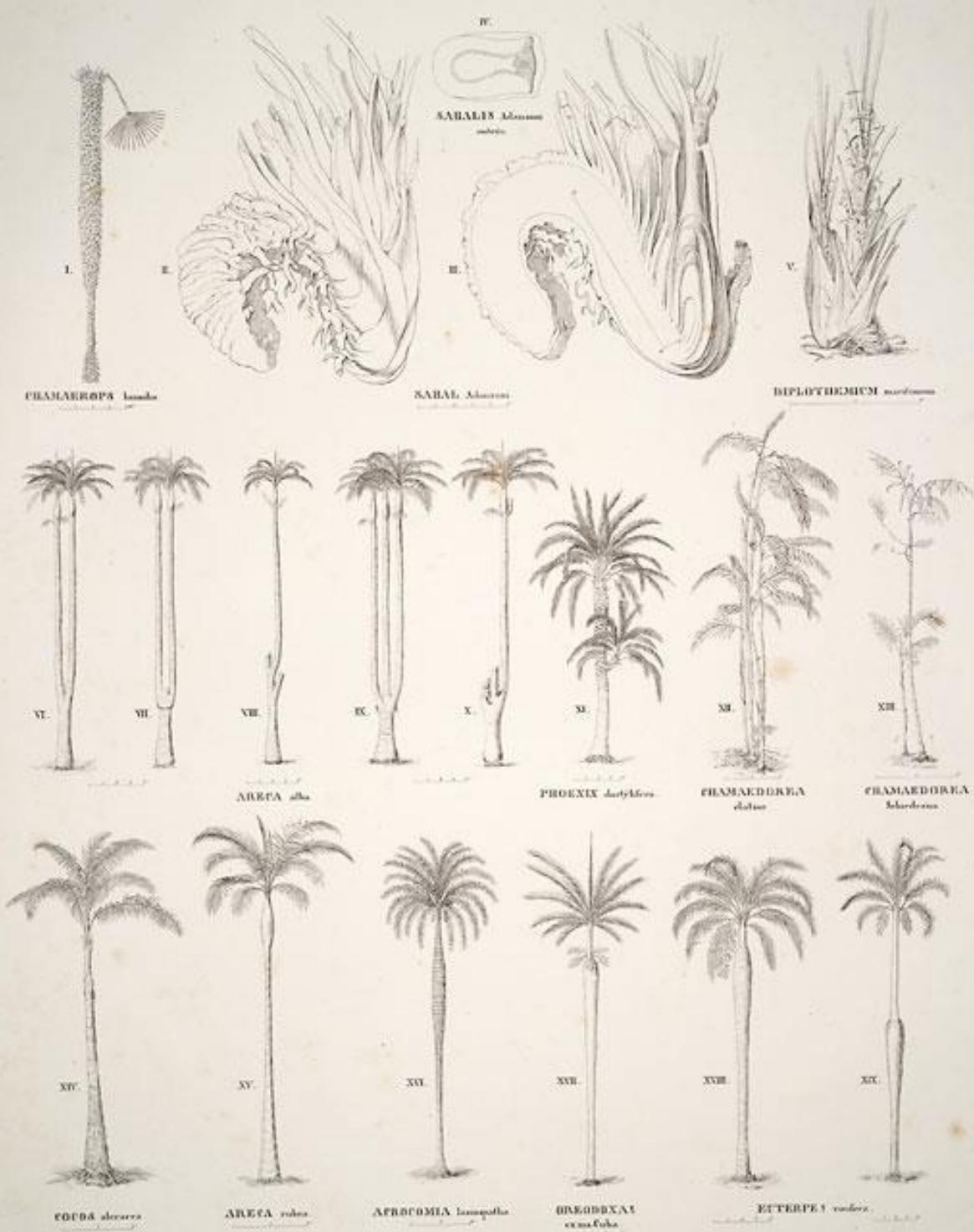


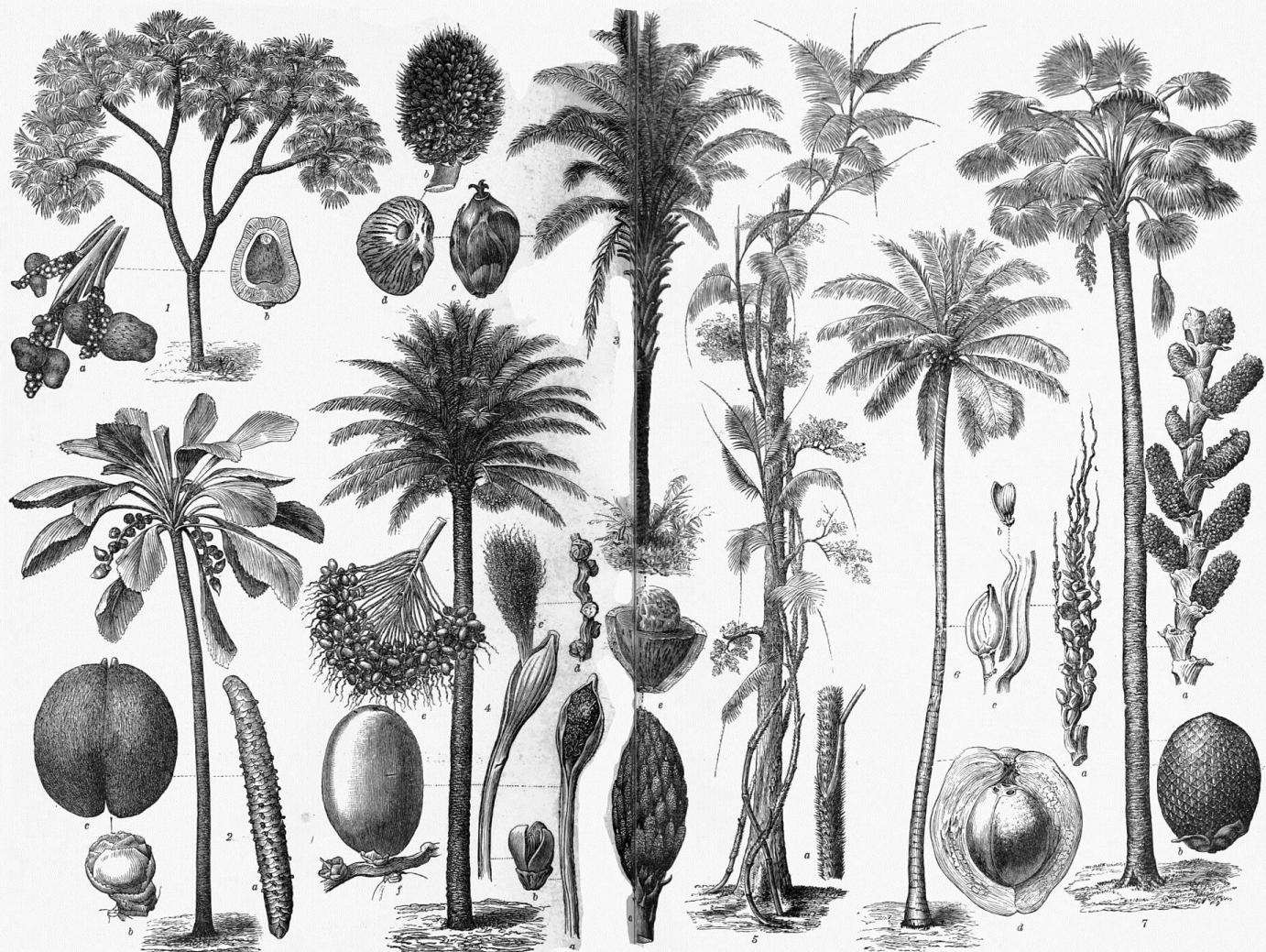
Figure 6. Une inflorescence (G. Peyron, 1994).

Les fleurs sont quasi sessiles, sans pédoncule. Elles sont portées par des pédicelles, ou épillets (figure 7). Les pédicelles sont portés par un axe charnu, la hampe, ou spadice.

L'ensemble est enveloppé dans une grande bractée membraneuse close, la spathe. Les spathes sont de forme allongée. D'une manière très générale, les spathes d'un palmier mâle sont plus courtes et plus renflées (figure 8).

Tab. Z. II.





# **PLANT DEVELOPMENT**



a



b



c



e



f



g

## Glossary fig. 2 — Habits

a, solitary (*Roystonea regia*);

b, clustered (*Chamaedorea* sp.);

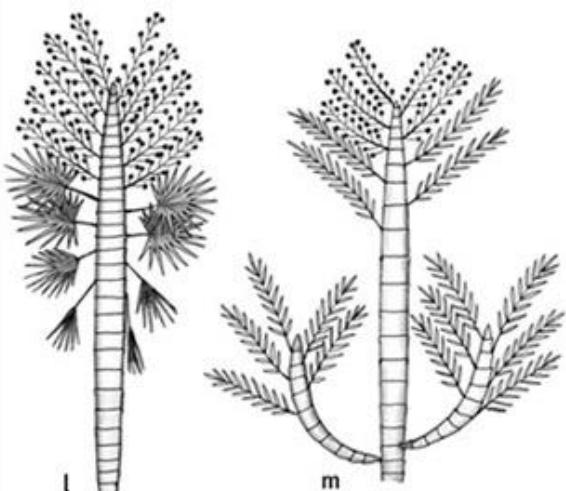
c, d, dichotomously branched (*Hyphaene coriacea*);

e, acaulescent (*Sabal etonia*);

f, decumbent (*Serenoa repens*);

g, climbing (*Korthalsia echinometra*).

**acropetal** hapaxanthic flowering

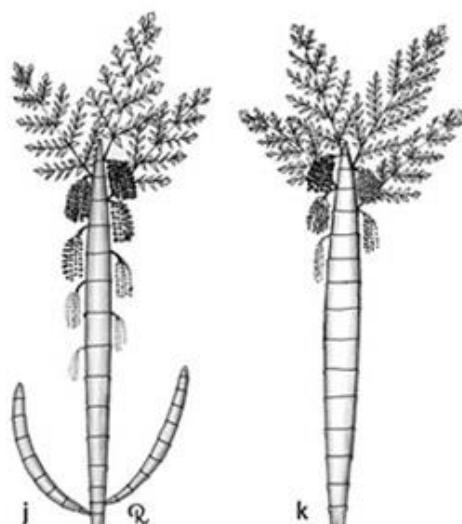


l, solitary erect stem  
(e.g. all species of *Corypha*)

m, basal branching  
(e.g. *Metroxylon sagu*)

n, aerial dichotomous branching  
and basal axillary branching,  
shrub or vine,  
(e.g. *Nannorrhops ritchiana*  
and *Korthalsia* spp.)

**basipetal** hapaxanthic flowering

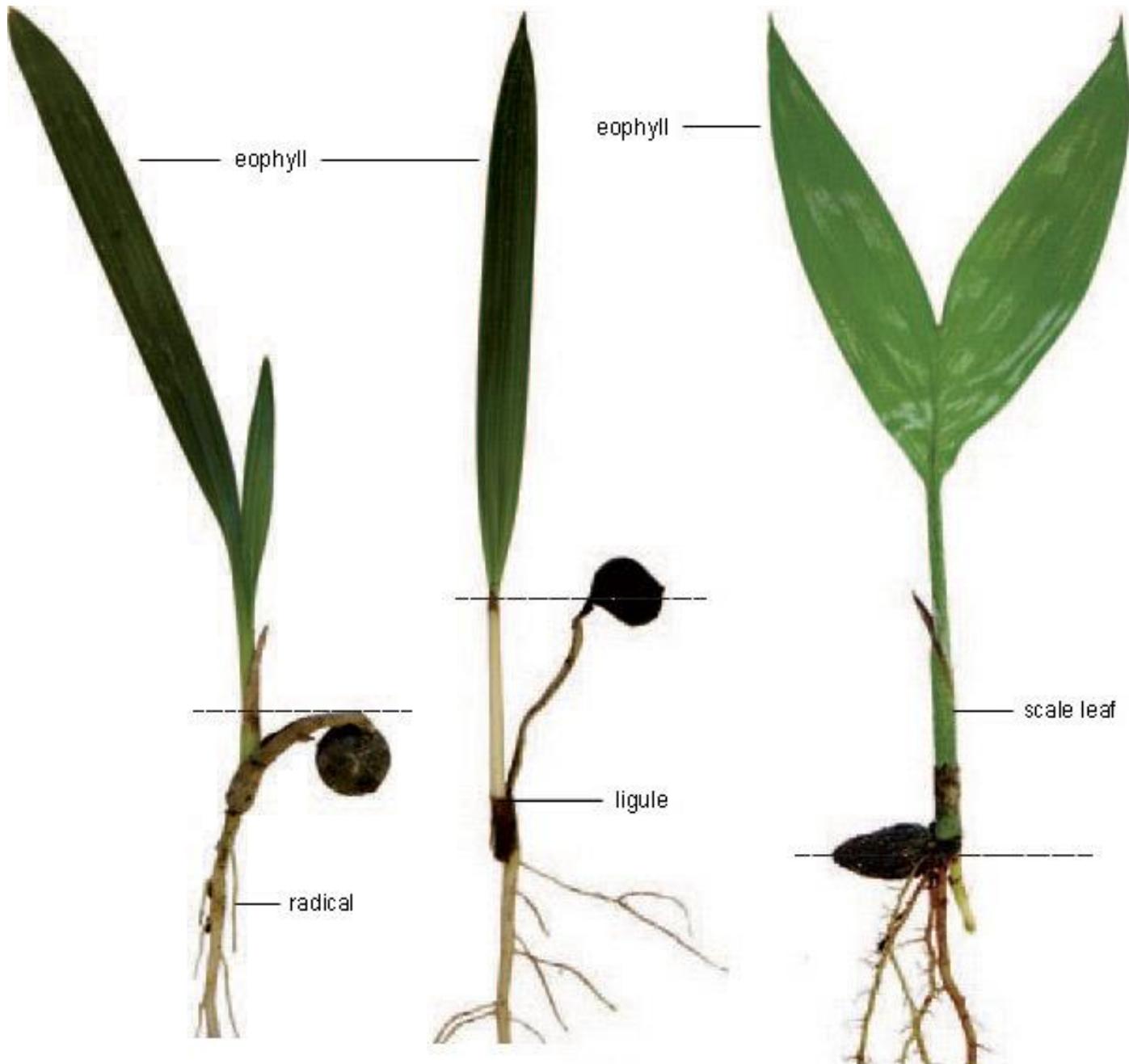


j, clustering stems  
(e.g. *Caryota mitis*)

k, solitary stem  
(e.g. *Caryota urens*)

(Drawn by Marion Ruff Sheehan)

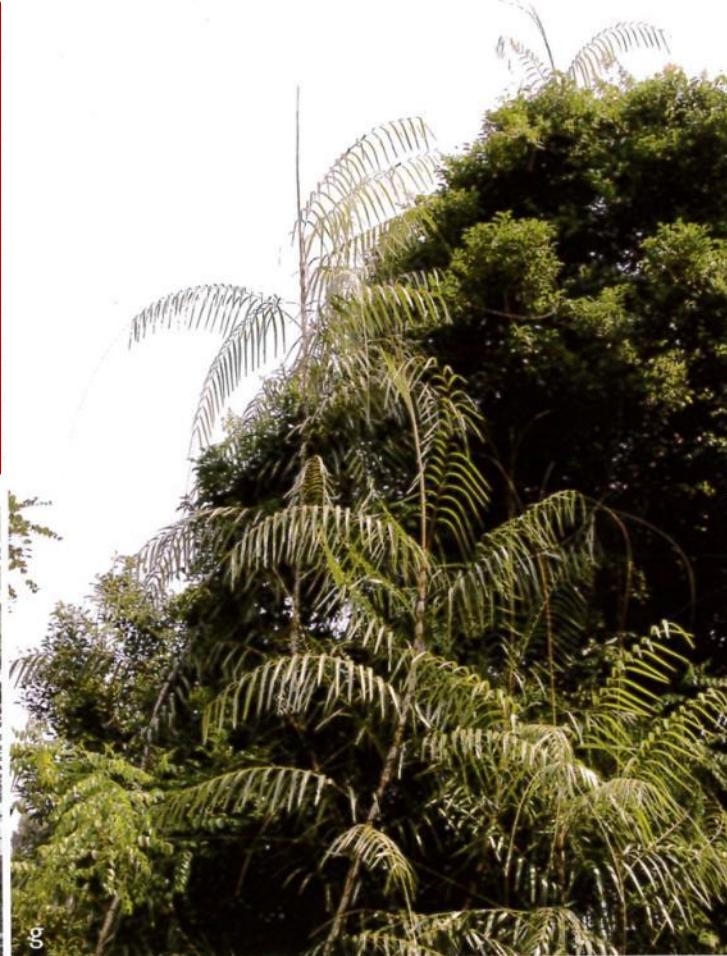
*Adjacent Ligular*  
*Remote Ligular*  
*Remote Tubular*



remote tubular  
*Coccothrinax spissa*  
(C.E. Lewis)

remote ligular  
*Sabal maritima*  
(C.E. Lewis)

adjacent ligular  
*Satakentia liukiuensis*  
(C.E. Lewis)



**acaulescent**  
(*Sabal etonia*)

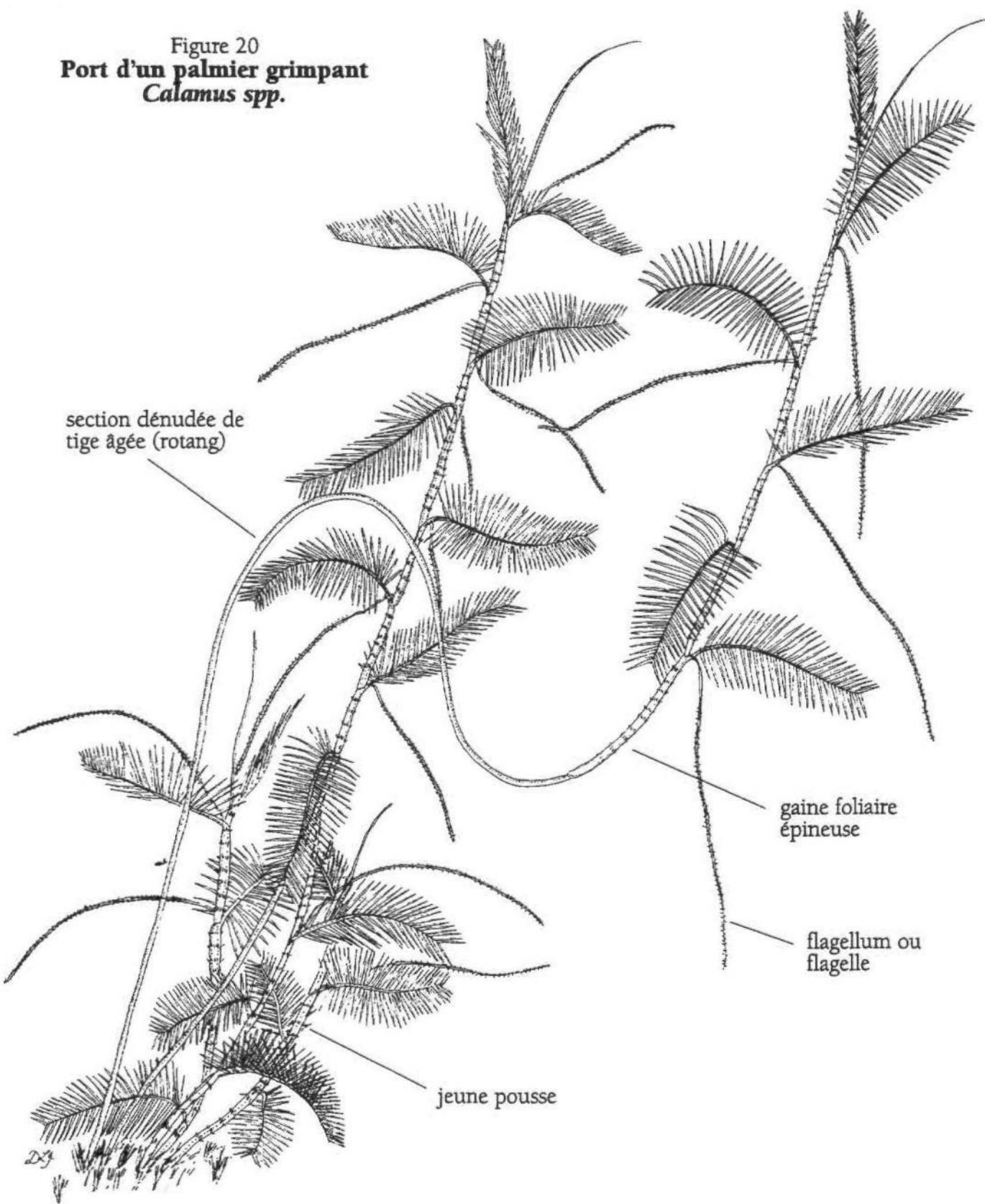


# *Kothalsia echinometra*

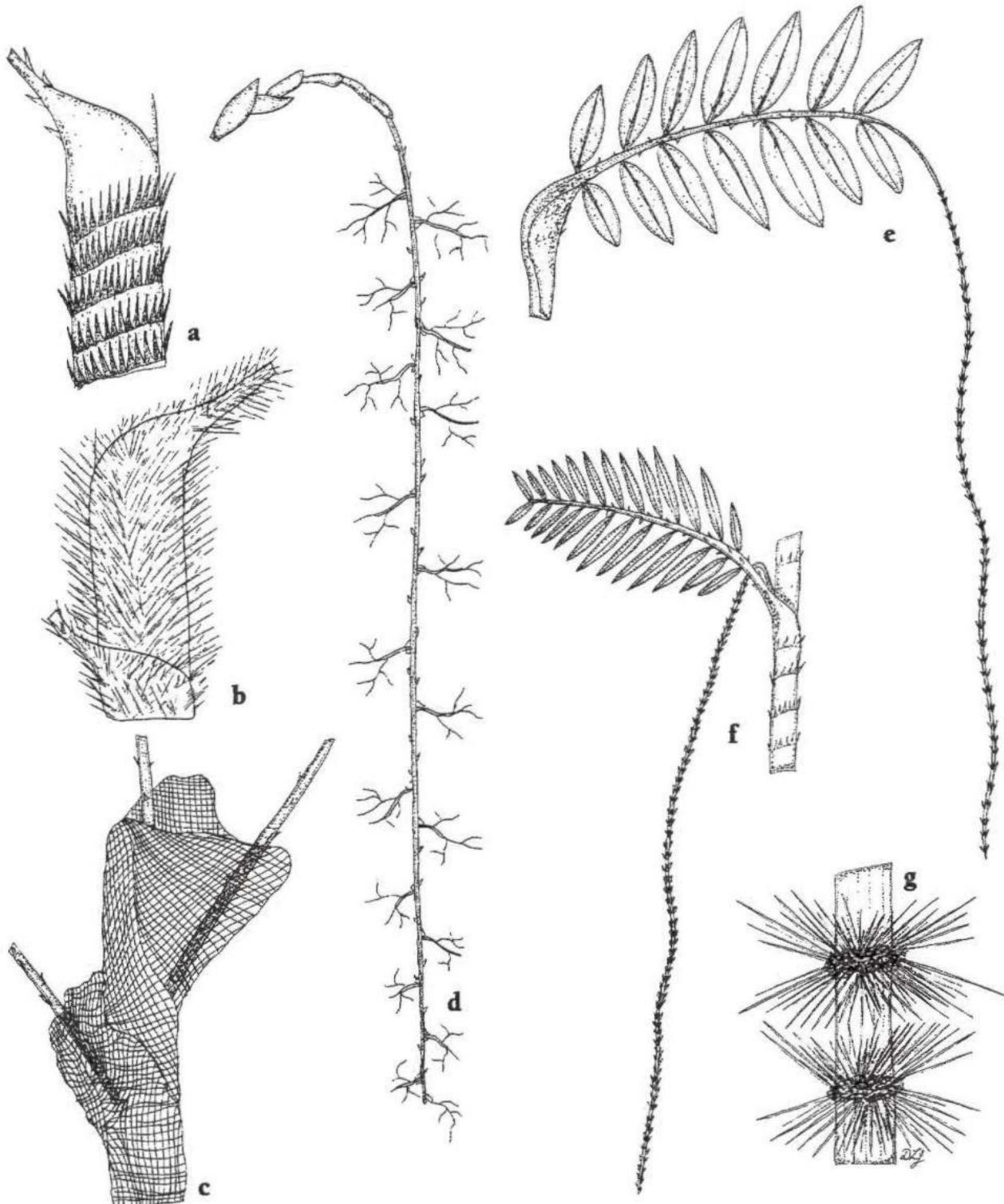
Climbing



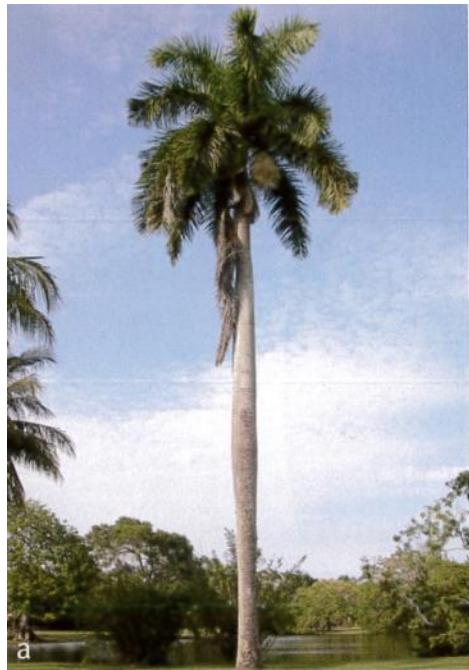
Figure 20  
Port d'un palmier grimpant  
*Calamus spp.*



## Caractères particuliers de certains palmiers grimpants



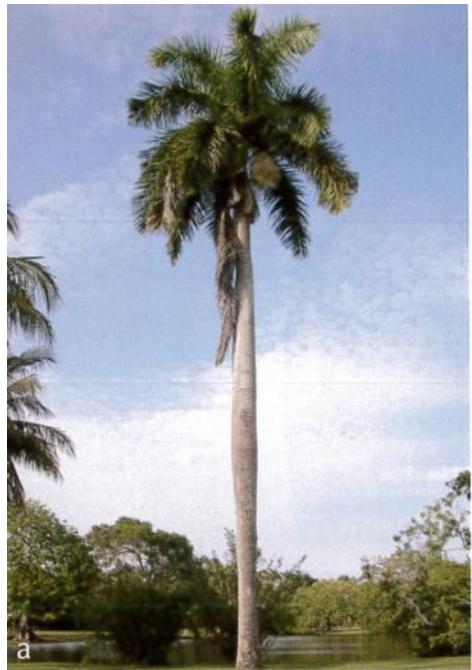
- a) verticilles d'épines hérissees sur la gaine foliaire (*Calamus moti*)
- b) nombreuses épines sur les tiges, pétioles et gaines (*Calamus radicalis*)
- c) ochréa en filet sur la gaine foliaire (*Korthalsia jala*)
- d) étroite panicule allongée, pendante, armée d'épines (*Calamus spp.*)
- e) extension du rachis en forme de fouet, appelée cirrhe (*Calamus hollrungii*)
- f) inflorescence stérile en forme de fouet, appelée flagellum ou flagelle (*Calamus australis*)
- g) verticilles de longues épines qui peuvent être colonisées par les fourmis (*Daemonorops formicaria*)



*Clustered  
Caespitose*

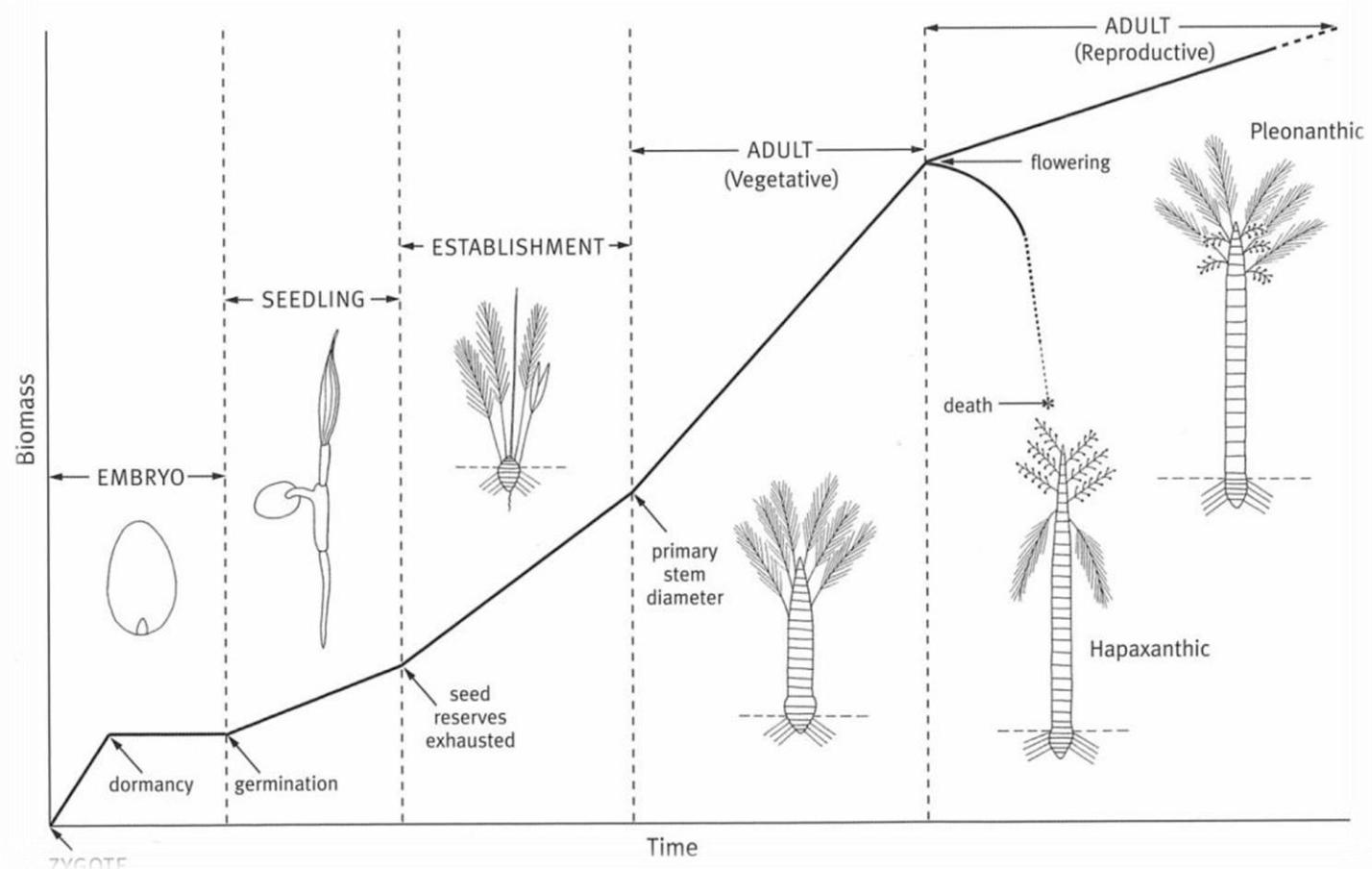
**clustered**  
*(Chamaedorea sp.)*



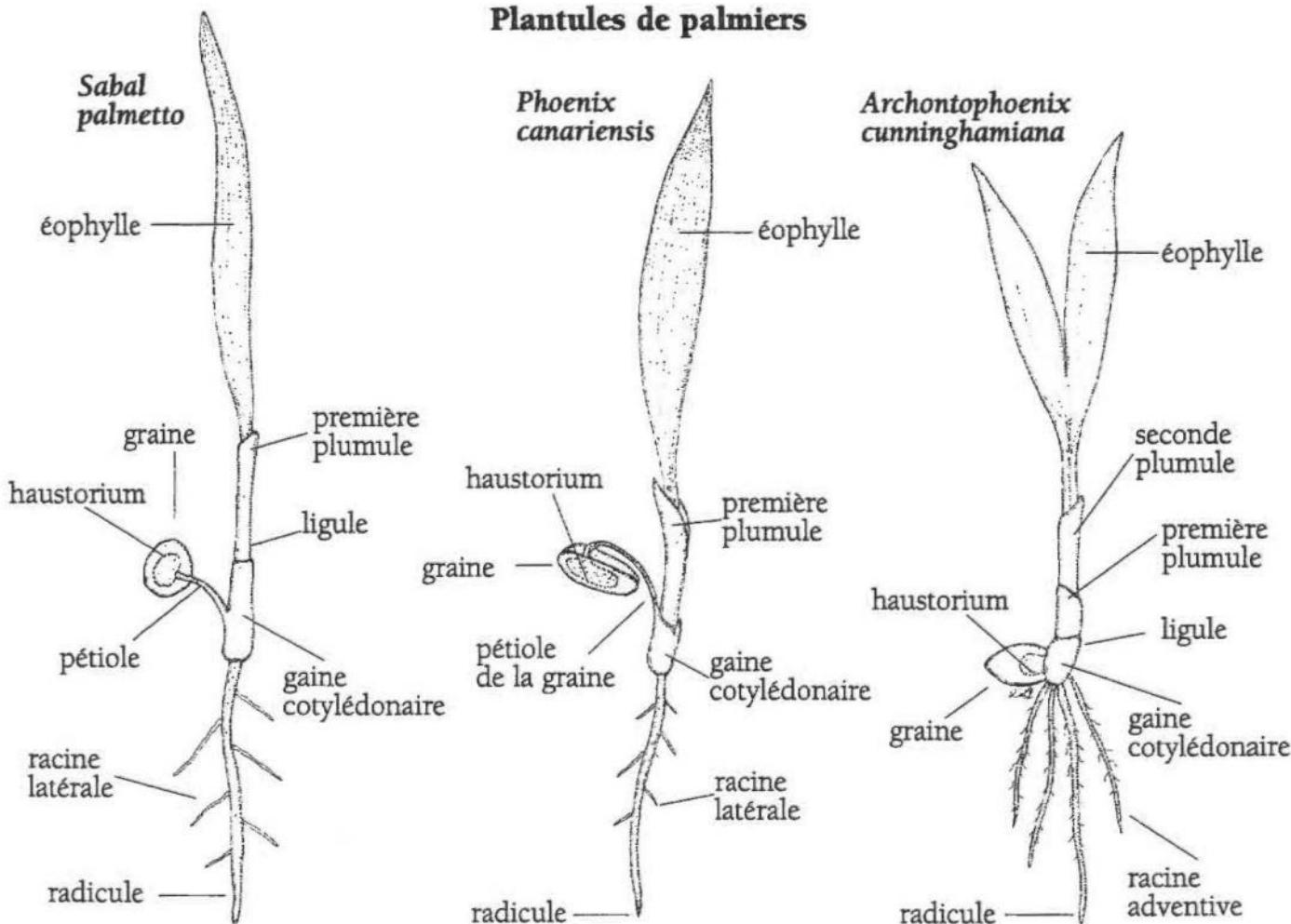


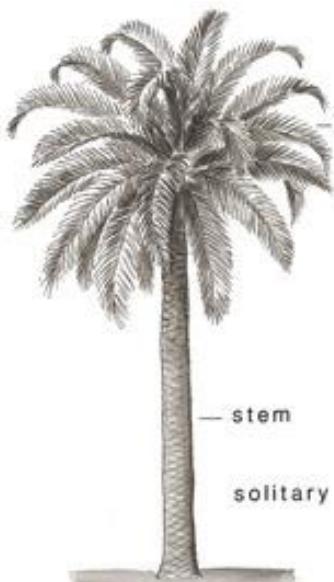
**decumbent**  
(*Serenoa repens*)





## Plantules de palmiers

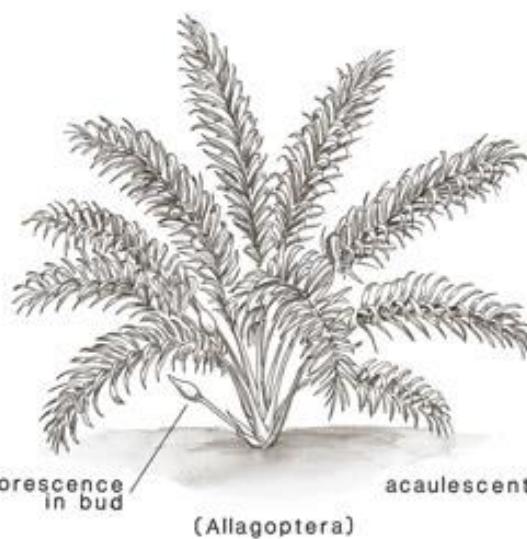




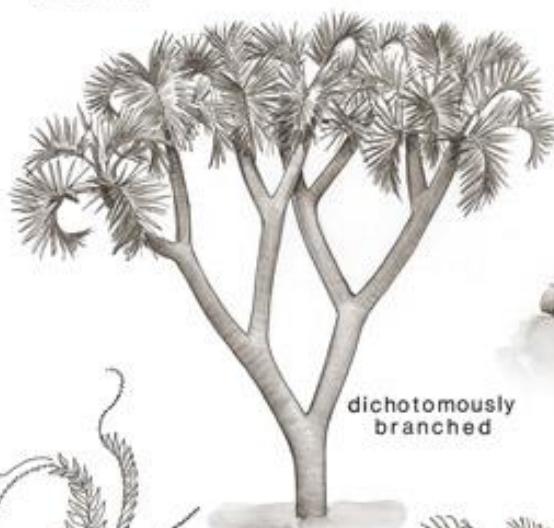
(*Phoenix*)



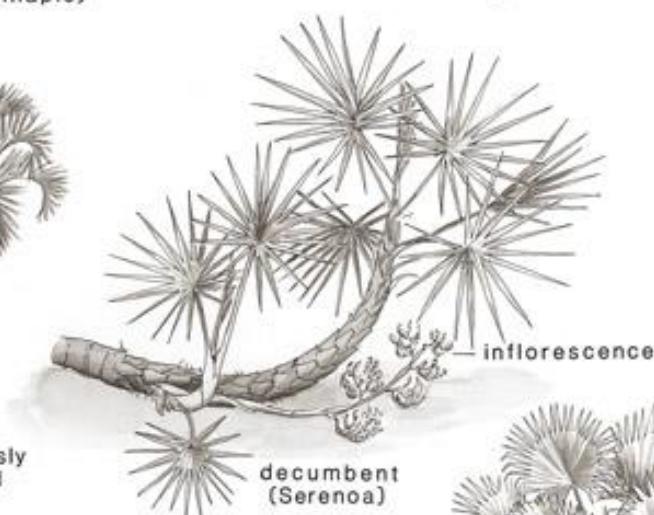
(*Rhipis*)



(*Allagoptera*)



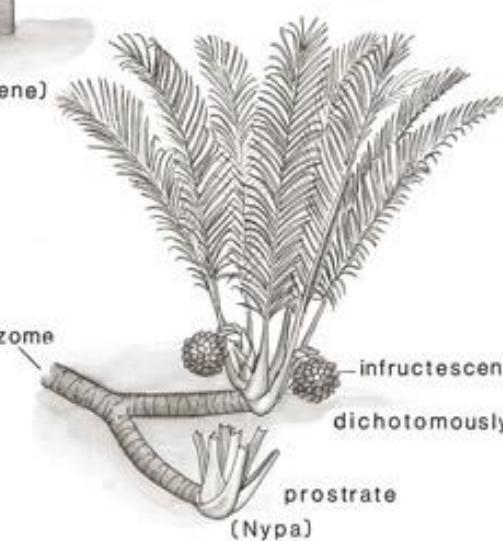
(*Hyphaene*)



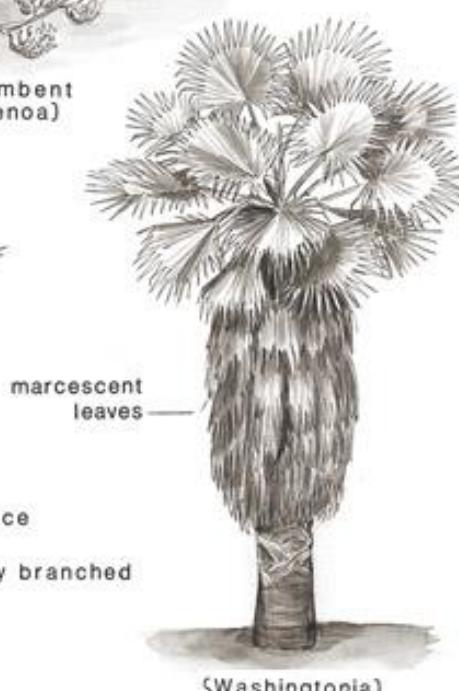
decumbent  
(*Serenoa*)



climbing  
(*Calamus*)



prostrate  
(*Nypa*)



(*Washingtonia*)

stipes multiples  
(palmier  
cespiteux),  
feuilles pennées  
(*Hydriastele* spp.)



stipe solitaire,  
feuilles palmées  
(*Trachycarpus*  
*fortunei*)



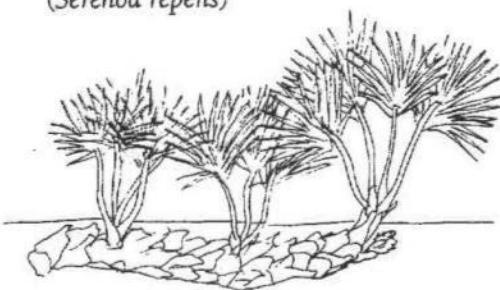
ramifications  
aériennes dichotomes  
(*Hyphaene thebaica*)



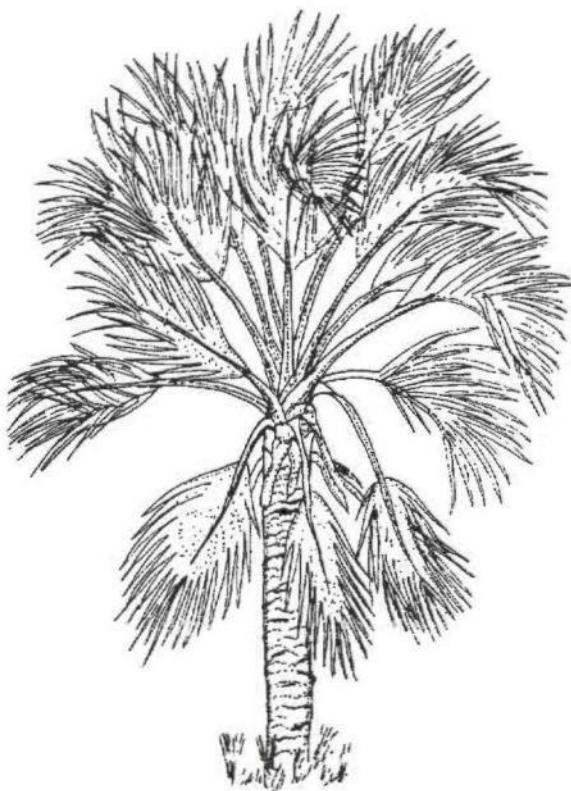
ramifications  
souterraines  
dichotomes  
(*Nypa*  
*fruticans*)



stipe souterrain,  
ramifications latérales  
(*Serenoa repens*)



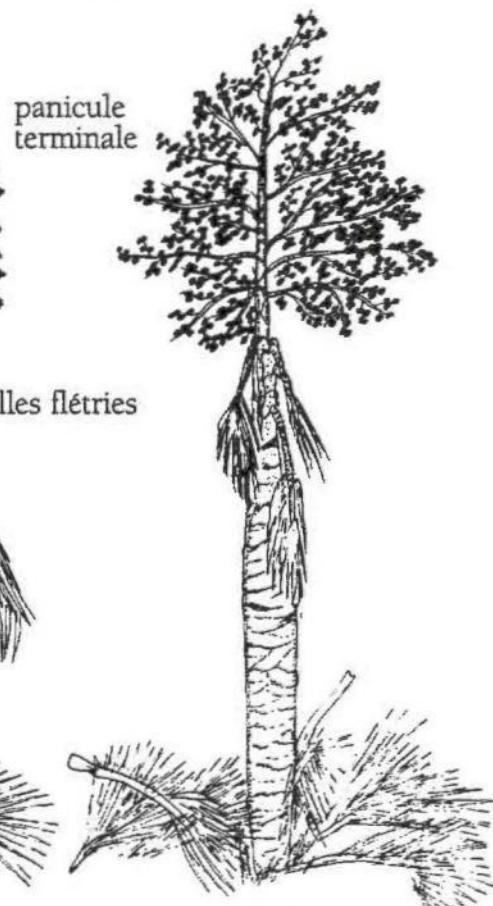
**Mode de développement monocarpique de *Corypha utan***



**plante à maturité**



**plante fleurie**



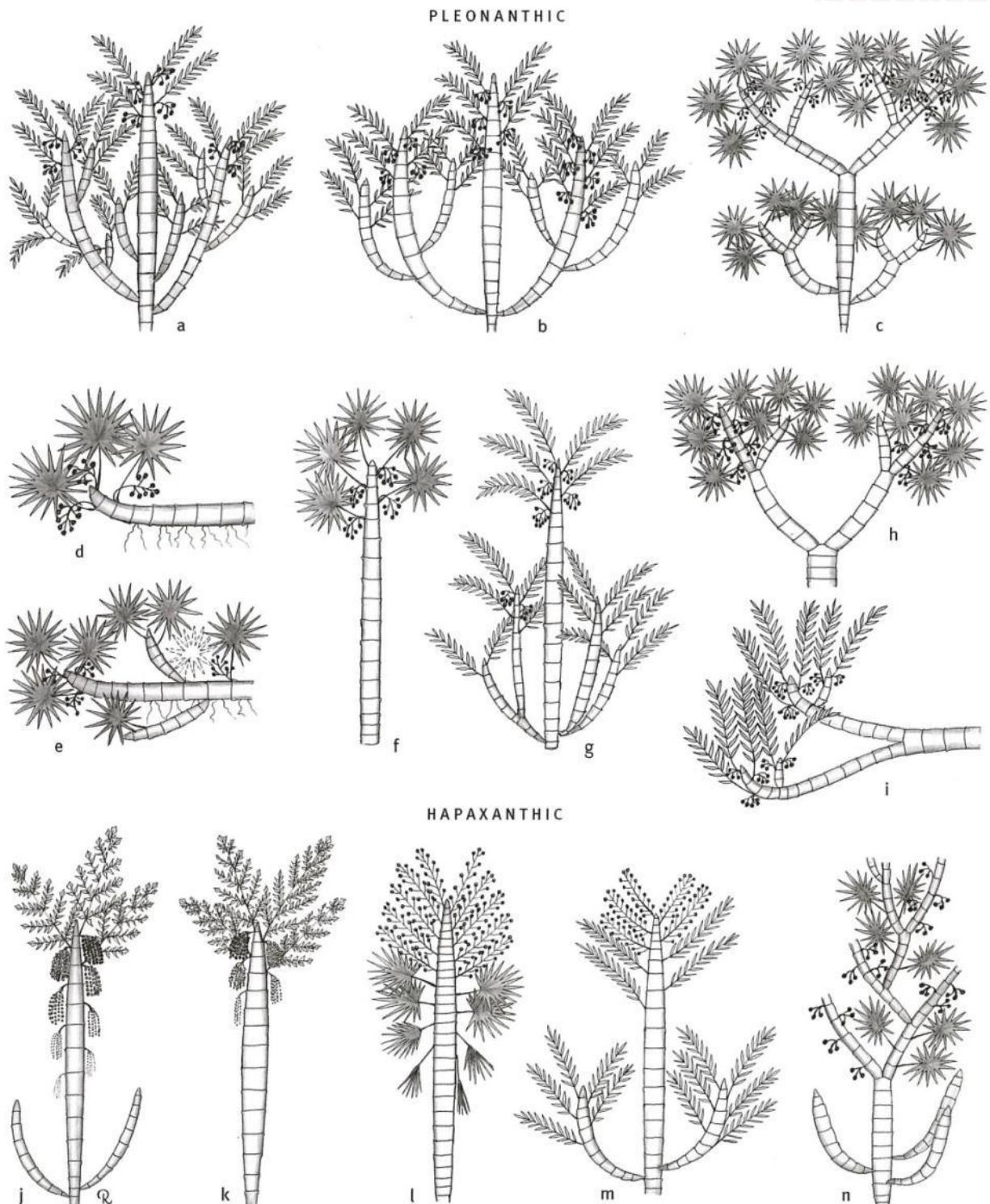
**fructification**

# Dichotomous



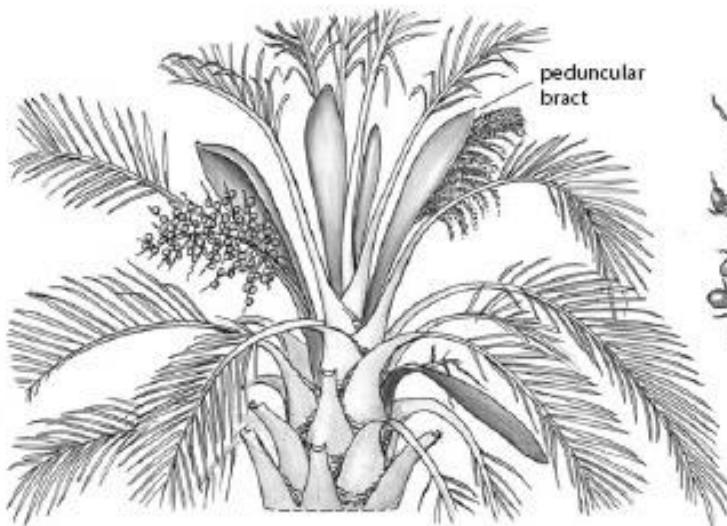
dichotomously branched (*Hyphaene coriacea*)



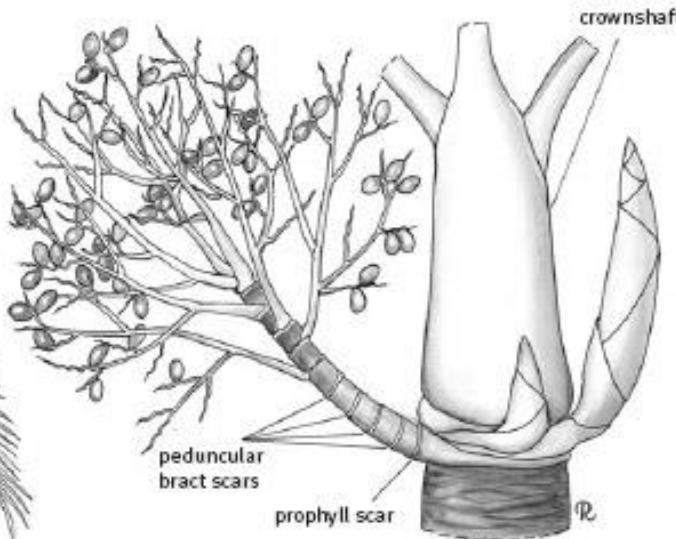


**Fig. 1.1** Diagrammatic drawings of palm architectures. **a**, non-axillary branching, e.g., *Dypsis lutescens*; **b**, colonial (clustering) by rhizome or stolon, e.g., *Bactris coloniata*, *Chamaedorea stolonifera*; **c**, dichotomous branching and basal axillary branching, e.g., *Hyphaene coriacea*; **d**, prostrate stem, e.g., *Brahea decumbens*; **e**, prostrate stem, some axillary buds producing inflorescences, others producing vegetative shoots, *Serenoa repens*; **f**, stem solitary, e.g., *Trachycarpus fortunei* and many others; **g**, stem erect or climbing, caespitose (clustering), e.g., *Chamaedorea seifrizii* and many others; **h**, erect, dichotomously branching stem, e.g., *Hyphaene compressa*; **i**, dichotomous branching in prostrate stem, e.g., *Nypa fruticans*; **j**, basipetal hapaxanthic flowering, clustering stems, e.g., *Caryota mitis*; **k**, basipetal hapaxanthic flowering, solitary stem, e.g., *Caryota urens*; **l**, acropetal hapaxanthic flowering, solitary erect stem, e.g., all species of *Corypha*; **m**, acropetal hapaxanthic flowering and basal branching, e.g., *Metroxylon sagu* (can also be acaulescent, e.g., *Eleiodoxa conferta*); **n**, acropetal hapaxanthic flowering, aerial dichotomous branching, and basal axillary branching, shrub or vine, e.g., *Nannorrhops ritchiana* and *Korthalsia* spp. (Drawn by Marion Ruff Sheehan)

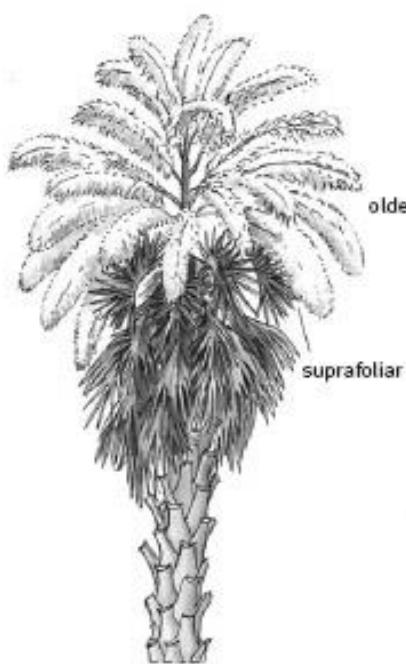
**Pleonanthic  
Hapaxanthic  
Intrafoliar  
Interfoliar**



Pleonanthic, with interfoliar inflorescences



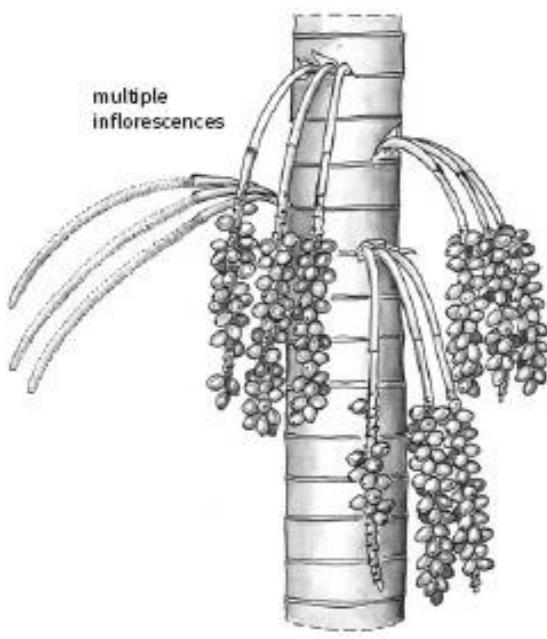
Pleonanthic with intrafoliar inflorescences



Hapaxanthic, with acropetal maturation



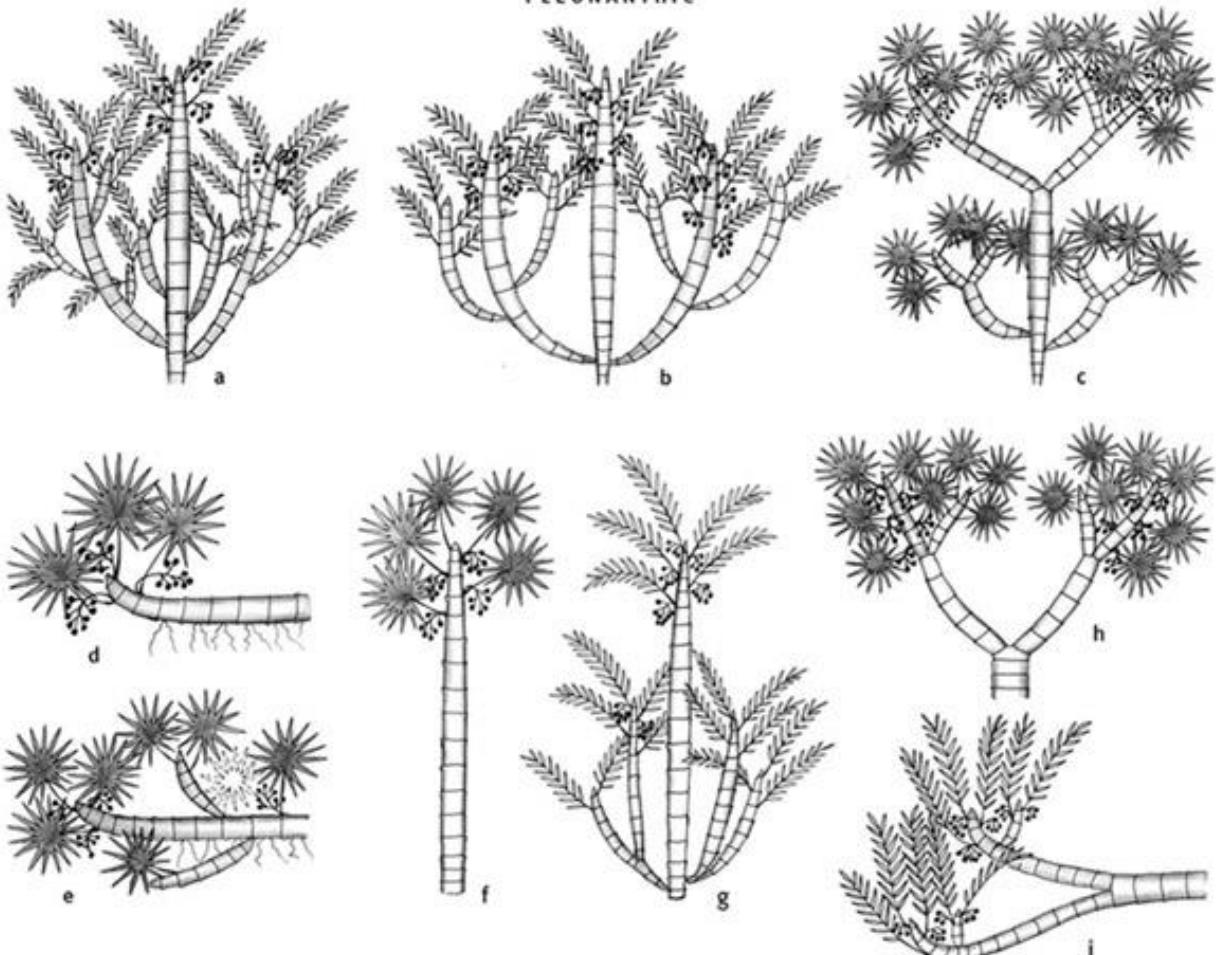
Hapaxanthic, with basipetal maturation



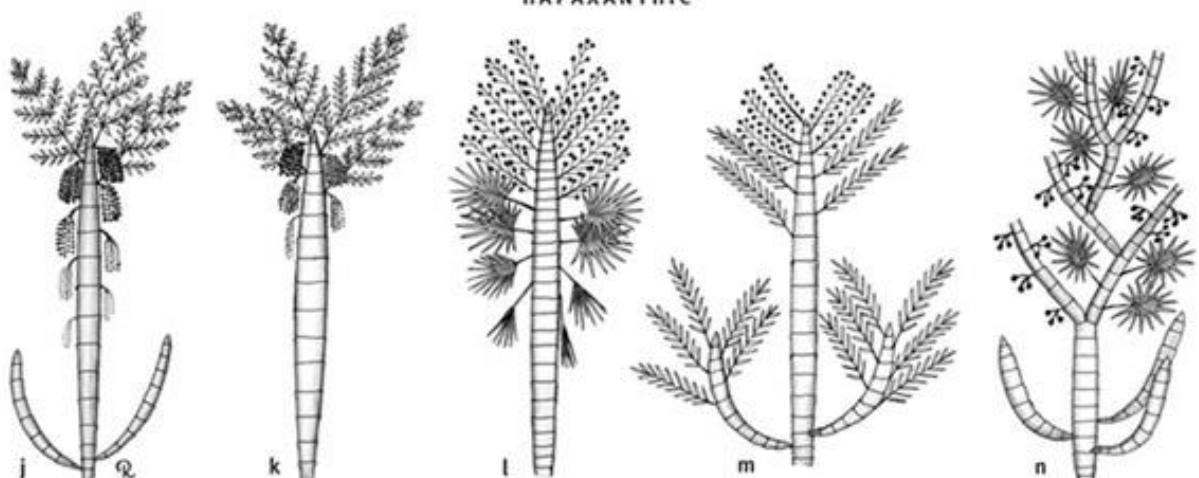
Pleonanthic, interfoliar inflorescences (becoming intrafoliar)

Variation in inflorescence presentation in palms. (Drawn by Marion Ruff Sheehan)

## PLEONANTHIC



## HAPAXANTHIC

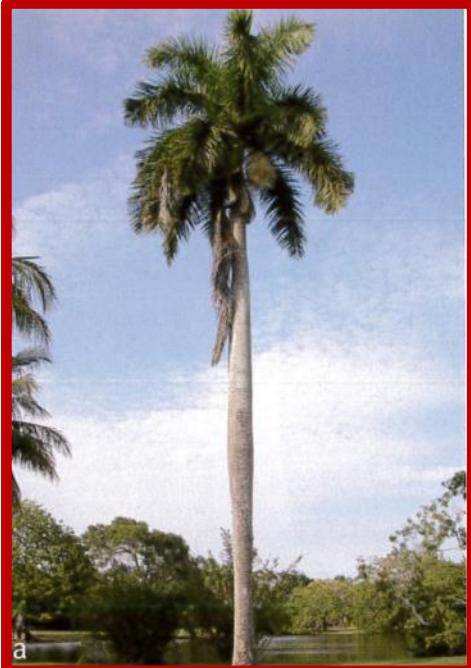


Diagrammatic drawings of palm architectures. a, non-axillary branching, e.g., *Dypsis lutescens*; b, colonial (clustering) by rhizome or stolon, e.g., *Bactris coloniata*, *Chamaedorea stolonifera*; c, dichotomous branching and basal axillary branching, e.g., *Hyphaene coriacea*; d, prostrate stem, e.g., *Brahea decumbens*; e, prostrate stem, some axillary buds producing inflorescences, others producing vegetative shoots, *Serenoa repens*; f, stem solitary, e.g., *Trachycarpus fortunei* and many others; g, stem erect or climbing, caespitose (clustering), e.g., *Chamaedorea seifrizii* and many others; h, erect, dichotomously branching stem, e.g., *Hyphaene compressa*; i, dichotomous branching in prostrate stem, e.g., *Nypa fruticans*; j, basipetal hapaxanthic flowering, clustering stems, e.g., *Caryota mitis*; k, basipetal hapaxanthic flowering, solitary stem, e.g., *Caryota urens*; l, acropetal hapaxanthic flowering, solitary erect stem, e.g., all species of *Corypha*; m, acropetal hapaxanthic flowering and basal branching, e.g., *Metroxylon sagu* (can also be acaulescent, e.g., *Eleiodoxa conferta*); n, acropetal hapaxanthic flowering, aerial dichotomous branching, and basal axillary branching, shrub or vine, e.g., *Nannorrhops ritchiana* and *Korthalsia* spp.

(Drawn by Marion Ruff Sheehan)

# *Roystonea regia*

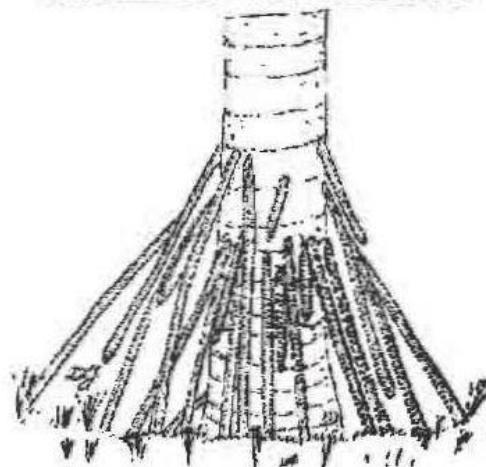
Solitary



**STEM BASE  
ROOTS**

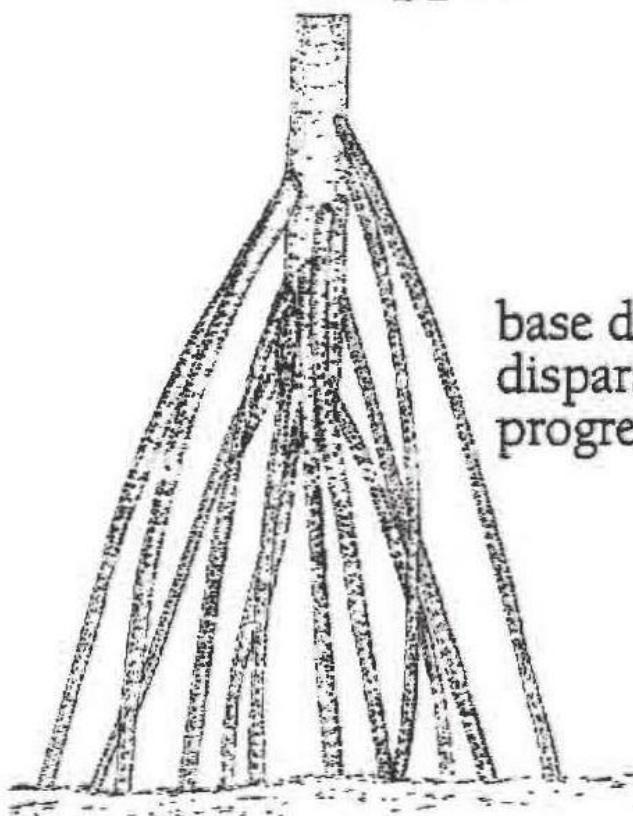
Figure 2  
**Racines aériennes des palmiers**

**racines-échasses**



(*Clinostigma gronophyllum*)

**racines-support**



base du tronc  
disparaissant  
progressivement

(*Socratea durissima*)

## Stem bases and roots



**root boss**  
*(Thrinax radiata)*

All photos C.E. Lewis

a, cylindrical (*Sabal domingensis*)

b, basally swollen (*Borassus flabellifer*)

c, ventricose (*Pseudophoenix vinifera*)

d, roots exposed (*Heterospathe elata*)

e, stilt roots (*Areca novohibernica*)

f, root boss (*Thrinax radiata*)

**Stem bases and roots**

**root boss**  
*(Thrinax radiata)*

All photos C.E. Lewis

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e, stilt roots (*Areca novohibernica*)

f, root boss (*Thrinax radiata*)

## Stem bases and roots



**still roots**  
(*Areca novohibernica*)

All photos C.E. Lewis

a, cylindrical (*Sabal domingensis*)

b, basally swollen (*Borassus flabellifer*)

c, ventricose (*Pseudophoenix vinifera*)

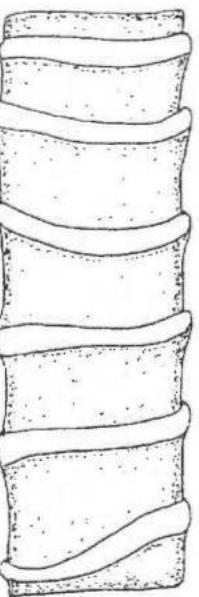
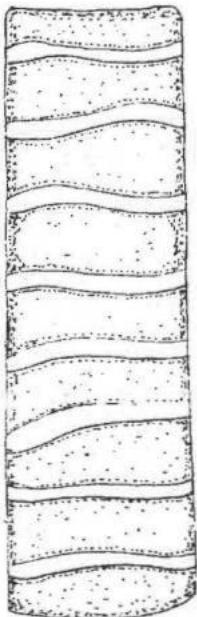
d, roots exposed (*Heterospathe elata*)

e, stilt roots (*Areca novohibernica*)

f, root boss (*Thrinax radiata*)

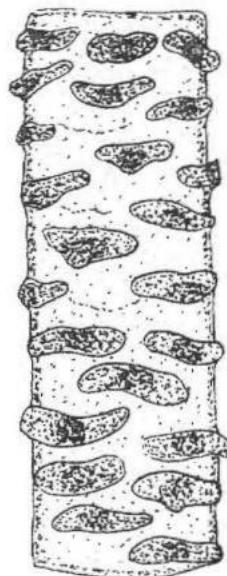
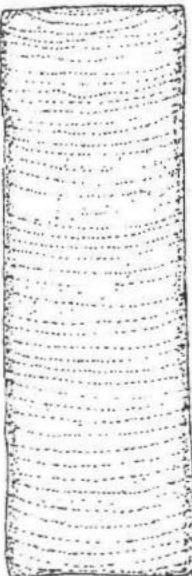
# **STEM**

anneaux de croissance distincts, tronc lisse (*Howea belmoreana*)

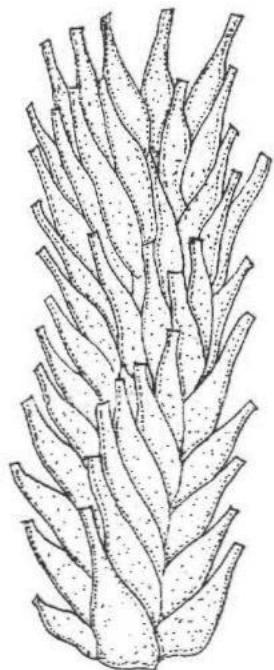


anneaux de croissance à crêtes proéminentes (*Archontophoenix alexandrae*)

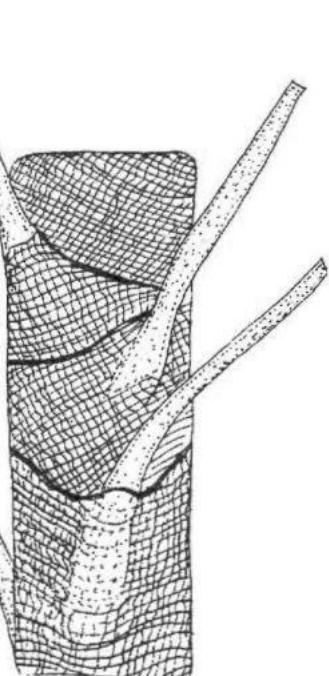
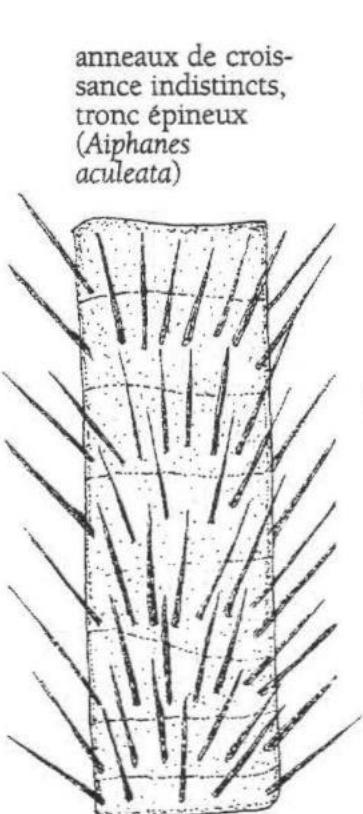
anneaux de croissance indistincts, tronc lisse (*Veitchia merrillii*)



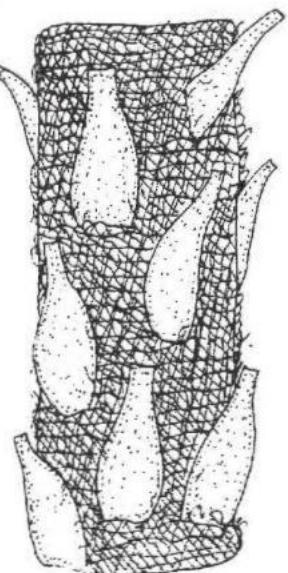
bases foliaires persistantes (*Syagrus coronata*)



anneaux de croissance indistincts, tronc épineux (*Aiphanes aculeata*)



tige bambusiforme, racines aériennes (*Chamaedorea elegans*)



bases foliaires persistantes, à gaines fibreuses chevauchantes (*Rapis excelsa*)

bases foliaires persistantes, gaines fibreuse entière (*Trachycarpus fortunei*)



a, cylindrical (*Sabal domingensis*)  
b, basally swollen (*Borassus flabellifer*)  
c, ventricose (*Pseudophoenix vinifera*)

## Stems



**root spines**  
(*Cryosophila stauracantha*)

**root spines**  
(*Mauritiella armata*)

All photos C.E. Lewis

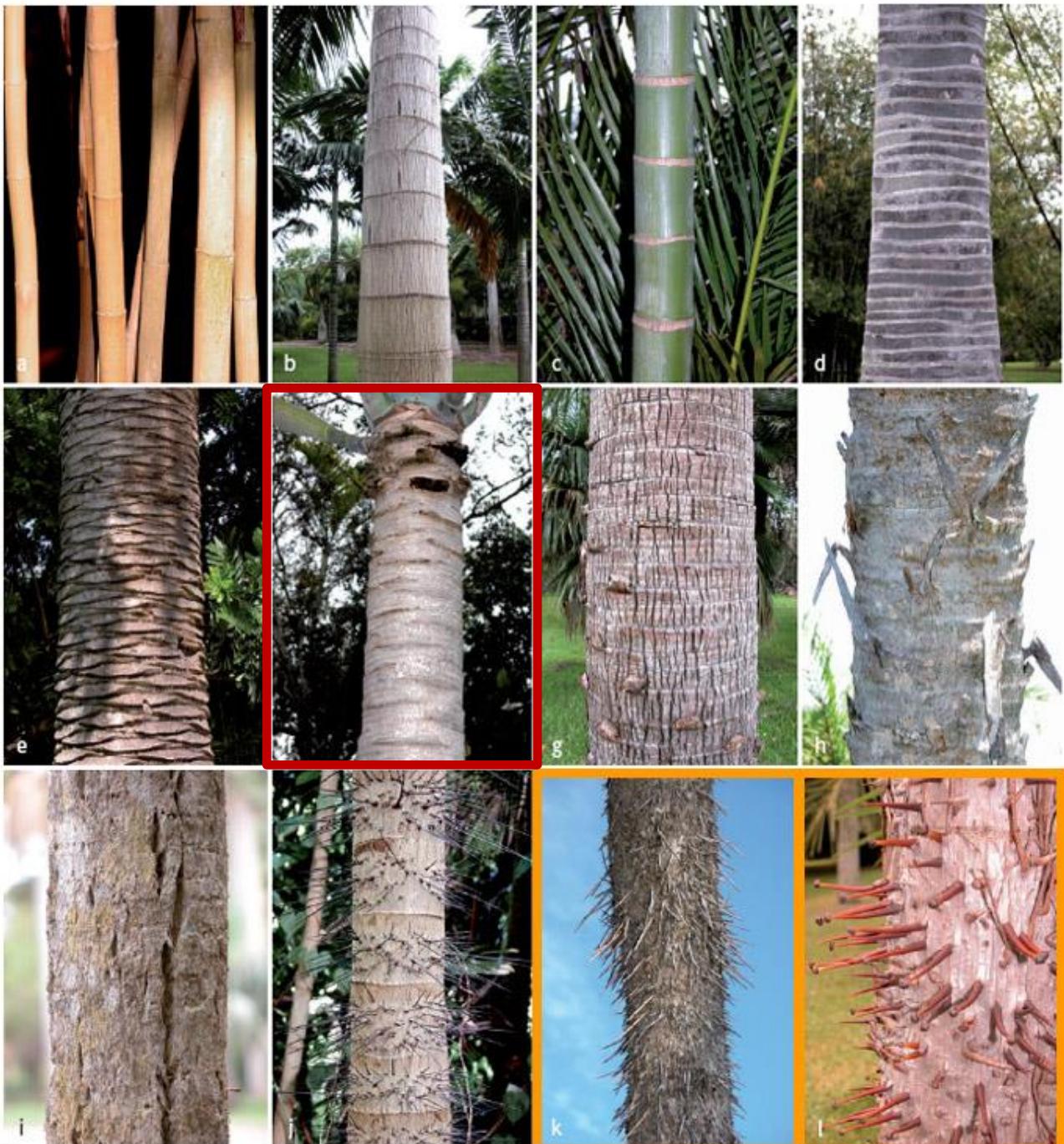
- a, reed-like (*Geonoma* sp.)
- b, ringed (*Veitchia joannis*)
- c, ringed (*Dypsis lutescens*)
- d, obliquely ringed (*Borassus aethiopum*)
- e, large flat scars (*Phoenix canariensis*)
- f, inflorescence scars (*Hyophorbe verschaffeltii*)

- g, striate (*Sabal dominicensis*)
- h, rough-ringed with eroding leaf bases (*Sabal mexicana*)
- i, corky (*Schippia concolor*)
- j, spiny (*Aiphanes aculeata*)
- k, rootspines (*Cryosophila stauracantha*)
- l, root spines (*Mauritiella armata*)



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b, basally swollen (*Borassus flabellifer*)  
c, ventricose (*Pseudophoenix vinifera*)

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(*Cryosophila stauracantha*)

root spines  
(*Mauritiella armata*)

All photos C.E. Lewis

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**root spines**  
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All photos C.E. Lewis

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- h, rough-ringed with eroding leaf bases (*Sabal mexicana*)
- i, corky (*Schippia concolor*)
- j, spiny (*Aiphanes aculeata*)
- k, rootspines (*Cryosophila stauracantha*)
- l, root spines (*Mauritiella armata*)

## Stems



All photos C.E. Lewis

- a, reed-like (*Geonoma* sp.)
- b, ringed (*Veitchia joannis*)
- c, ringed (*Dypsis lutescens*)
- d, obliquely ringed (*Borassus aethiopum*)
- e, large flat scars (*Phoenix canariensis*)
- f, inflorescence scars (*Hyophorbe verschaffeltii*)

- g, striate (*Sabal dominicensis*)
- h, rough-ringed with eroding leaf bases (*Sabal mexicana*)
- i, corky (*Schippia concolor*)
- j, spiny (*Aiphanes aculeata*)
- k, rootspines (*Cryosophila stauracantha*)
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All photos C.E. Lewis

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 b, ringed (*Veitchia joannis*)  
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 j, spiny (*Aiphanes aculeata*)  
 k, rootspines (*Cryosophila stauracantha*)  
 l, root spines (*Mauritiella armata*)

All photos C.E. Lewis

## Stems



**root spines**  
(*Cryosophila stauracantha*)

**root spines**  
(*Mauritiella armata*)

All photos C.E. Lewis

- a, reed-like (*Geonoma* sp.)
- b, ringed (*Veitchia joannis*)
- c, ringed (*Dypsis lutescens*)
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- k, rootspines (*Cryosophila stauracantha*)
- l, root spines (*Mauritiella armata*)

# Root Spines



*Mauritiella armata* (C.E. Lewis)



*Cryosophila stauracantha* (C.E. Lewis)

## Stems



- a, reed-like (*Geonoma* sp.)
- b, ringed (*Veitchia joannis*)
- c, ringed (*Dypsis lutescens*)
- d, obliquely ringed (*Borassus aethiopum*)
- e, large flat scars (*Phoenix canariensis*)
- f, inflorescence scars (*Hyophorbe verschaffeltii*)

- g, striate (*Sabal domingensis*)
- h, rough-ringed with eroding leaf bases (*Sabal mexicana*)
- i, corky (*Schippia concolor*)
- j, spiny (*Aiphanes aculeata*)
- k, rootspines (*Cryosophila stauracantha*)
- l, root spines (*Mauritiella armata*)

All photos C.E. Lewis

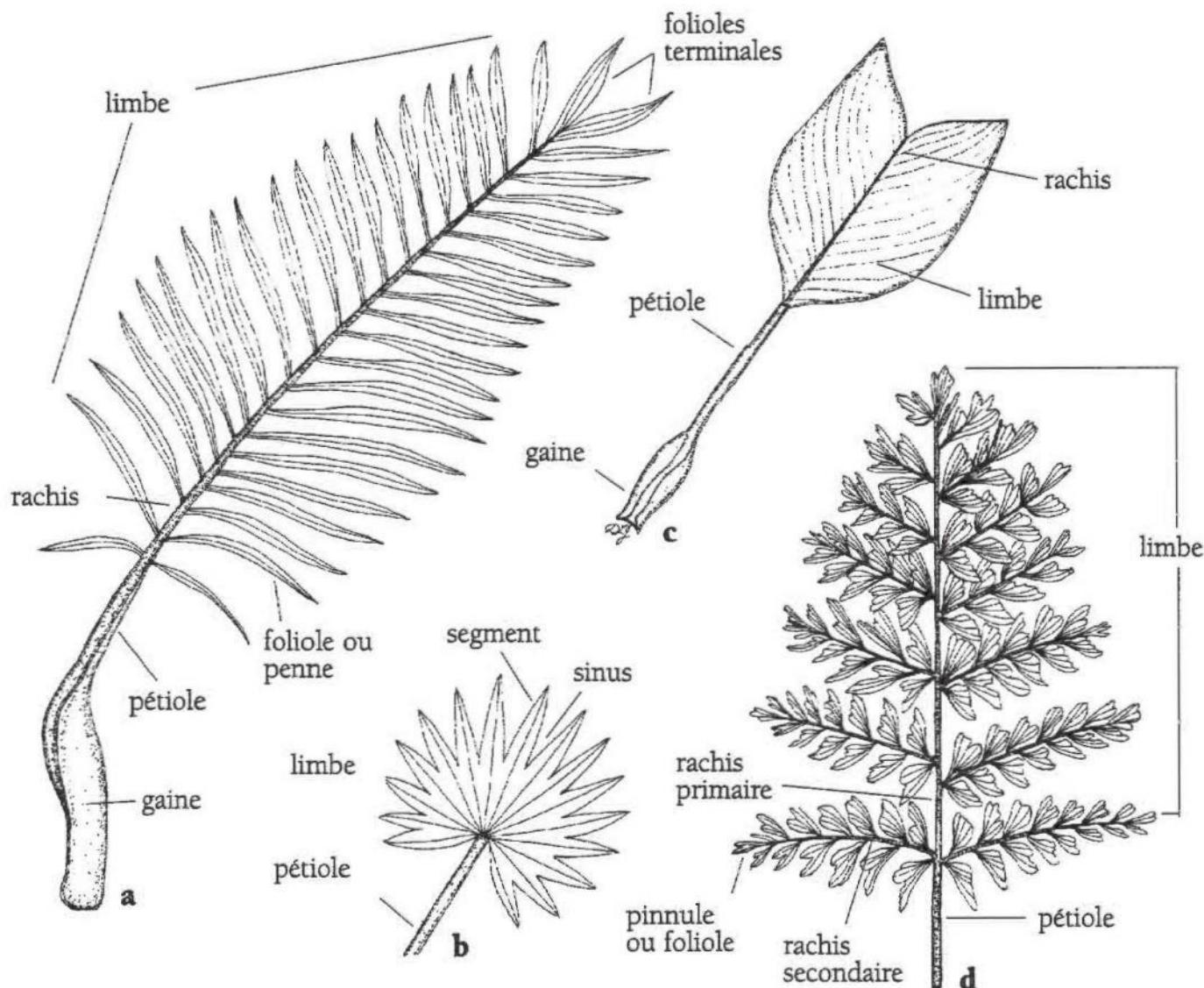


*Sabal domingensis* (C.E. Lewis)



*Pseudophoenix vinifera* (C.E. Lewis)

# LEAVES



a) pennée *Archontophoenix cunninghamiana*  
 b) palmée ou flabellée *Sabal minora*

c) entière *Chamaedorea geometriformis*  
 d) bipennée *Caryota mitis*



*Pinnate*  
(*Chamaedorea tepejilote*)



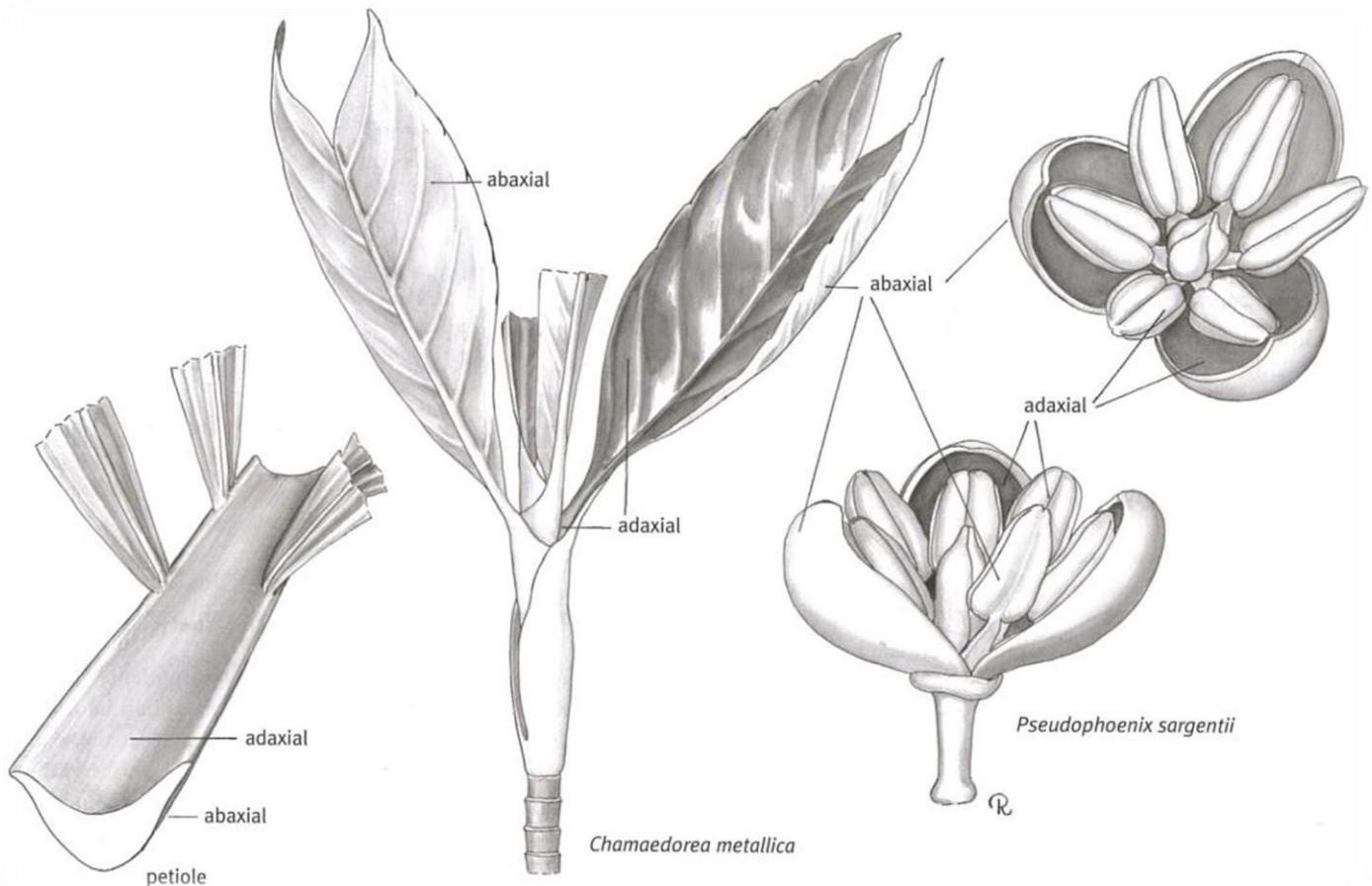
*Palmate*  
(*Coccothrinax jamaicensis*)

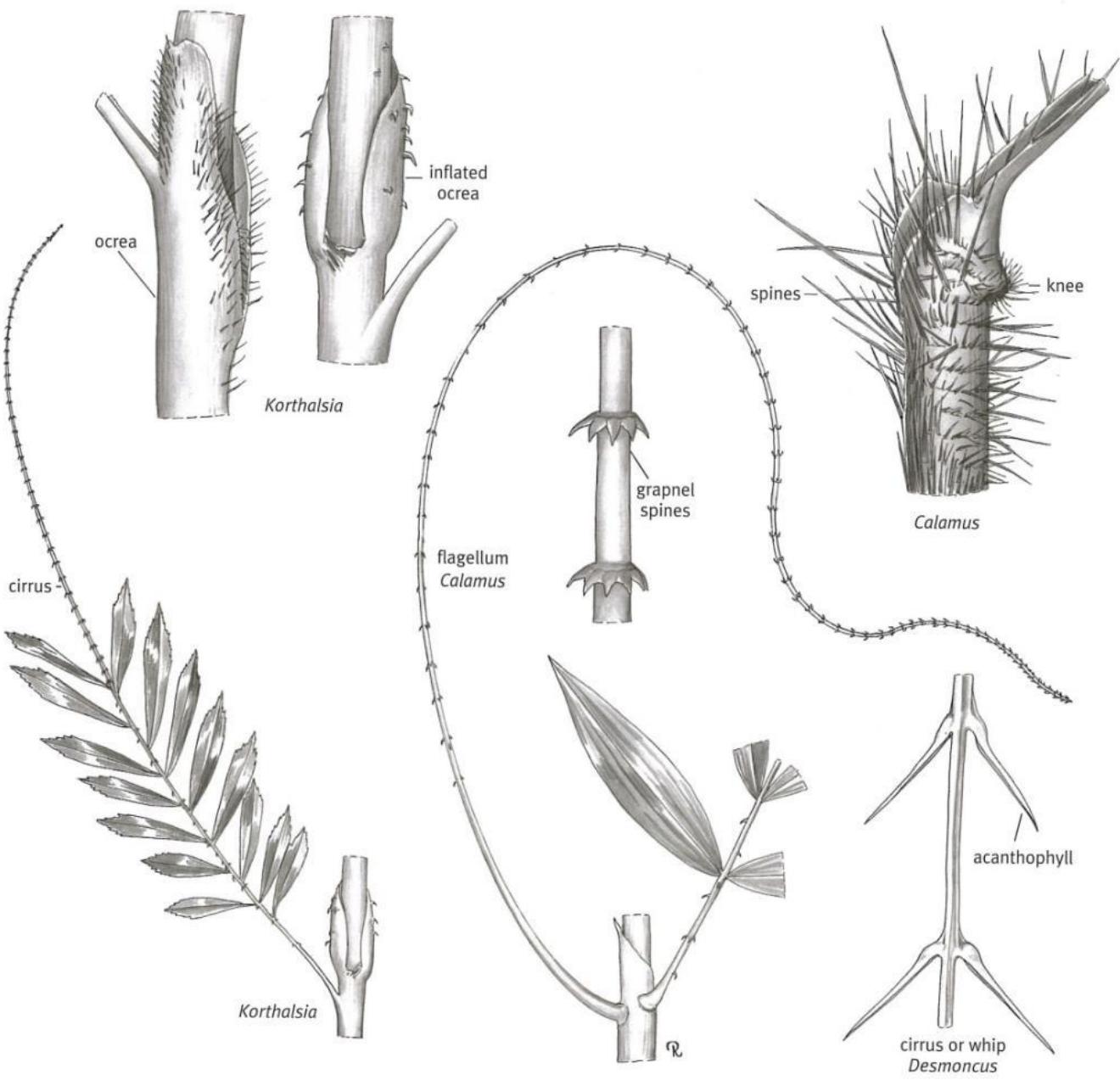
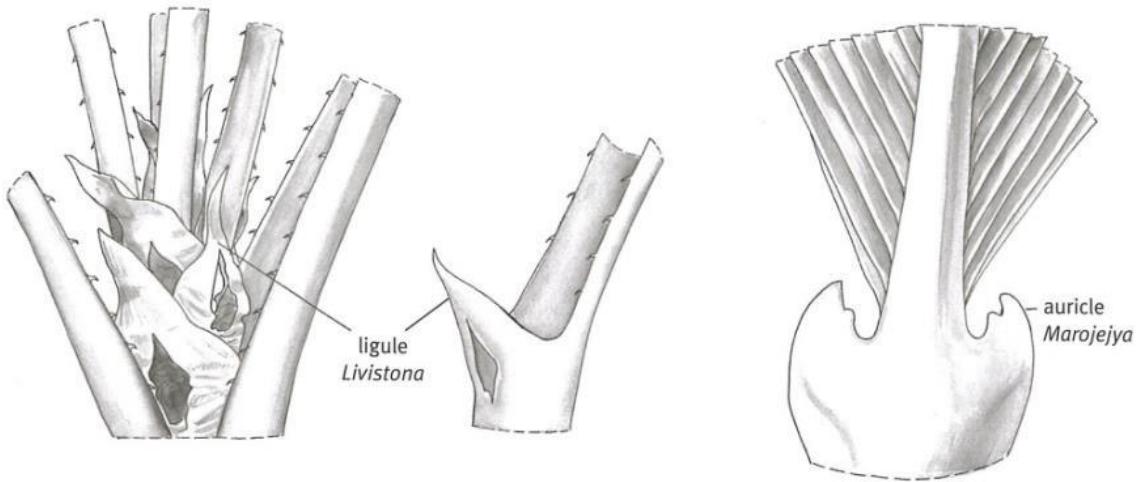


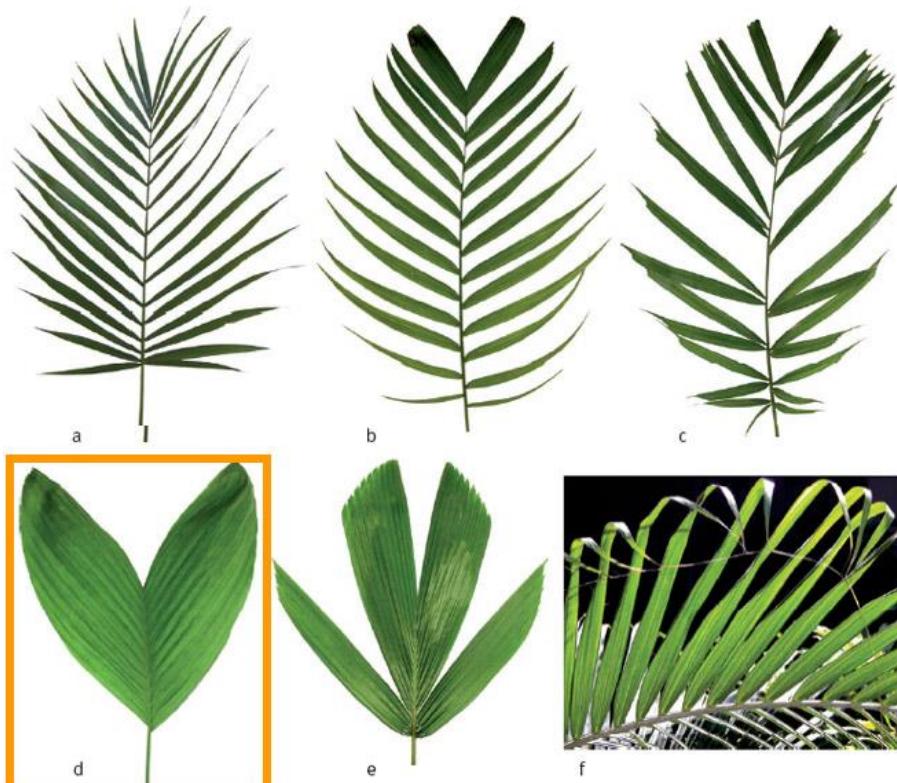
*Bipinnate*  
(*Caryota mitis*)



*Costapalmate*  
(*Sabal maritima*)







**bifid**

(*Chamaedorea brachypoda*)

All photos C.E. Lewis

a, leaflets subopposite (*Chamaedorea radicalis*)

b, distichous paripinnate (*Pinanga dicksonii*)

c, irregularly pinnate (*Ptychosperma microcarpum*)

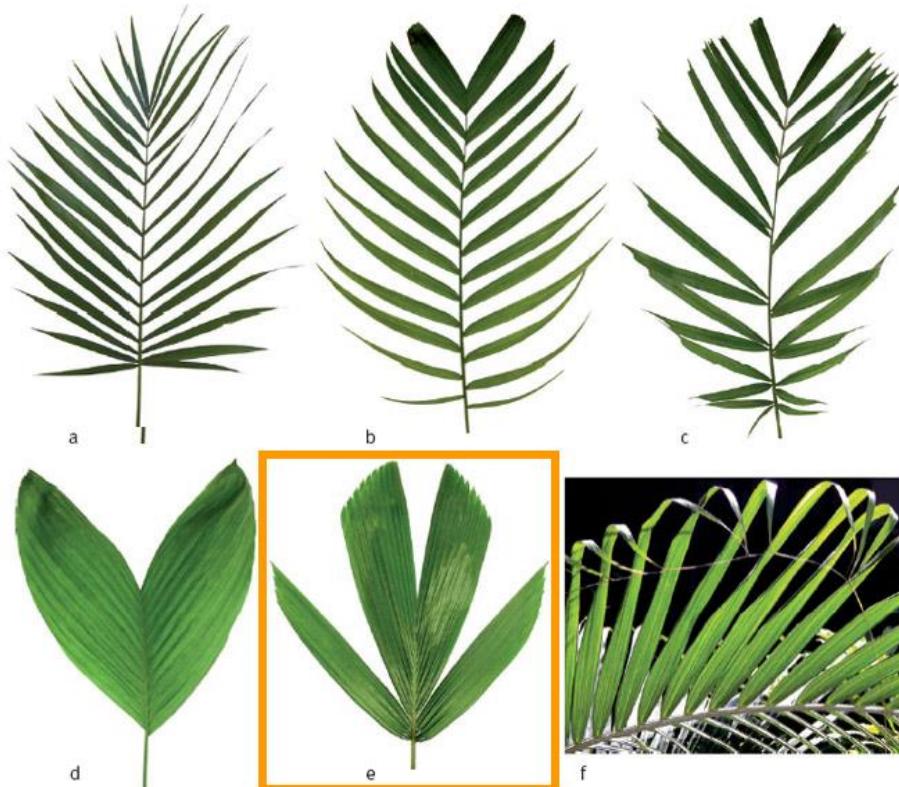
d, bifid (*Chamaedorea brachypoda*)

e, bijugate (*Reinhardtia latisecta*)

f, leaflets joined by marginal rein (*Dictyosperma album*)



*Chamaedorea brachypoda* (C.E. Lewis)



**bijugate**  
(*Reinhardtia latisecta*)

All photos C.E. Lewis

a, leaflets subopposite (*Chamaedorea radicalis*)  
b, distichous paripinnate (*Pinanga dicksonii*)  
c, irregularly pinnate (*Ptychosperma microcarpum*)

d, bifid (*Chamaedorea brachypoda*)  
e, bijugate (*Reinhardtia latisecta*)  
f, leaflets joined by marginal rein (*Dictyosperma album*)



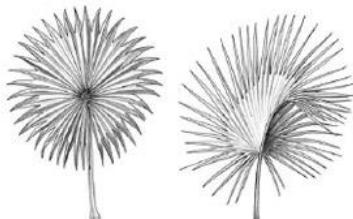
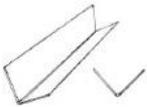
*Reinhardtia latisecta* (C.E. Lewis)

# Major leaf forms and splitting types

across subfamilies of palms

Bipinnate

## INDUPPLICATE LEAVES



palmate  
Coryphoideae

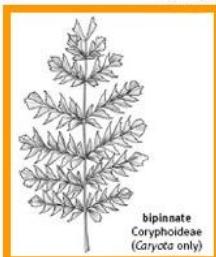
costapalmate  
Coryphoideae



entire (palmate)  
Coryphoideae  
(Licuala and Johannesteijsmannia only)



pinnate  
Coryphoideae  
(Phoenix, Arenga and Wallitchia only)



bipinnate  
Coryphoideae  
(Caryota only)

## REDUPLICATE LEAVES



pinnate  
Coryphoideae  
Nypoideae  
Ceroxyloideae  
Arecoideae



entire bifid (pinnate)  
Calamoideae  
Arecoideae



costapalmate  
Calamoideae  
(Mauritiinae only)

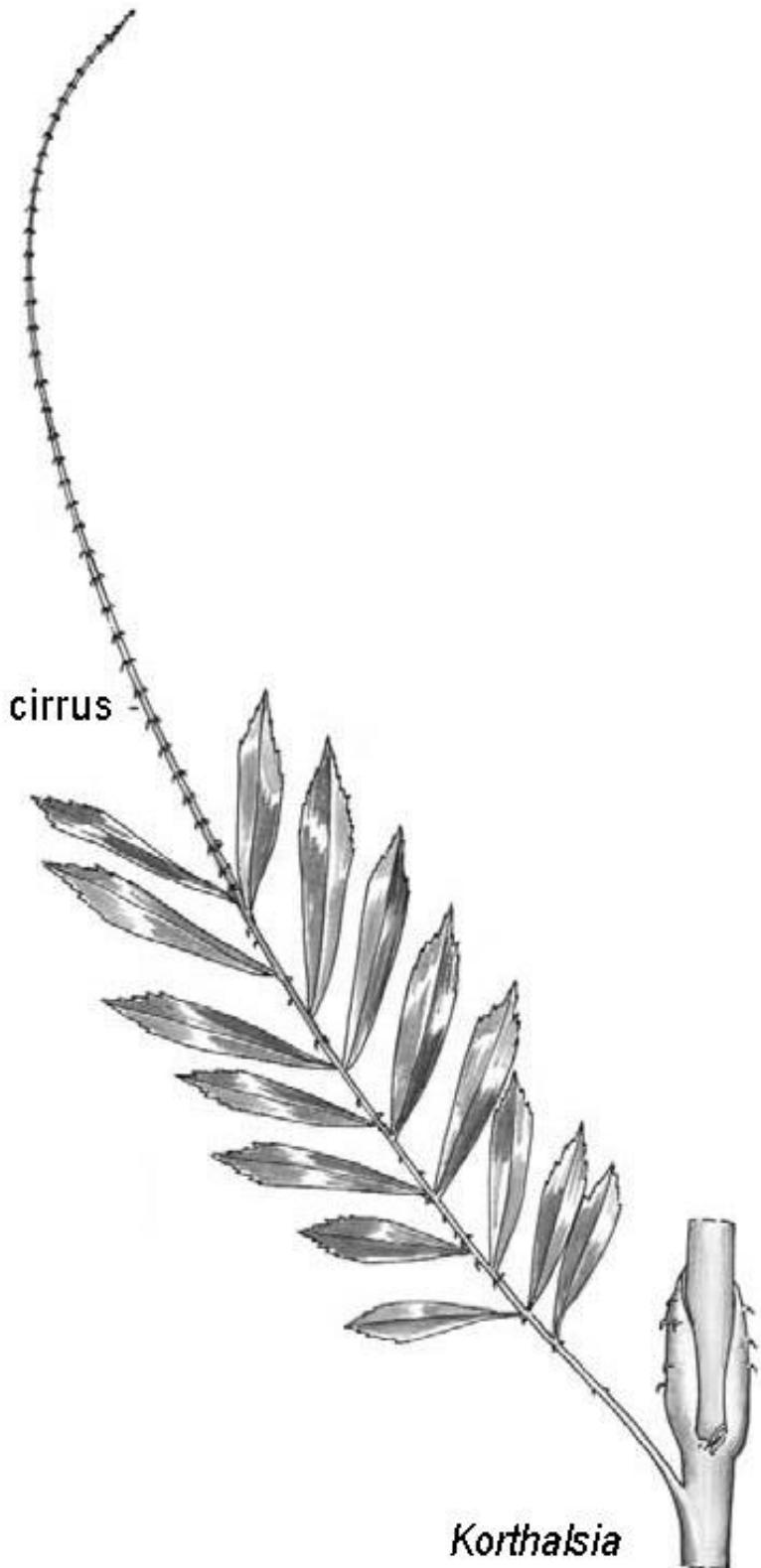


palmate  
Calamoideae  
(Mauritiinae only)  
Coryphoideae  
(Guilihaia only)



Caryota mitis (C.E. Lewis)

*Cirrate*  
*Cirrus*  
*see Whip*

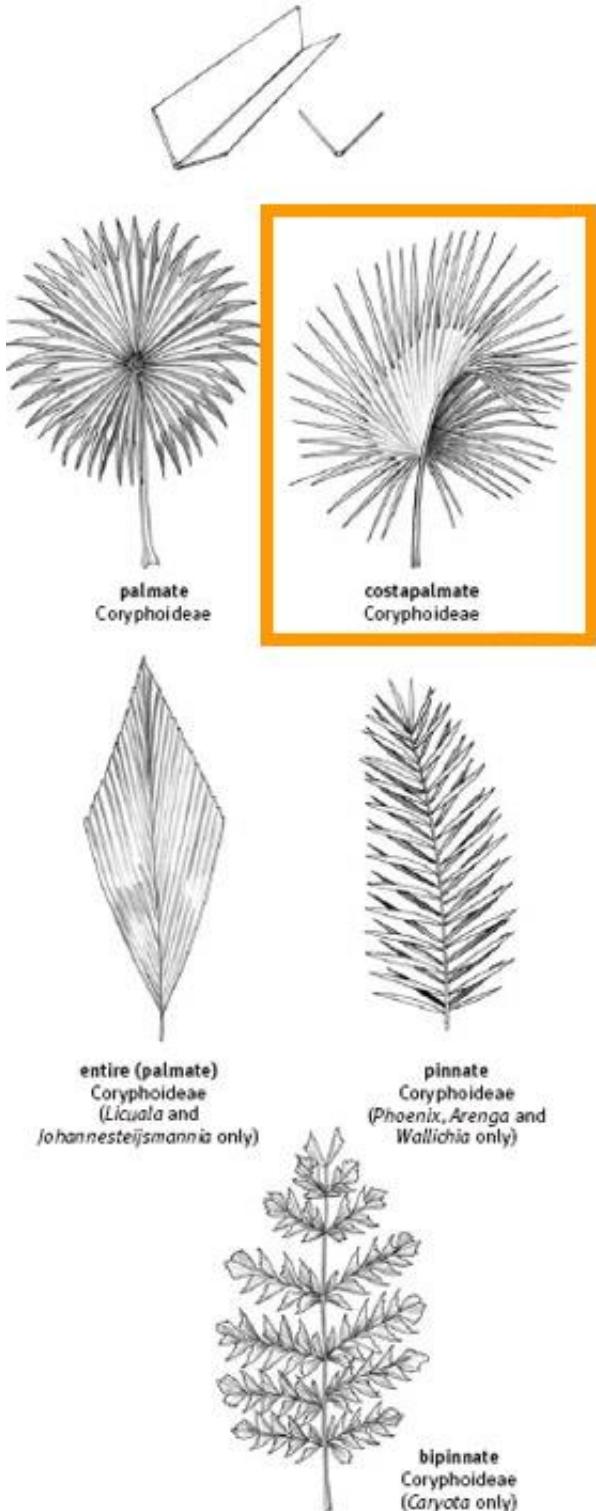


*Korthalsia*

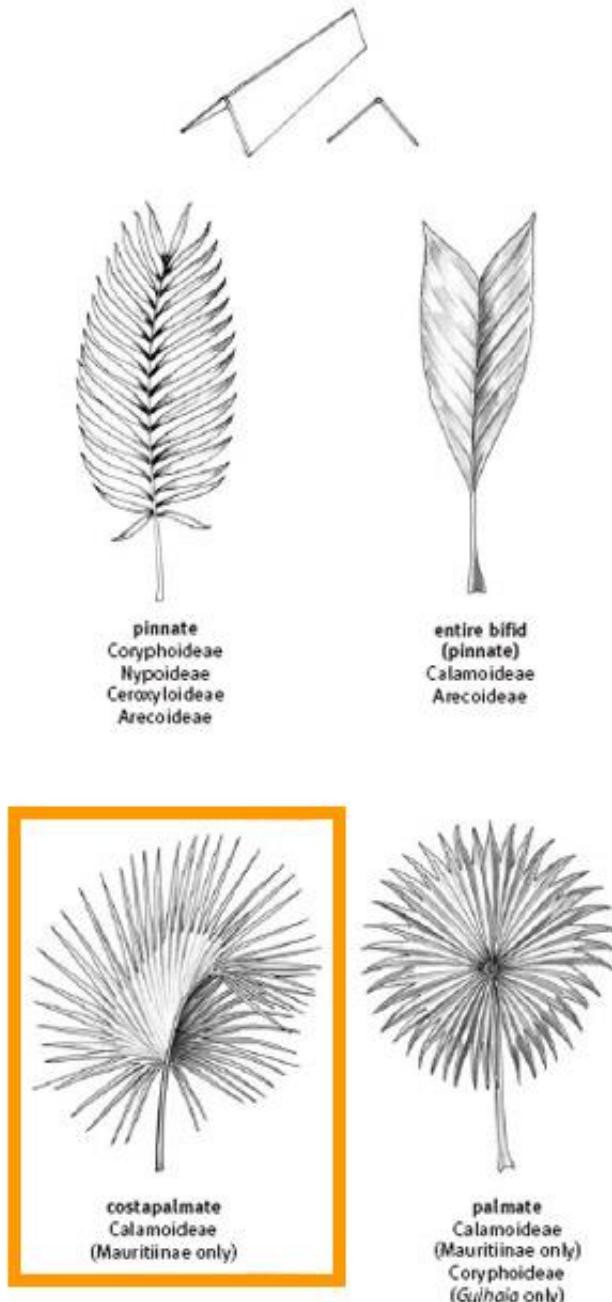
Drawn by Marion Ruff Sheehan

## Major leave forms and splitting types across subfamilies of palms

### INDUPLICATE LEAVES



### REDUPLICATE LEAVES



## Palmate leaves



**costapalmate abaxial view**  
(*Corypha umbraculifera*)

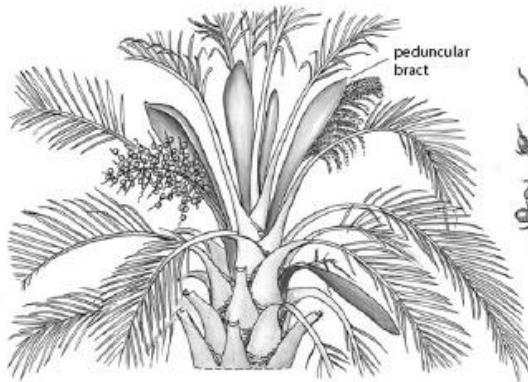
All photos C.E. Lewis

a, deeply split, segments several-fold (*Licuala spinosa*)  
b, entire, many fold (*Licuala grandis*)  
c, deep central split (*Cryosophila kalbreyeri*)  
d, segments single-fold (*Schippia concolor*)

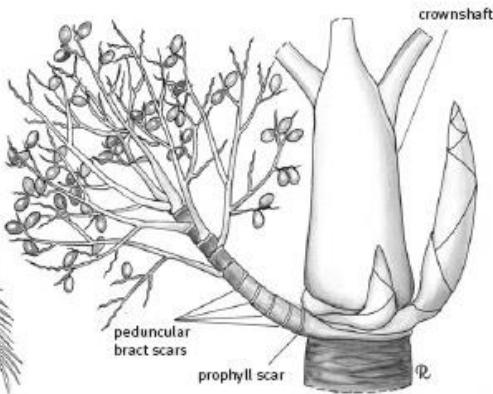
e, intersegmental fibres (*Medemia argun*)  
f, leaf entire (*Johannesteijsmannia altifrons*)  
g, costapalmate abaxial view (*Corypha umbraculifera*)  
h, briefly costapalmate, adaxial view (*Mauritia flexuosa*)



*Sabal maritima* (C.E. Lewis)



*Butia*  
Pleonanthic, with interfoliar inflorescences



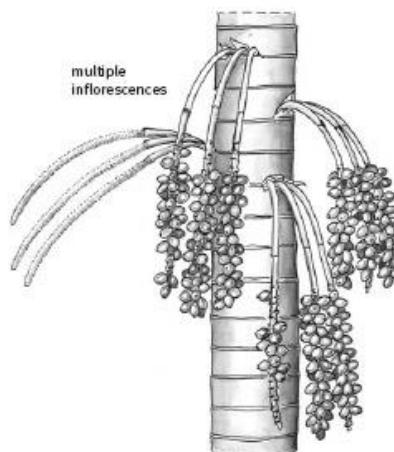
*Hyophorbe*  
Pleonanthic with infrafoliar inflorescences



*Corypha*  
Hapaxanthic, with acropetal maturation



*Caryota*  
Hapaxanthic, with basipetal maturation



*Howea*  
Pleonanthic, interfoliar inflorescences  
(becoming infrafoliar)

Variation in inflorescence presentation in palms. (Drawn by Marion Ruff Sheehan)

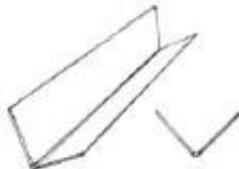


*Pinanga elmen* (C.E. Lewis)

## Major leave forms and splitting types

across subfamilies of palms

## INDUPLICATE LEAVES



palmate  
Coryphoideae



costapalmate  
Coryphoideae



entire (palmate)  
Coryphoideae  
(Licuala and  
Johannesteijsmannia only)



pinnate  
Coryphoideae  
(Phoenix, Arenga and  
Wallitchia only)



bipinnate  
Coryphoideae  
(Caryota only)

## REDUPLICATE LEAVES



pinnate  
Coryphoideae  
Nypoideae  
Ceratoxyloideae  
Arecoideae



entire bifid  
(pinnate)  
Calamoideae  
Arecoideae



costapalmate  
Calamoideae  
(Mauritiinae only)



palmate  
Calamoideae  
(Mauritiinae only)  
Coryphoideae  
(Guiliaria only)

## Palmate leaves

**entire, manifold**

(*Licuala grandis*)



**entire**

(*Johannesteijsmannia altifrons*)

All photos C.E. Lewis

a, deeply split, segments several-fold (*Licuala spinosa*)

b, entire, many fold (*Licuala grandis*)

c, deep central split (*Cryosophila kalbreyeri*)

d, segments single-fold (*Schippia concolor*)

e, intersegmental fibres (*Medemia argun*)

f, leaf entire (*Johannesteijsmannia altifrons*)

g, costapalmate abaxial view (*Corypha umbraculifera*)

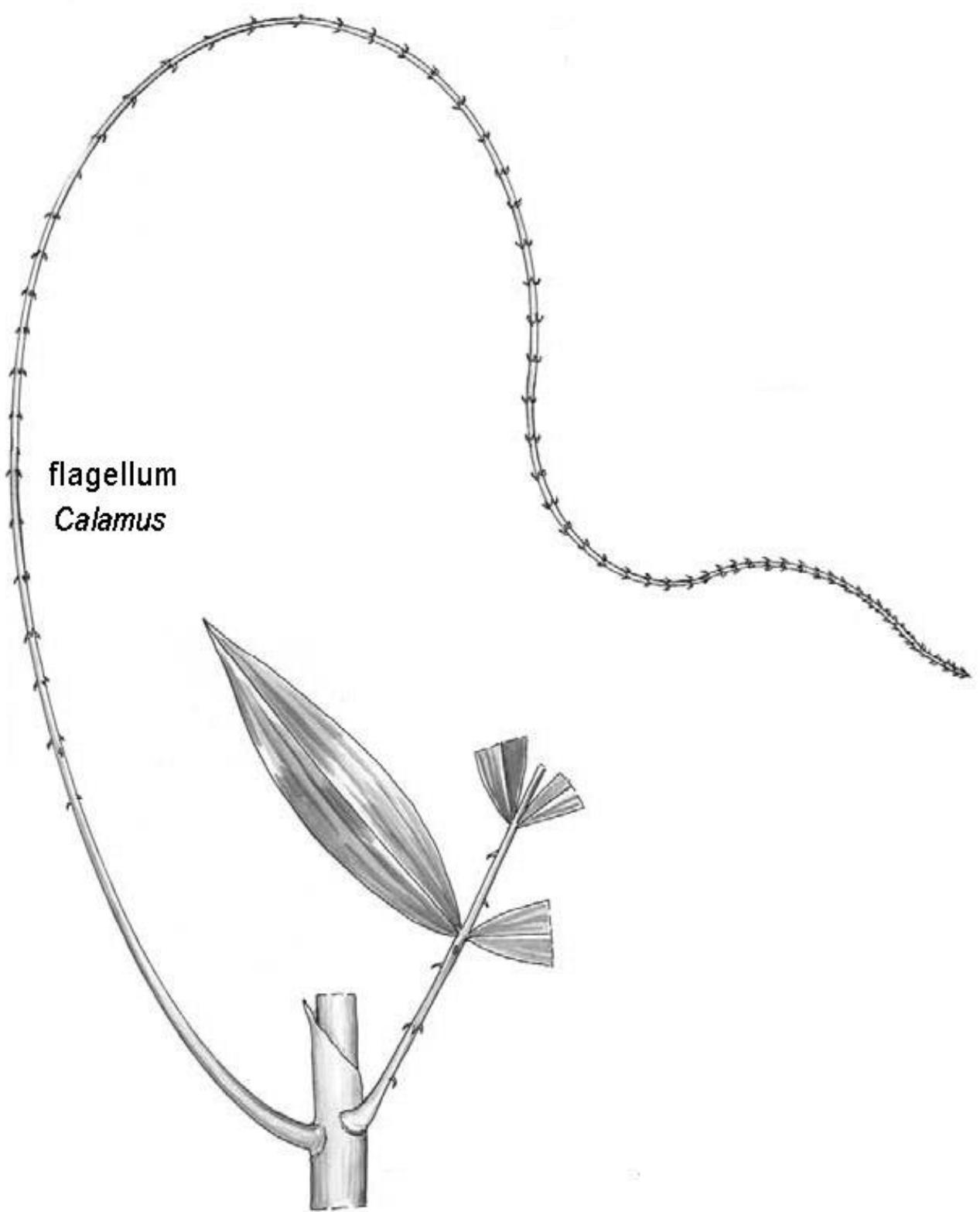
h, briefly costapalmate, adaxial view (*Mauritia flexuosa*)



*Licuala grandis* (C.E. Lewis)



*Johannesteijsmannia altifrons* (C.E. Lewis)



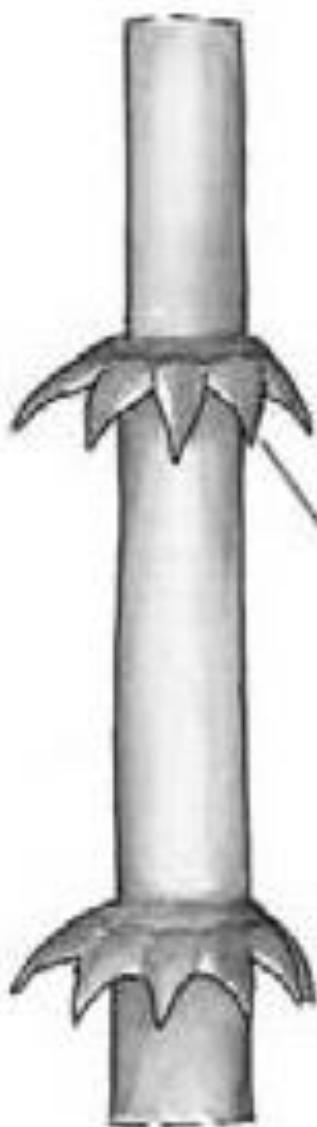
Drawn by Marion Ruff Sheehan



*Bismarckia nobilis* (C.E. Lewis)

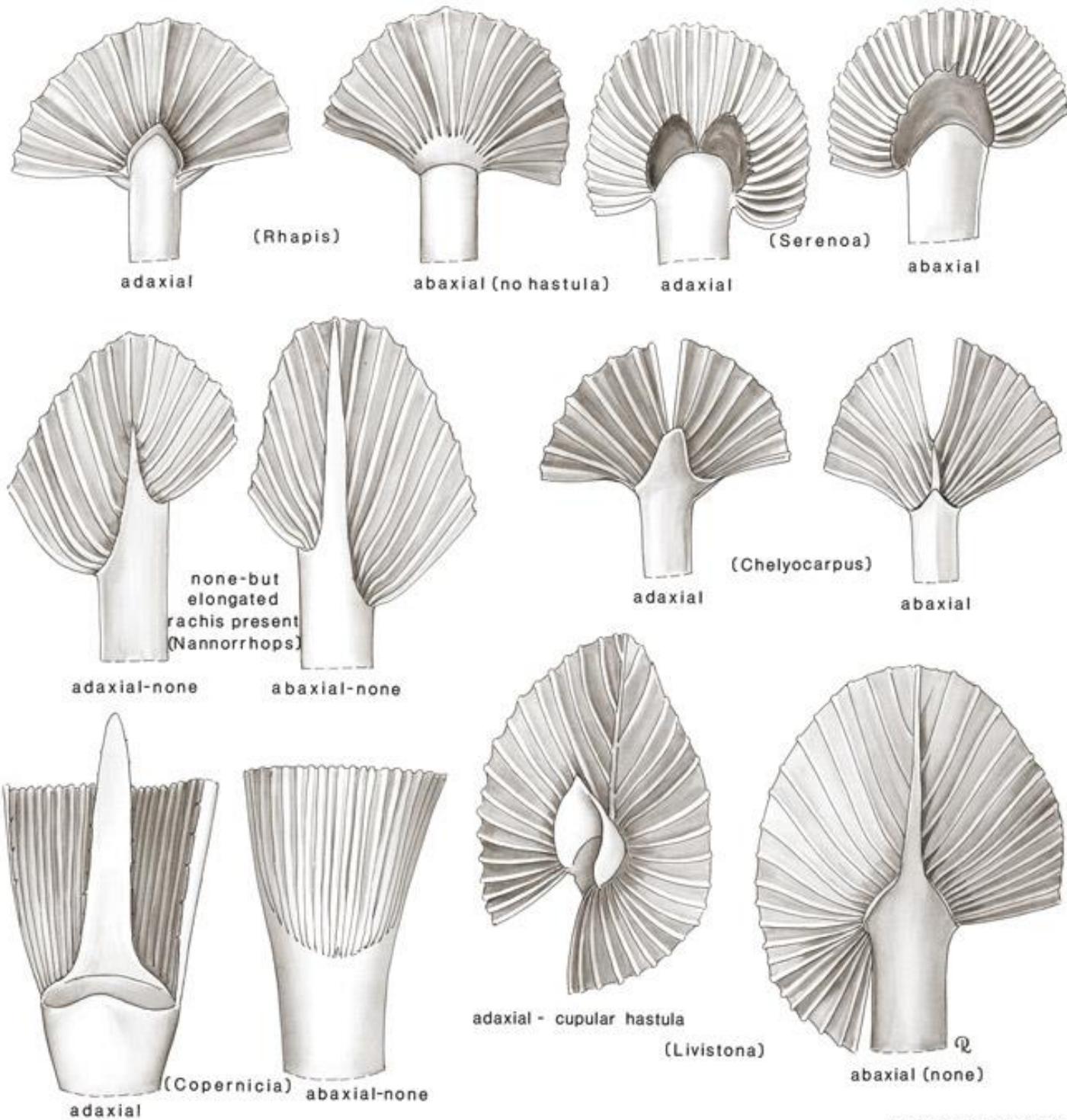


*Pritchardia hillebrandii* (C.E. Lewis)



grapnel  
spines

Drawn by Marion Ruff Sheehan



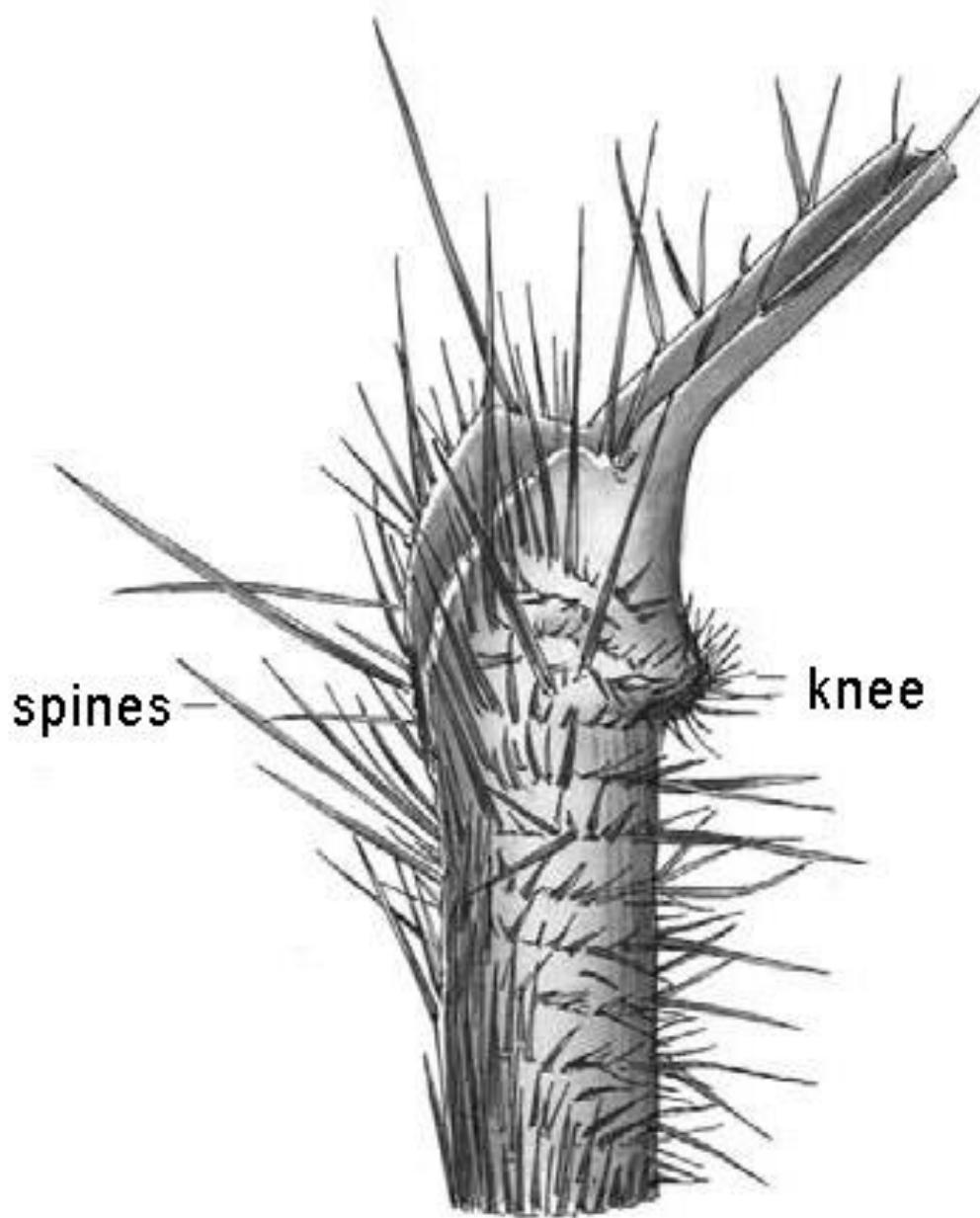
Drawn by Marion Ruff Sheehan

**Hastulas**

All photos C.E. Lewis

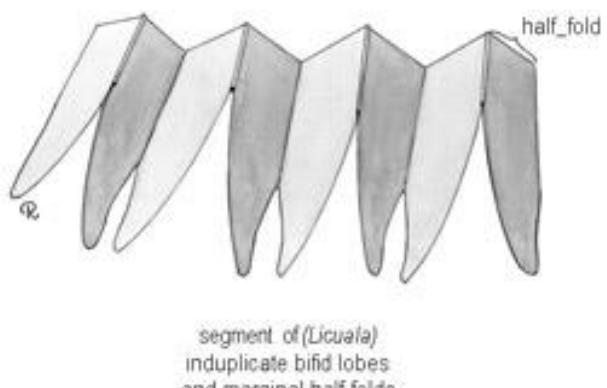
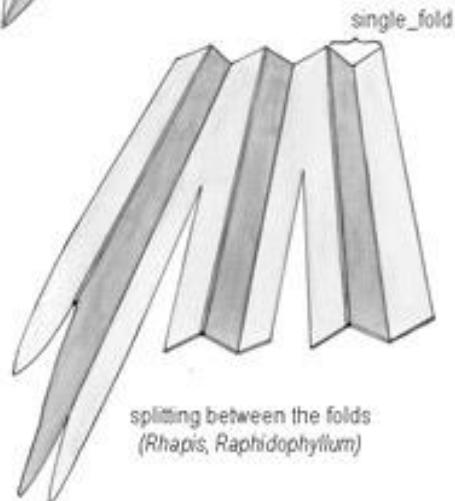
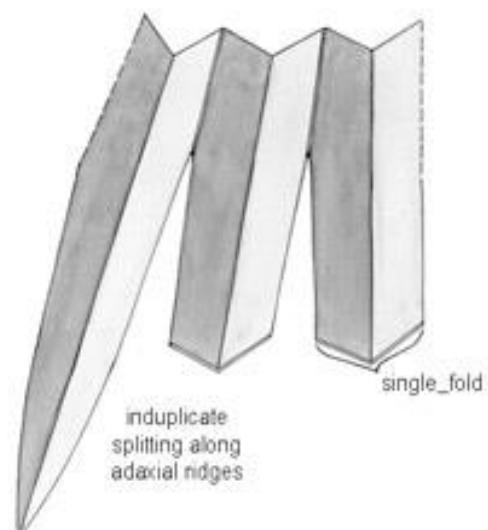
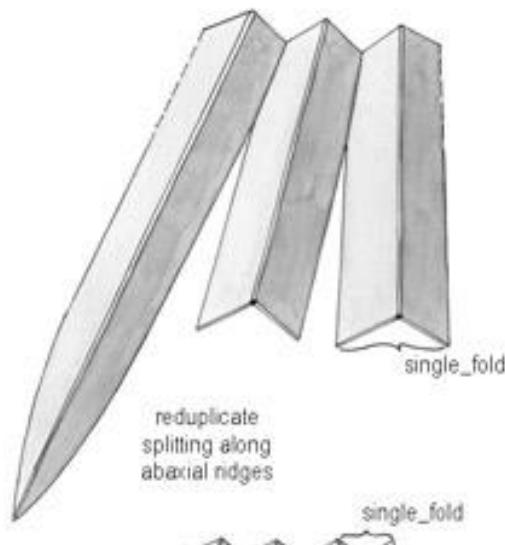
a, b, adaxial, abaxial (*Cryosophila williamsii*)  
c, d, adaxial, abaxial (*Acocellorrhaphis wrightii*)  
e, f, adaxial, abaxial (*Guisha argyraea*)  
g, h, adaxial, abaxial (*Kerriodoxa elegans*)

i, j, adaxial, abaxial (*Livistona australis*)  
k, l, adaxial, abaxial (*Zombia antillarum*)  
m, n, adaxial, abaxial (*Sabal etonia*)  
o, p, adaxial, abaxial (*Latania verschaffeltii*)

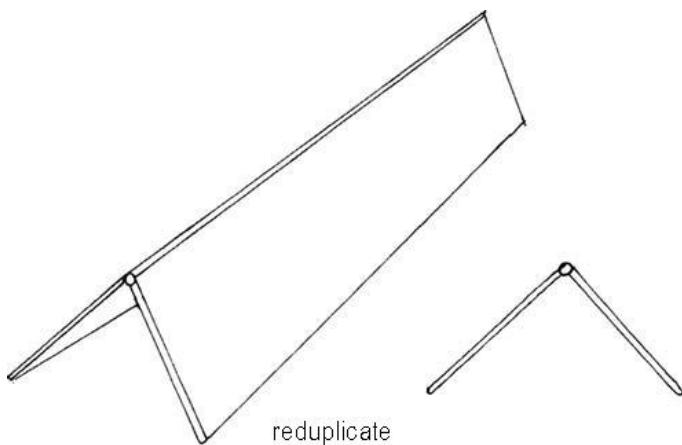
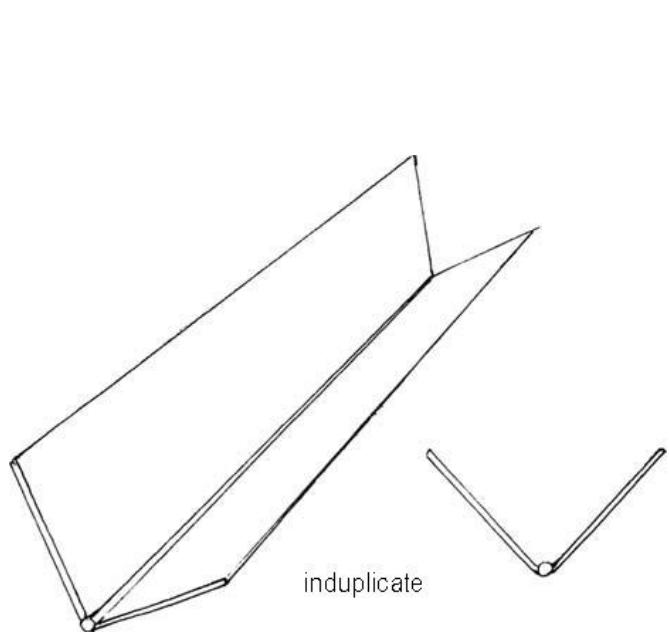


## *Calamus*

Drawn by Marion Ruff Sheehan

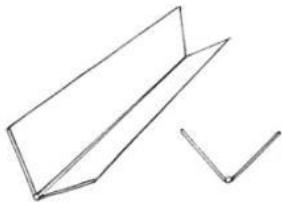


Drawn by Marion Ruff Sheehan



INDUPLICATE LEAVES

*Induplicate*



V

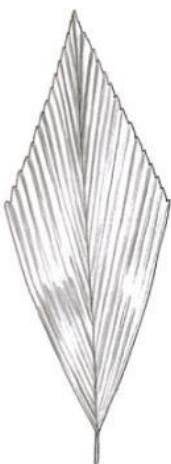
*Single fold*



palmate  
Coryphoideae



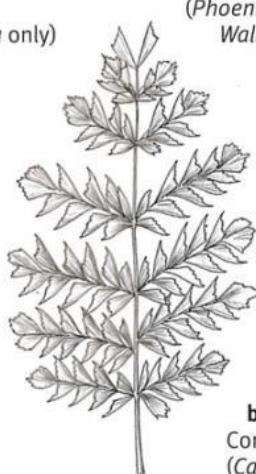
costapalmate  
Coryphoideae



entire (palmate)  
Coryphoideae  
(*Licuala* and  
*Johannesteijsmannia* only)



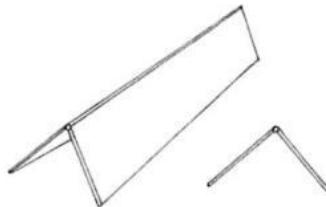
pinnate  
Coryphoideae  
(*Phoenix*, *Arenga* and  
*Wallichia* only)



bipinnate  
Coryphoideae  
(*Caryota* only)

## REDUPLICATE LEAVES

*Reduplicate*



*Single fold*



**pinnate**  
Coryphoideae  
Nypoideae  
Ceroxyloideae  
Arecoideae



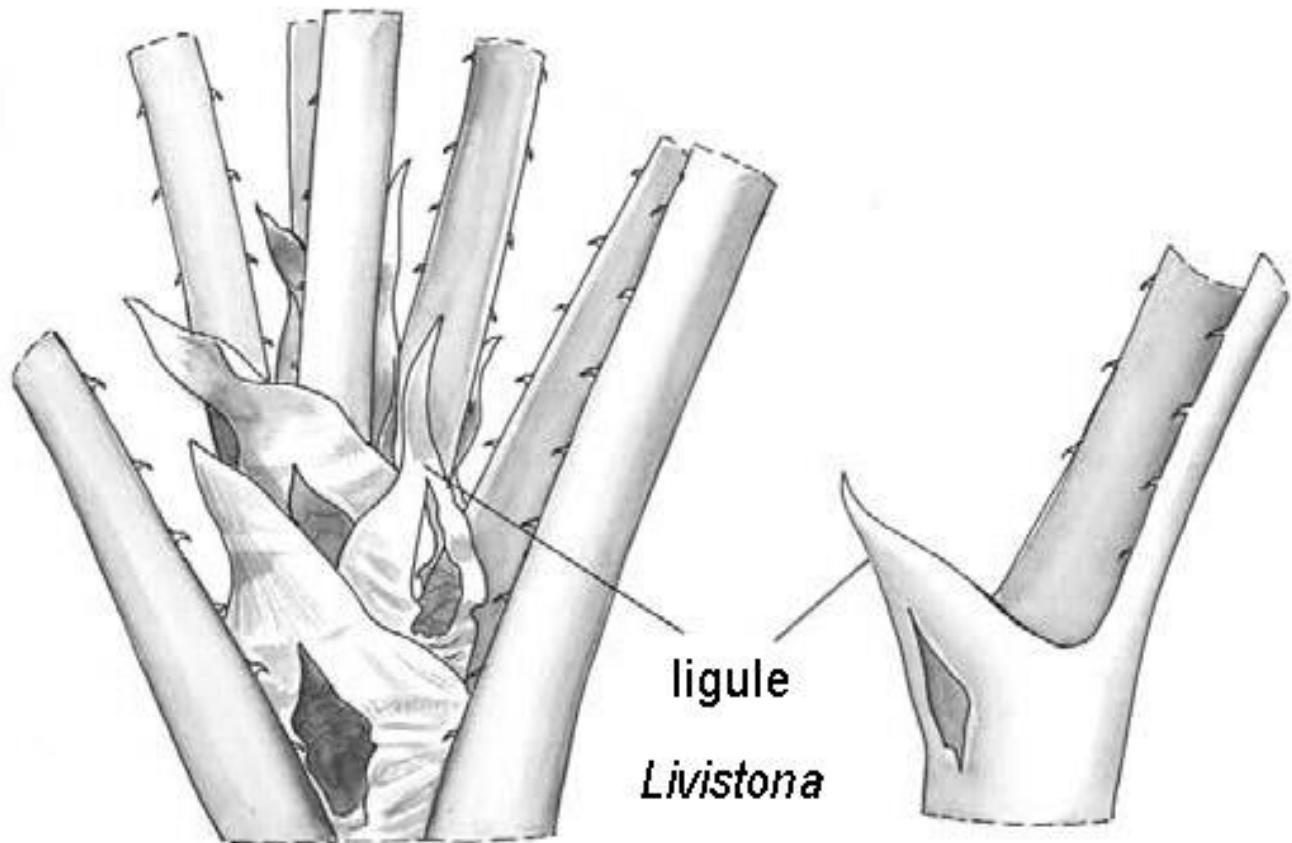
**entire bifid (pinnate)**  
Calamoideae  
Arecoidae



**costapalmate**  
Calamoideae  
(Mauritiinae only)



**palmate**  
Calamoideae  
(Mauritiinae only)  
Coryphoideae  
(*Guishaia* only)



Drawn by Marion Ruff Sheehan



marcescent leaves  
(*Copernicia macroglossa*)

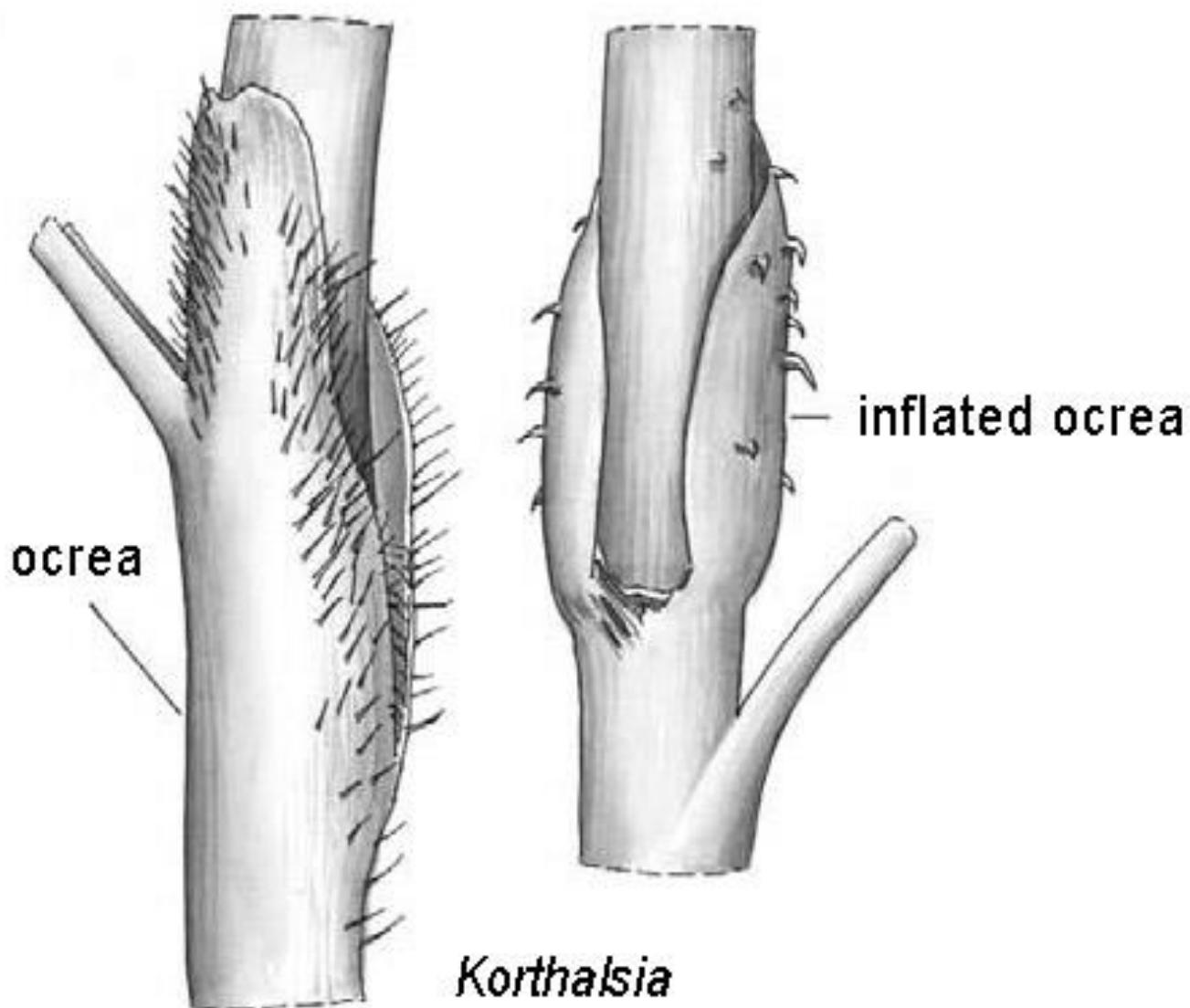
All photos C.E. Lewis

- a, crownshaft (*Pinanga elmen*)
- b, crownshaft with vertical abscission zone (*Pseudophoenix vinifera*)
- c, persistent fibrous leaf bases (*Syagrus botryophora*)
- d, leaf sheaths net-like (*Coccotrinax salvadora*)
- e, whorls of leaf-sheath spines (*Zombia antillarum*)
- f, sheath disintegrating into rigid fibres (*Arenga undulatifolia*)

- g, leaf bases spiny (*Syagrus schizophylla*)
- h, leaf bases unarmed (*Copernicia alba*)
- i, bulbous leaf bases (*Livistona benthamii*)
- j, leaf bases spirally arranged (*Corypha utan*)
- k, leaf bases split (*Latania loddigesii*)
- l, marcescent leaves (*Copernicia macroglossa*)



*Copernicia macroglossa* (C.E. Lewis)

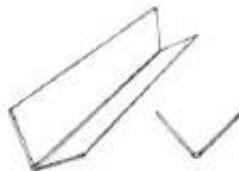


Drawn by Marion Ruff Sheehan

## Major leave forms and splitting types

across subfamilies of palms

INDUPLICATE LEAVES



**palmate**  
Coryphoideae



**costapalmate**  
Coryphoideae



**entire (palmate)**  
Coryphoideae  
(*Licuala* and  
*johannestejnsmannia* only)



**pinnate**  
Coryphoideae  
(*Phoenix*, *Arenga* and  
*Wallaichia* only)



**bipinnate**  
Coryphoideae  
(*Caryota* only)

REDUPLICATE LEAVES



**pinnate**  
Coryphoideae  
Hypoideae  
Cercoyoideae  
Arecoideae



**entire bifid  
(pinnate)**  
Calamoideae  
Arecoideae

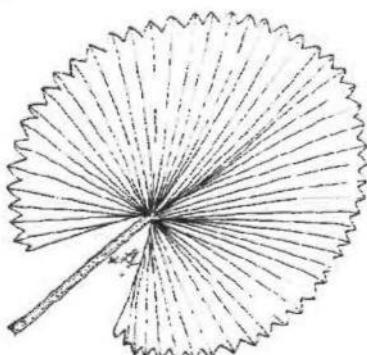
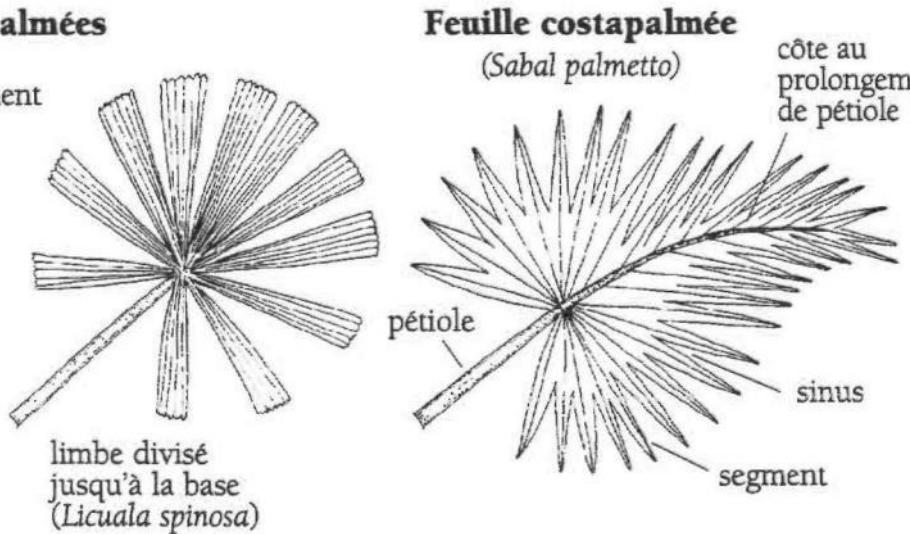
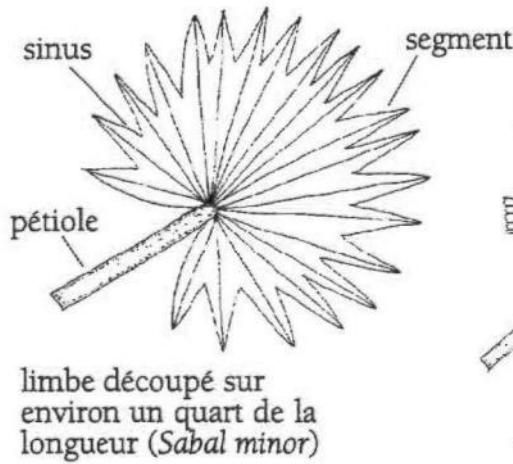


**costapalmate**  
Calamoideae  
(Mauritiinae only)

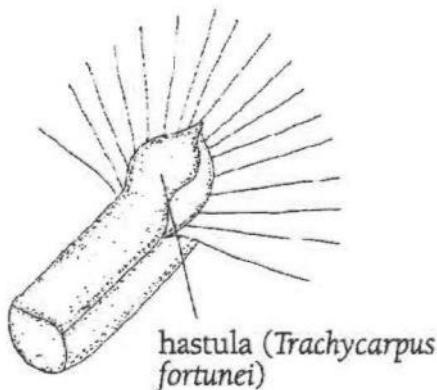


**palmate**  
Calamoideae  
(Mauritiinae only)  
Coryphoideae  
(*Guihaia* only)

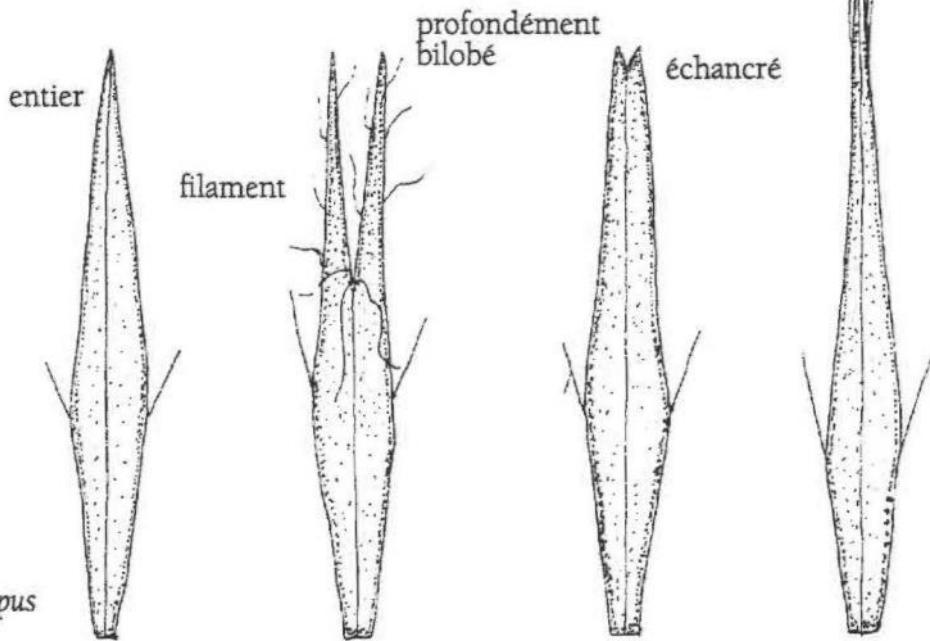
### Feuilles palmées



limbe presque entier  
(*Licuala grandis*)



### Types de segments



## Palmate leaves



All photos C.E. Lewis

a, deeply split, segments several-fold (*Licuala spinosa*)  
b, entire, many fold (*Licuala grandis*)  
c, deep central split (*Cryosophila kalbreyeri*)  
d, segments single-fold (*Schippia concolor*)

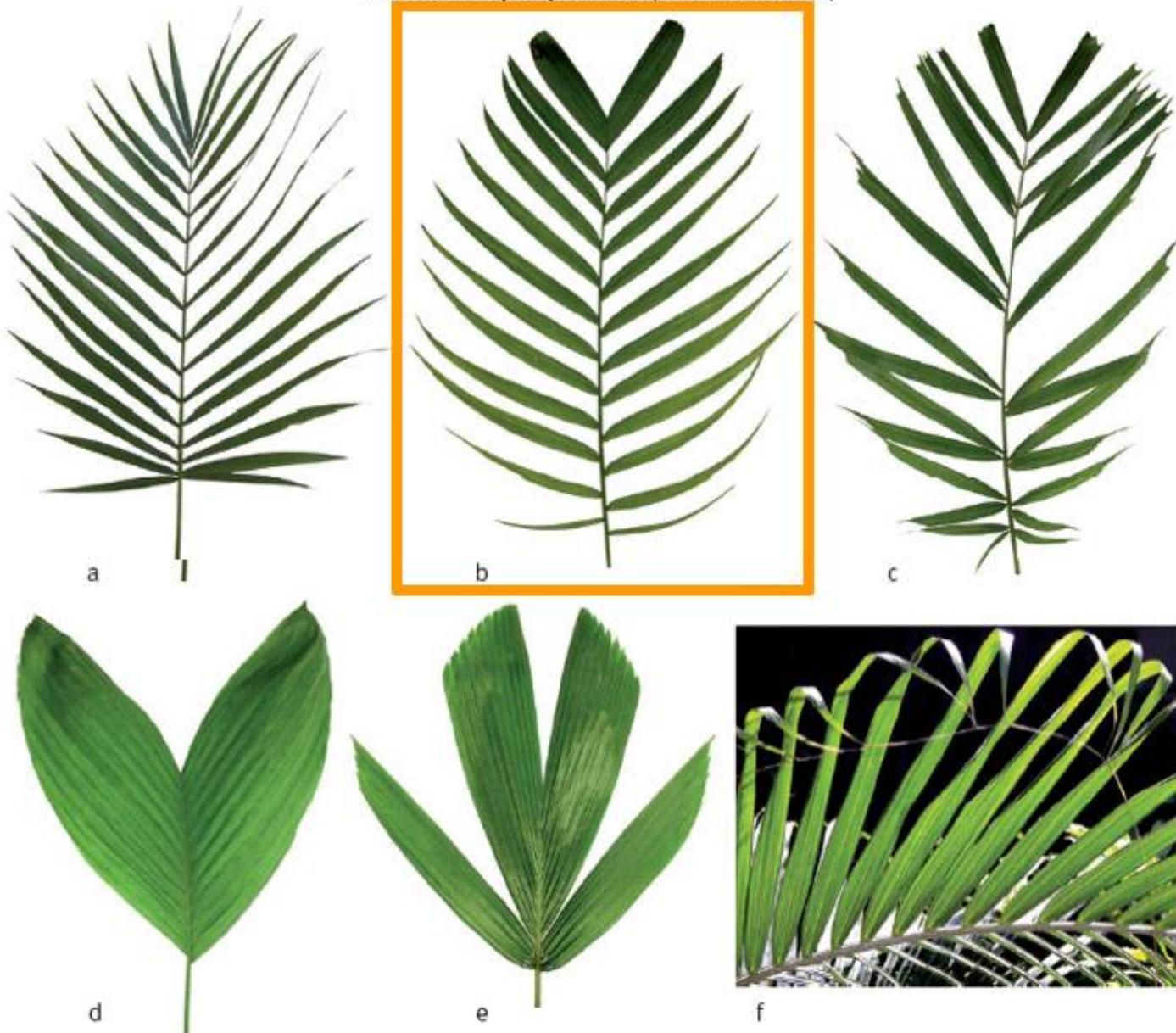
e, intersegmental fibres (*Medemia argun*)  
f, leaf entire (*Johannesteijsmannia altifrons*)  
g, costapalmate abaxial view (*Corpha umbraculifera*)  
h, briefly costapalmate, adaxial view (*Mauritia flexuosa*)



*Coccothrinax jamaicensis* (C.E. Lewis)

## Pinnate leaf forms

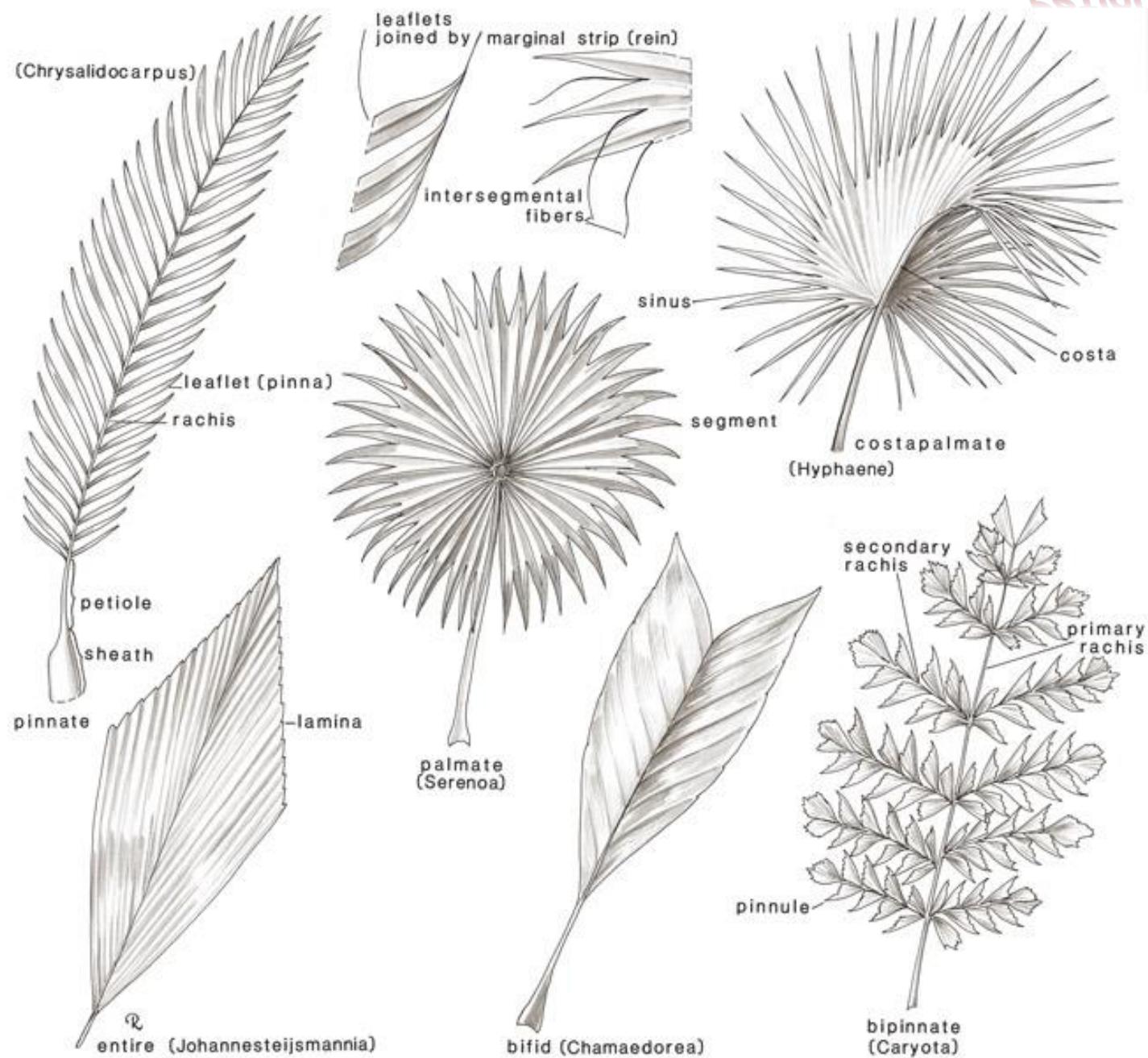
distichous paripinnate (*Pinanga dicksonii*)



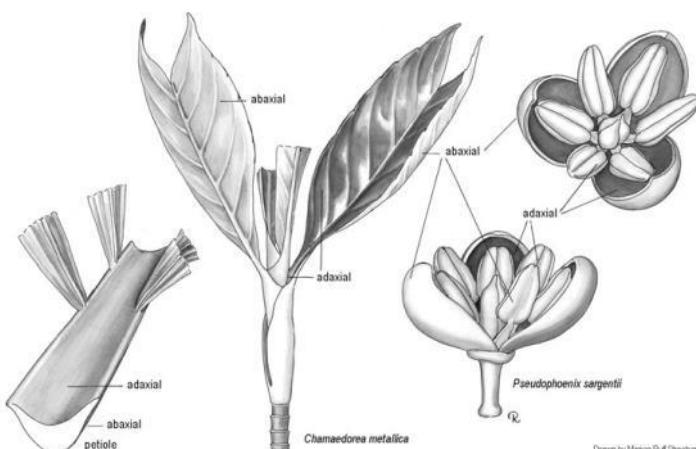
All photos C.E. Lewis

a, leaflets subopposite (*Chamaedorea radicalis*)  
b, distichous paripinnate (*Pinanga dicksonii*)  
c, irregularly pinnate (*Ptychosperma microcarpum*)

d, bifid (*Chamaedorea brachypoda*)  
e, bijugate (*Reinhardtia latisecta*)  
f, leaflets joined by marginal rein (*Dictyosperma album*)



Drawn by Marion Ruff Sheehan



Drawn by Marion Ruff Sheehan

# Petiol, Indumentum & spine



Indumentum and spines

- a, floccose (*Pritchardia hillebrandii*);
- b, floccose (*Bismarckia nobilis*);
- c, ramenta (*Nypa fruticans*);
- d, spiny leaflets and rachis (*Acrocomia crispa*);
- e, sheath spines (*Acanthophoenix rubra*);
- f, sheath and petiole spines (*Daemomerops curvani*);
- g, petiole spines (*Elaeis guineensis*);
- h, petiole spines (*Phoenix rupicola*);

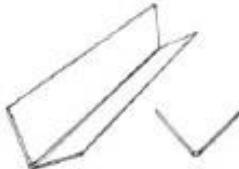
- i, petiole spines (*Syagrus schizophylla*);
- j, petiole spines (*Livistona robinsoniana*);
- k, petiole spines (*Serenoa repens*);
- l, petiole spines (*Chamaerops humilis*);
- m, petiole spines (*Ucuvala spinosa*);
- n, petiole spines (*Phoenix paludosa*);
- o, petiole spines (*Salacca zalacca*);
- p, petiole spines (*Bactris gasipaes*).

Photos C.E. Lewis

## Major leave forms and splitting types

across subfamilies of palms

## INDUPLICATE LEAVES



palmate  
Coryphoideae



costapalmate  
Coryphoideae



entire (palmate)  
Coryphoideae  
(*Licuala* and  
*Johannesteissmannia* only)



pinnate  
Coryphoideae  
(*Phoenix*, *Arenga* and  
*Wallaichia* only)



bipinnate  
Coryphoideae  
(*Caryota* only)

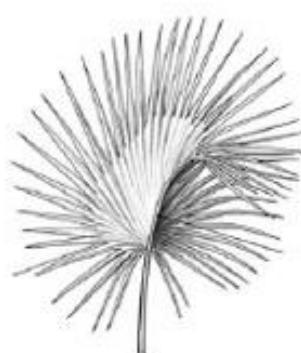
## REDUPLICATE LEAVES



pinnate  
Coryphoideae  
Nypoideae  
Ceroxyloideae  
Arecoideae



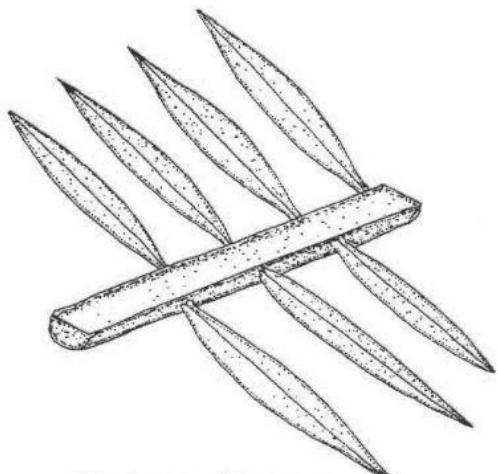
entire bifid  
(pinnate)  
Calamoideae  
Arecoideae



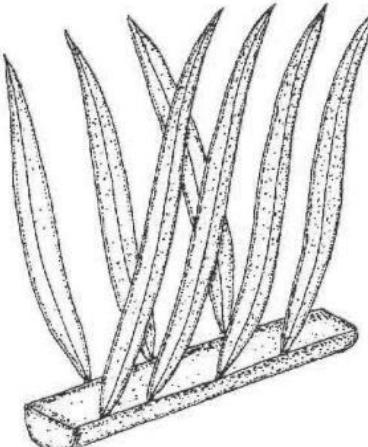
costapalmate  
Calamoideae  
(Mauritiinae only)



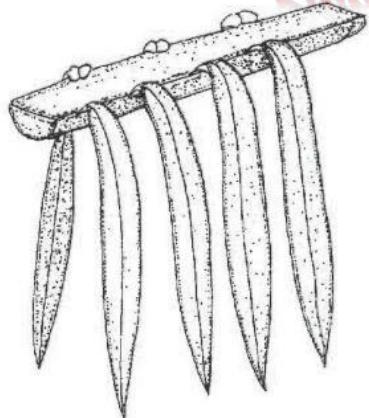
palmate  
Calamoideae  
(Mauritiinae only)  
Coryphoideae  
(*Guilielma* only)



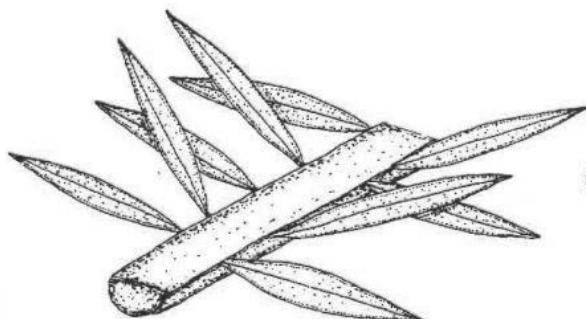
folioles régulièrement disposées dans un même plan (*Archontophoenix* spp.)



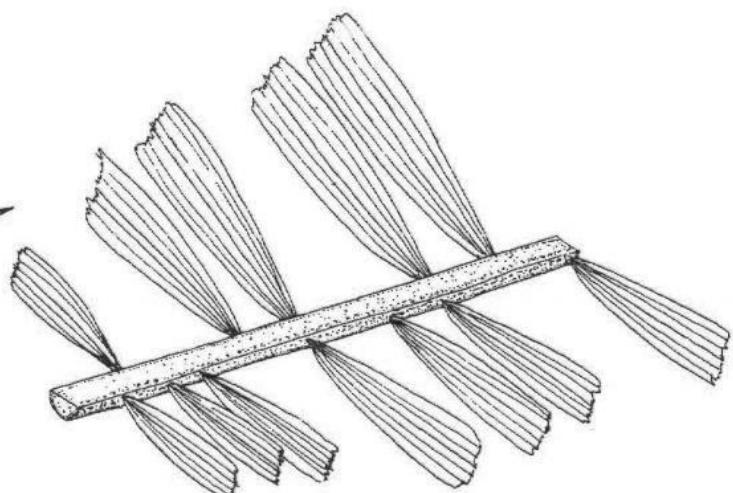
folioles dressées (*Howea belmoreana*)



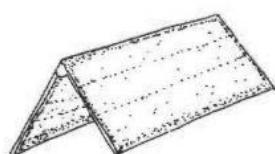
folioles pendantes (*Gulubia costata*)



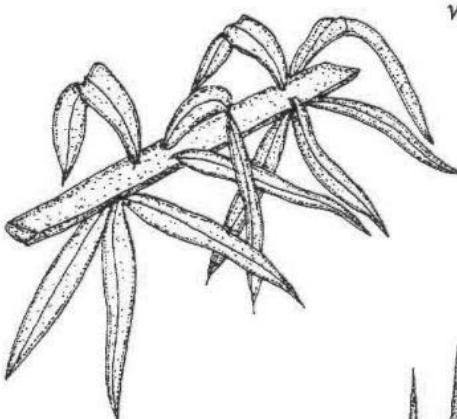
folioles disposées sur deux plans (*Phoenix* spp.)



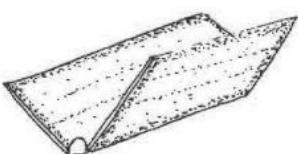
folioles à distribution irrégulière (*Hydriastele wendlandiana*)



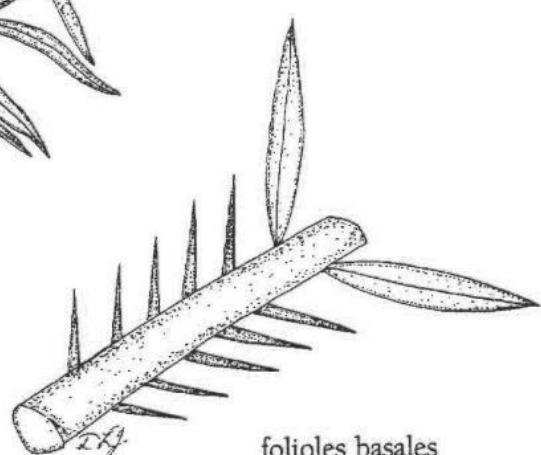
coupe d'une foliole rédupliquée (*Hyophorbe* spp.)



folioles disposées sur plusieurs rangs (*Syagrus romanzoffiana*)

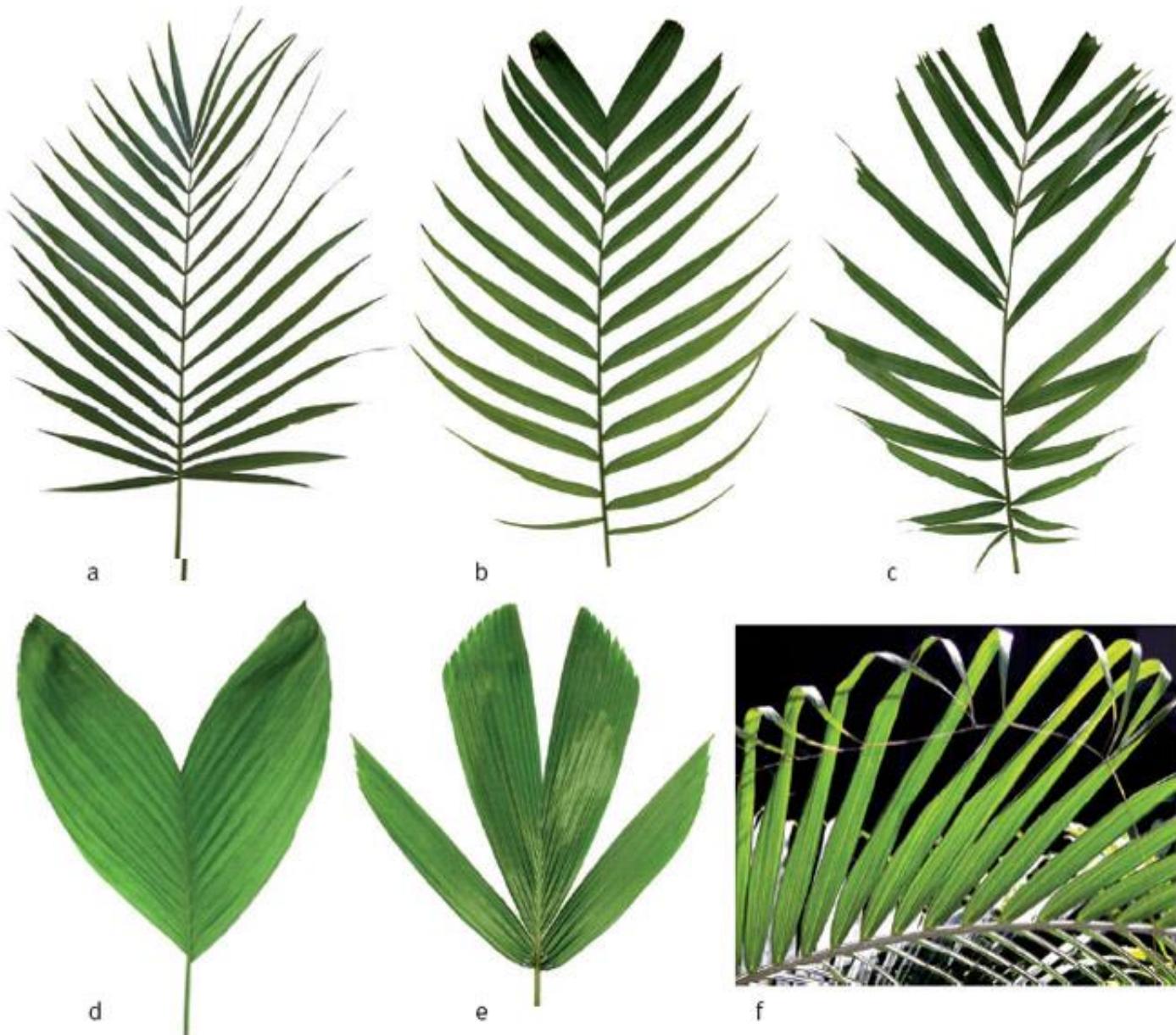


coupe d'une foliole indupliquée (*Phoenix* spp.)



folioles basales réduites à des épines (*Phoenix* spp.)

## Pinnate leaf forms

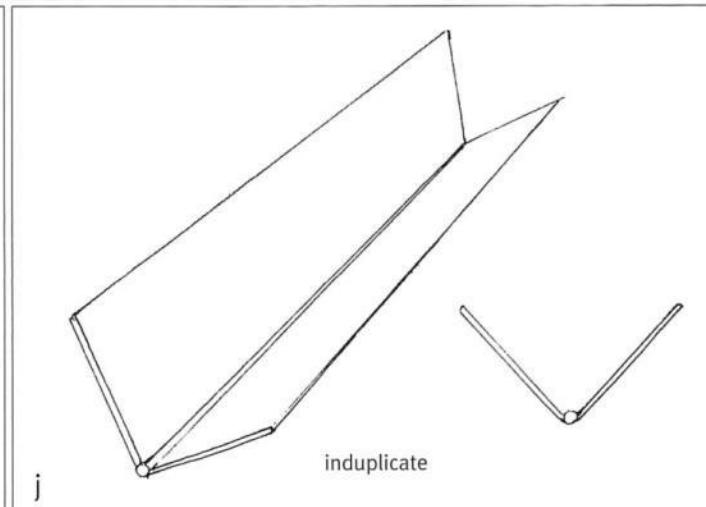
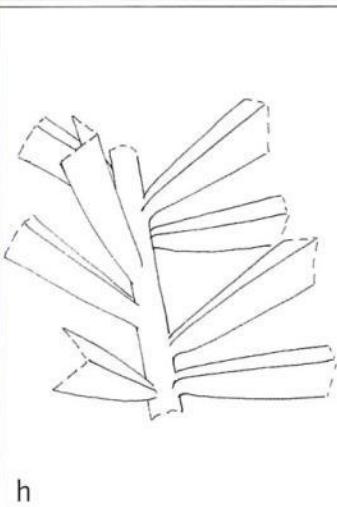
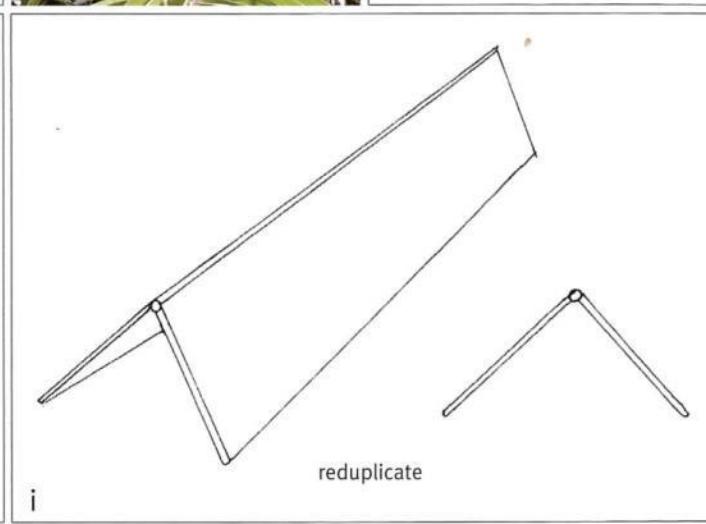
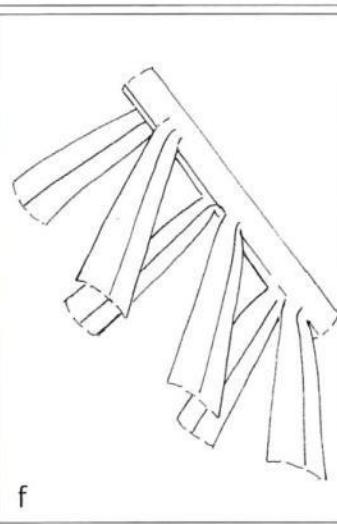
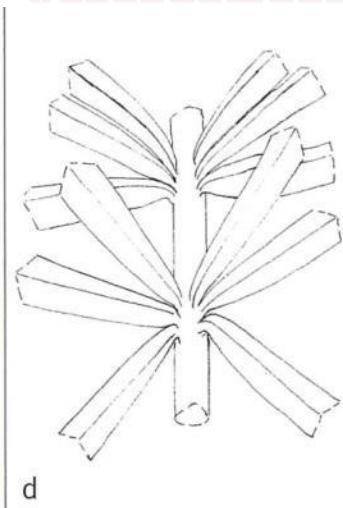


All photos C.E. Lewis

a, leaflets subopposite (*Chamaedorea radicalis*)  
b, distichous paripinnate (*Pinanga dicksonii*)  
c, irregularly pinnate (*Ptychosperma microcarpum*)

d, bifid (*Chamaedorea brachypoda*)  
e, bijugate (*Reinhardtia latisecta*)  
f, leaflets joined by marginal vein (*Dictyosperma album*)

# Pinnate Arrangement



Regularly arranged, 2 ranked  
(*Archontophoenix myolensis*)

Several ranked

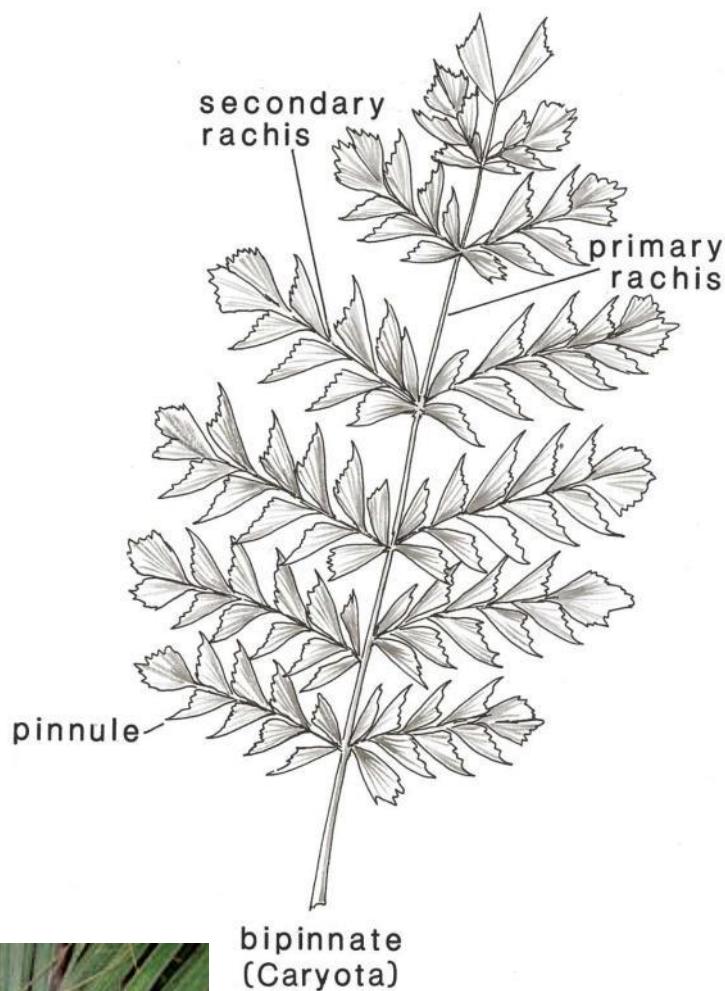
(*Phoenix reclinata*)

Pendulous, leaflets subopposite

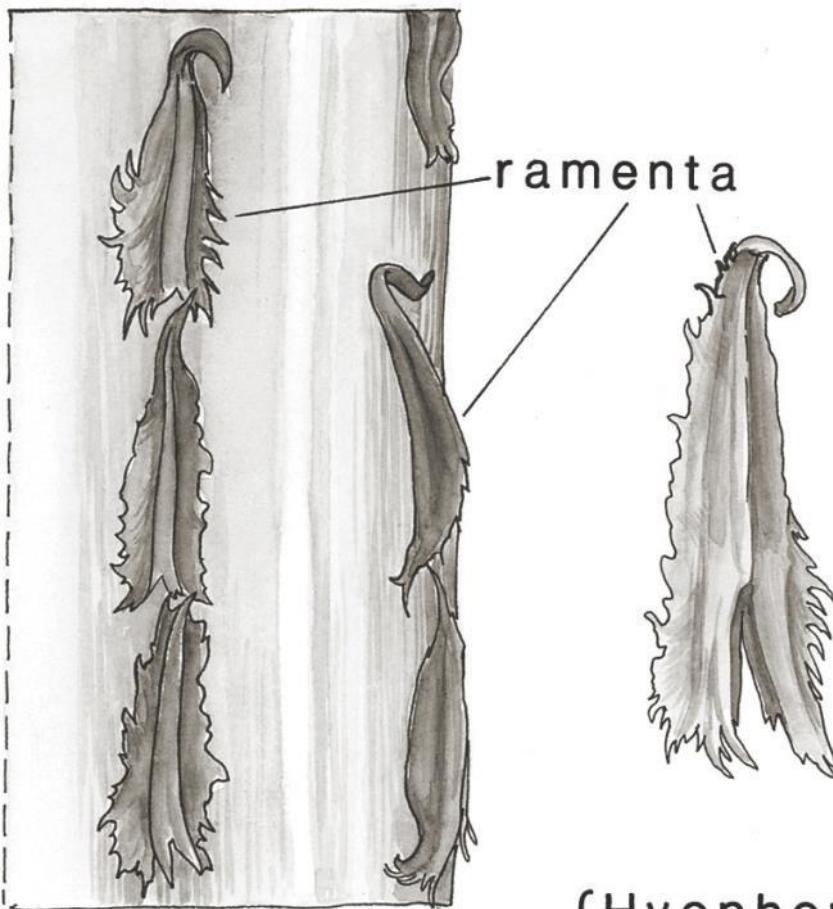
(*Euterpe oleracea*)

Grouped, fanned within the groups

(*Allogoptera arenaria*)



Drawn by Marion Ruff Sheehan



(Hyophorbe)

Drawn by Marion Ruff Sheehan

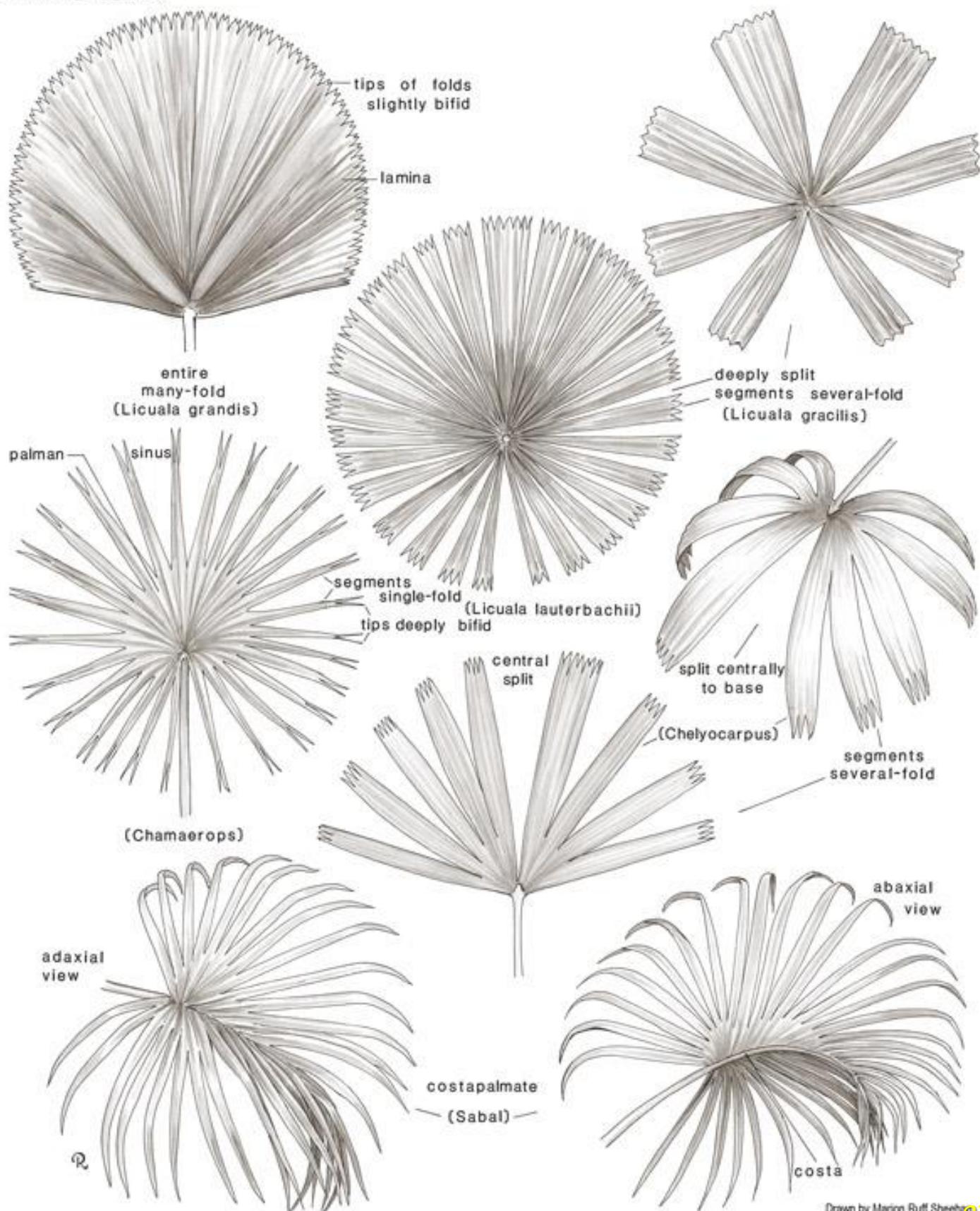


*Nypa fruticans* (C.E. Lewis)



*Dictyosperma album* (C.E. Lewis)

PALMATE LEAVES



## Palmate leaves



All photos C.E. Lewis

a, deeply split, segments several-fold (*Licuala spinosa*)

b, entire, many fold (*Licuala grandis*)

c, deep central split (*Cryosophila kalbreyeri*)

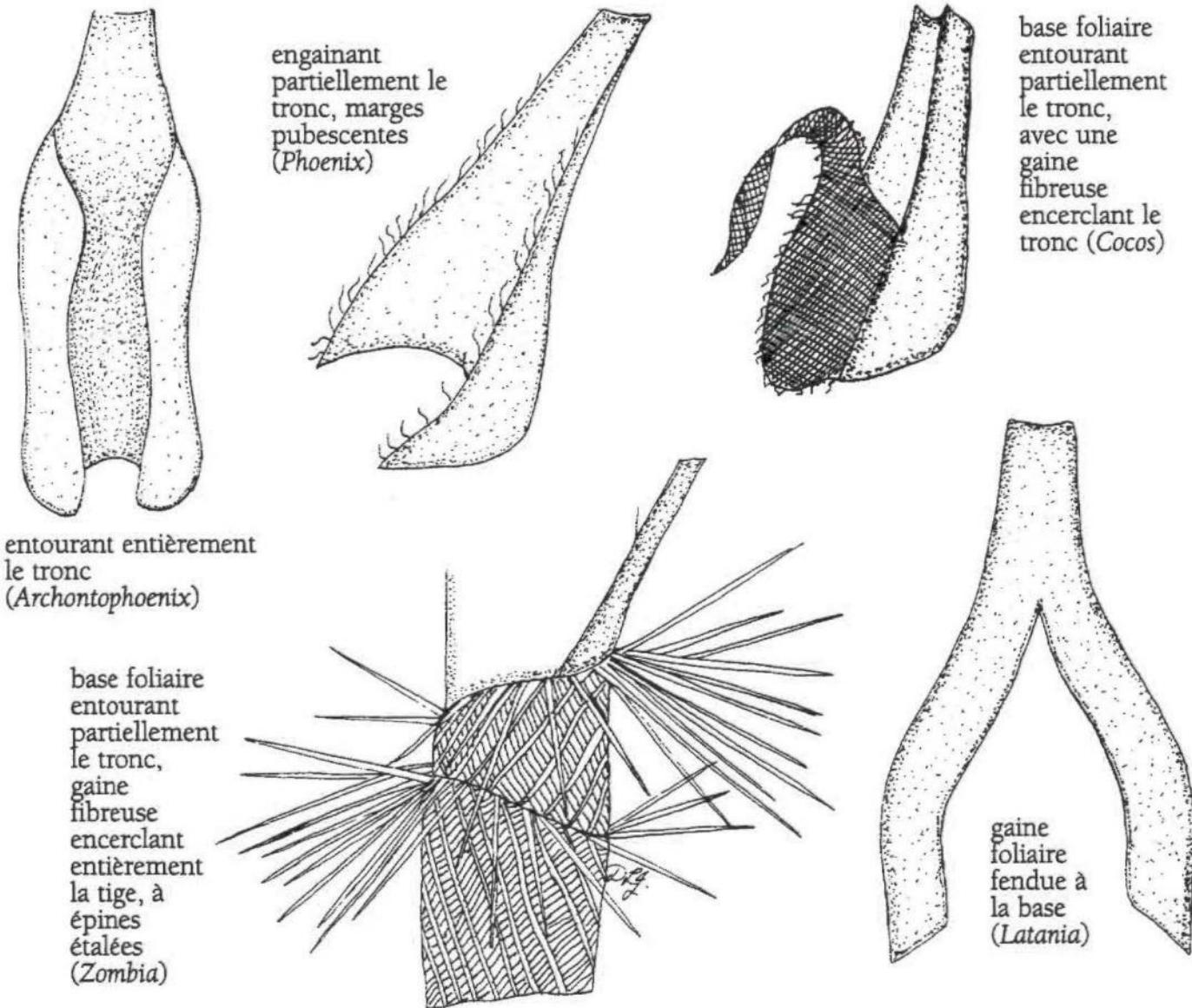
d, segments single-fold (*Schippia concolor*)

e, intersegmental fibres (*Medemia argun*)

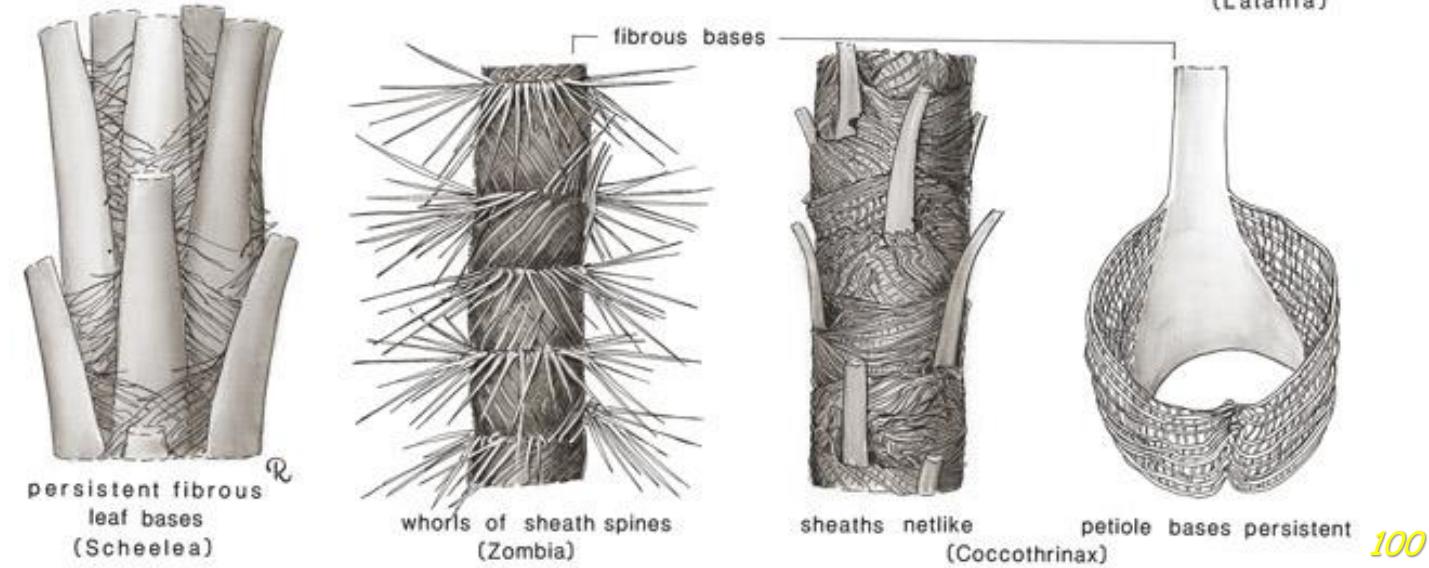
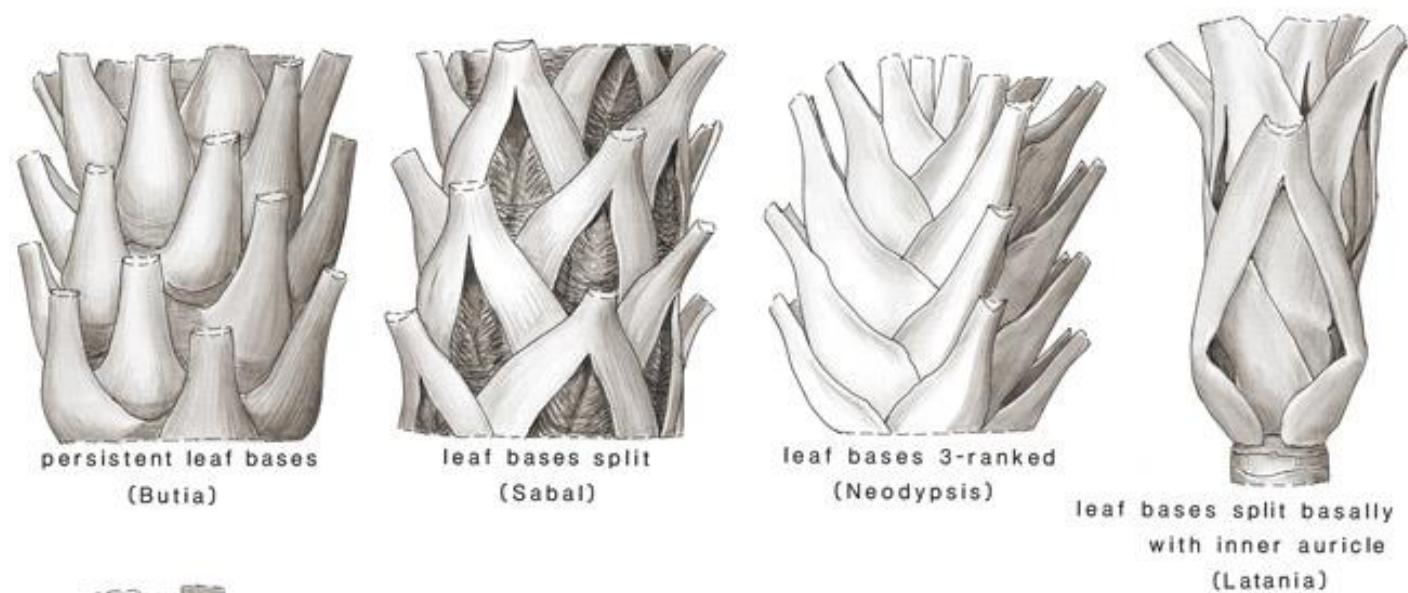
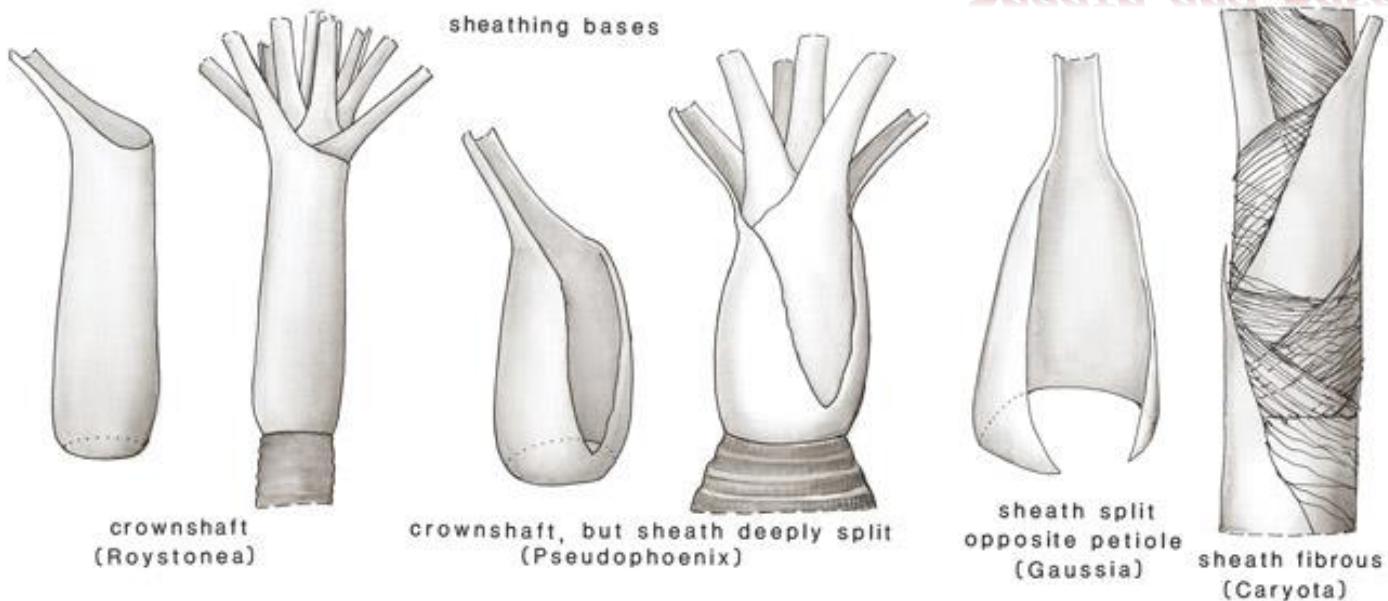
f, leaf entire (*Johannesteijsmannia altifrons*)

g, costapalmate abaxial view (*Corypha umbraculifera*)

h, briefly costapalmate, adaxial view (*Maunitia flexuosa*)



# Sheath and Base



## Leaf sheaths and bases



All photos C.E. Lewis

a, crownshaft (*Pinanga elmeri*)

b, crownshaft with vertical abscission zone (*Pseudophoenix vinifera*)

c, persistent fibrous leaf bases (*Syagrus balyophora*)

d, leaf sheaths net-like (*Coccothrinax salvatoris*)

e, whorls of leafsheath spines (*Zombia antillarum*)

f, sheaths disintegrating into rigid fibres (*Arenga undulatifolia*)

g, leaf bases spiny (*Syagrus schizophylla*)

h, leaf bases unarmed (*Copernicia alba*)

i, bulbous leaf bases (*Livistona benthamii*)

j, leaf bases spirally arranged (*Corypha utan*)

k, leaf bases split (*Latania loddigesii*)

l, marcescent leaves (*Copernicia macroglossa*)

## *Sheath and Base*

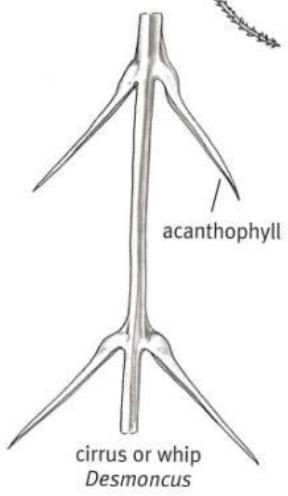
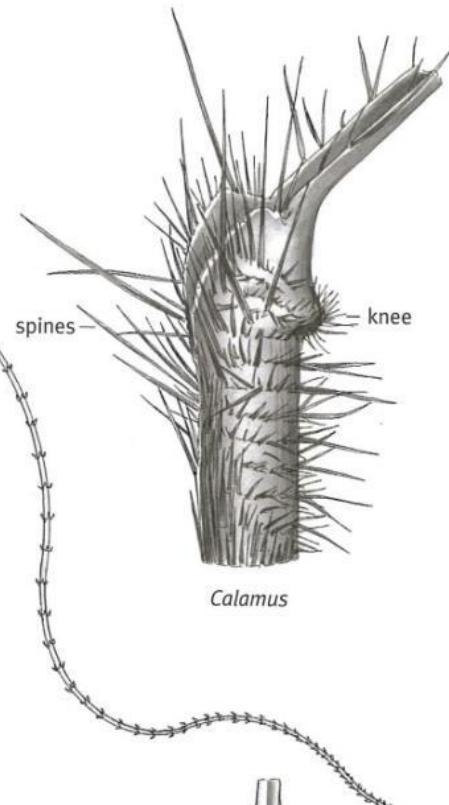
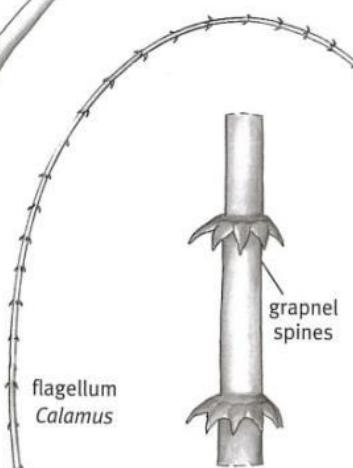
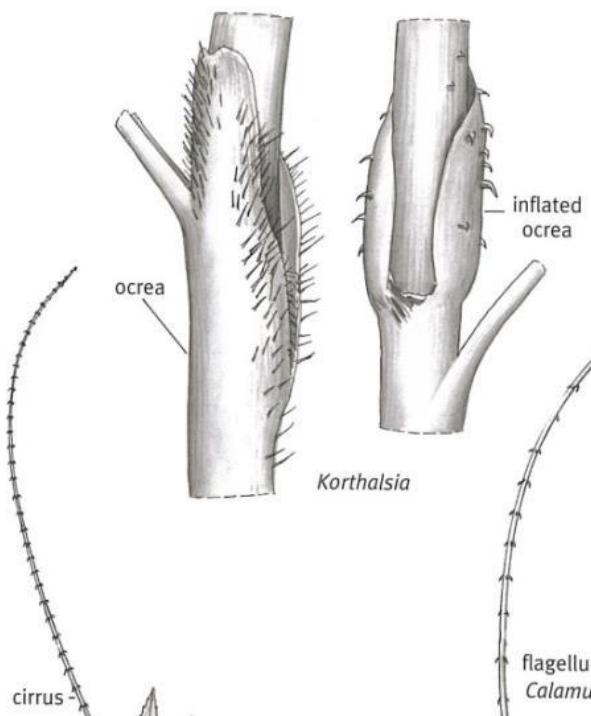
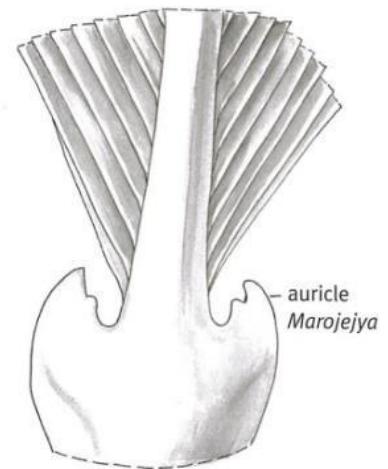
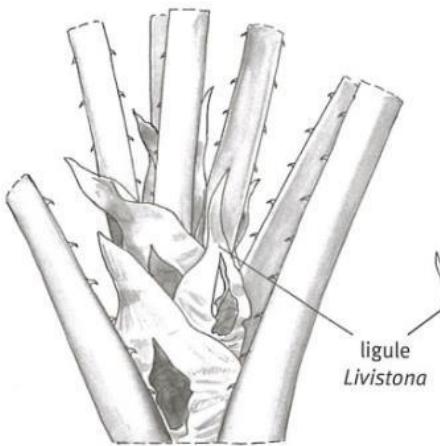


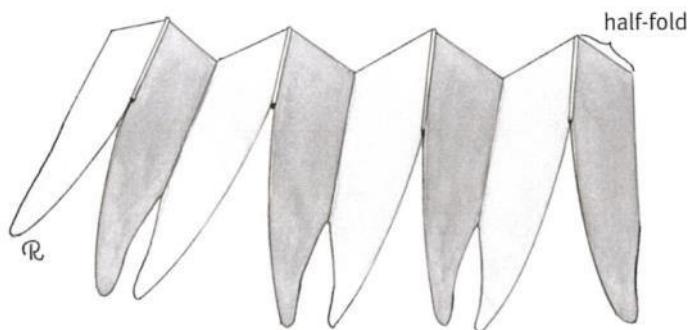
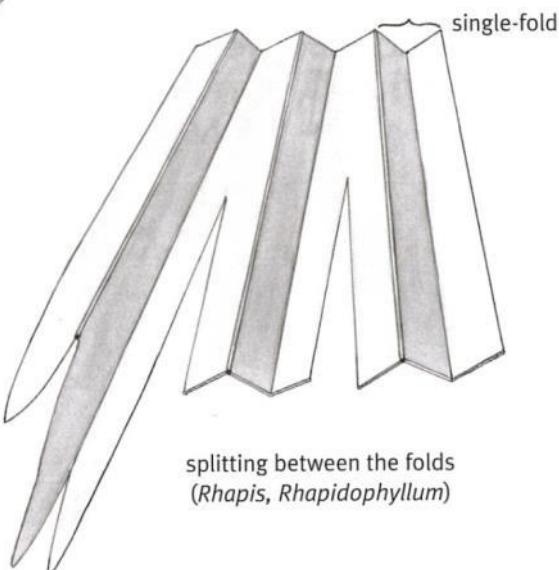
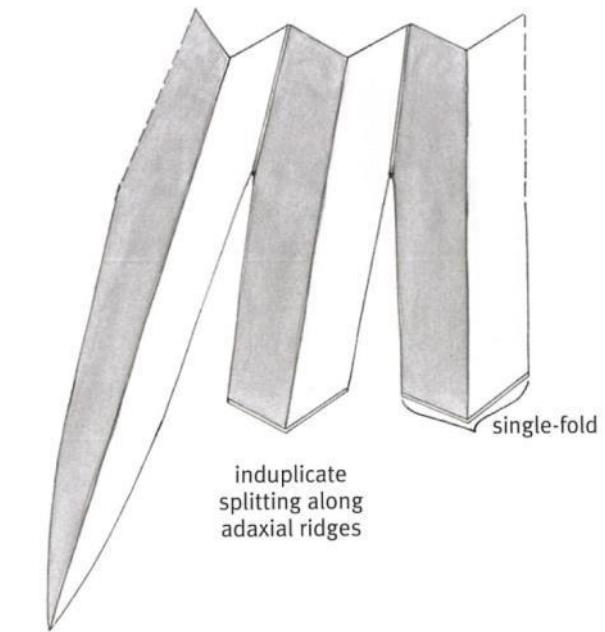
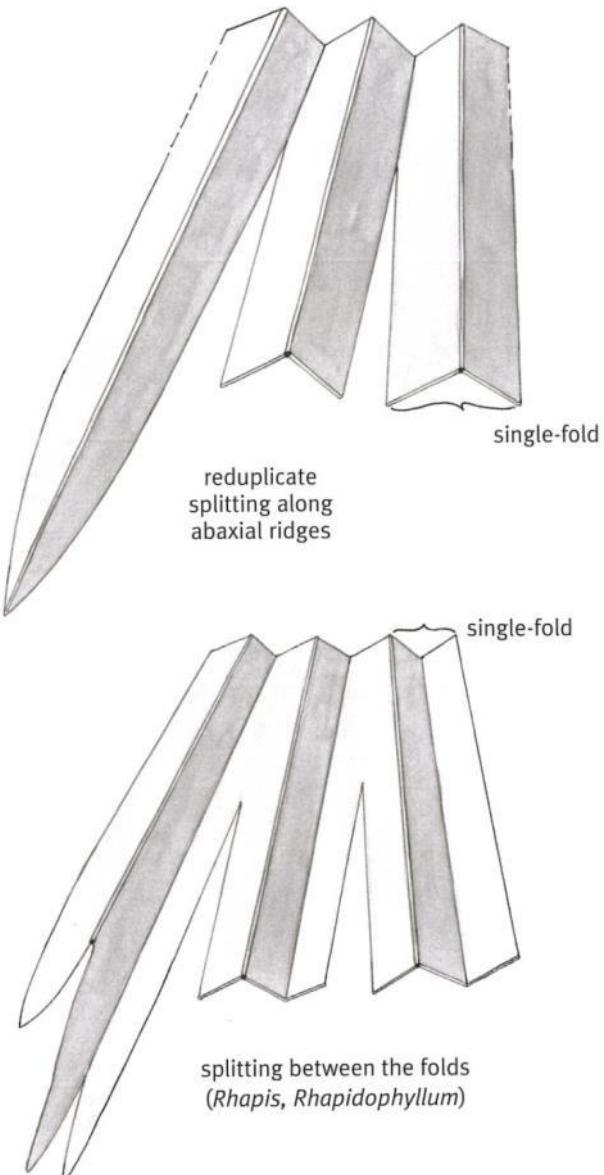
*Acanthophoenix rubra* (C.E. Lewis)

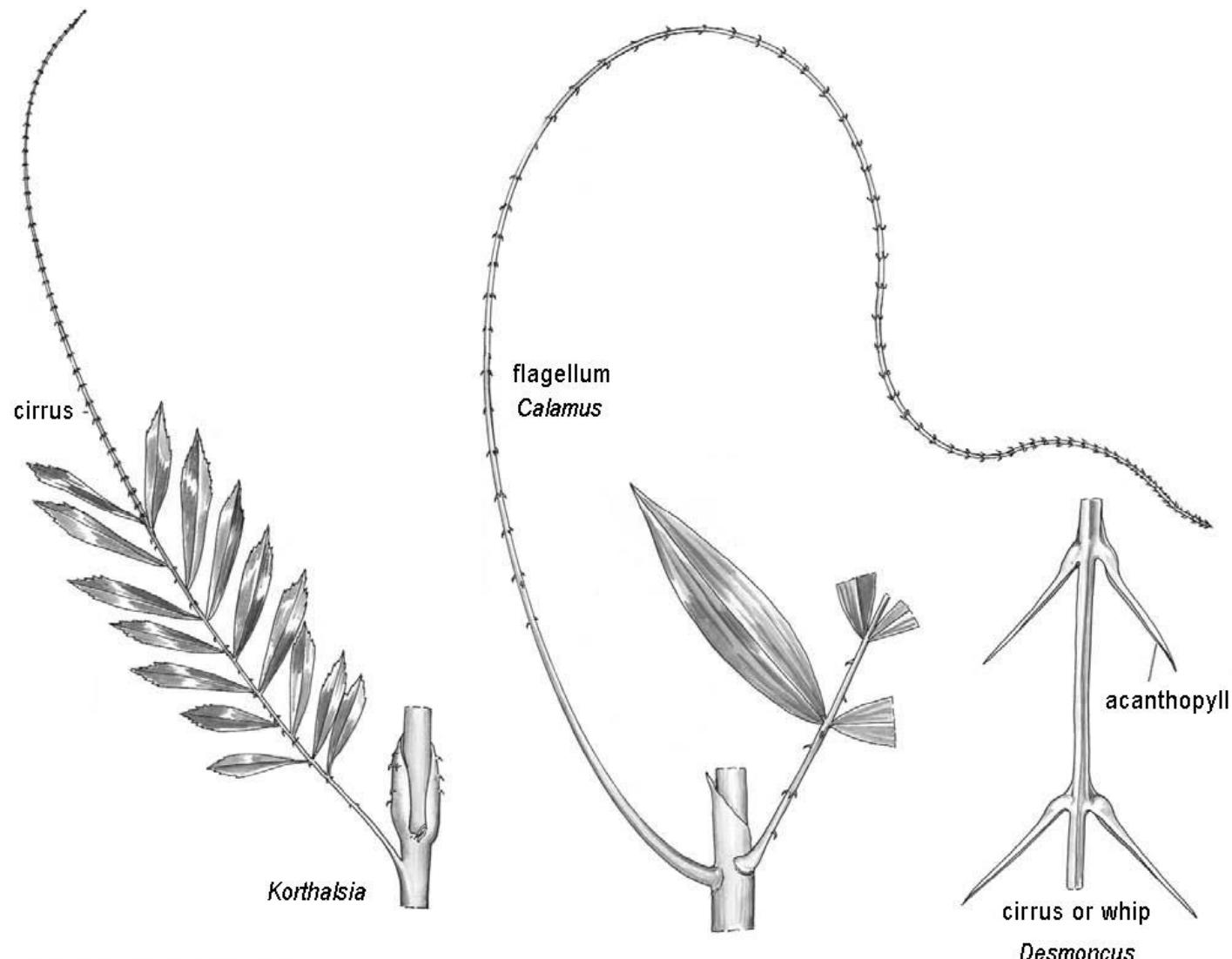


*Daemonorops curranii* (C.E. Lewis)

# Special Structure

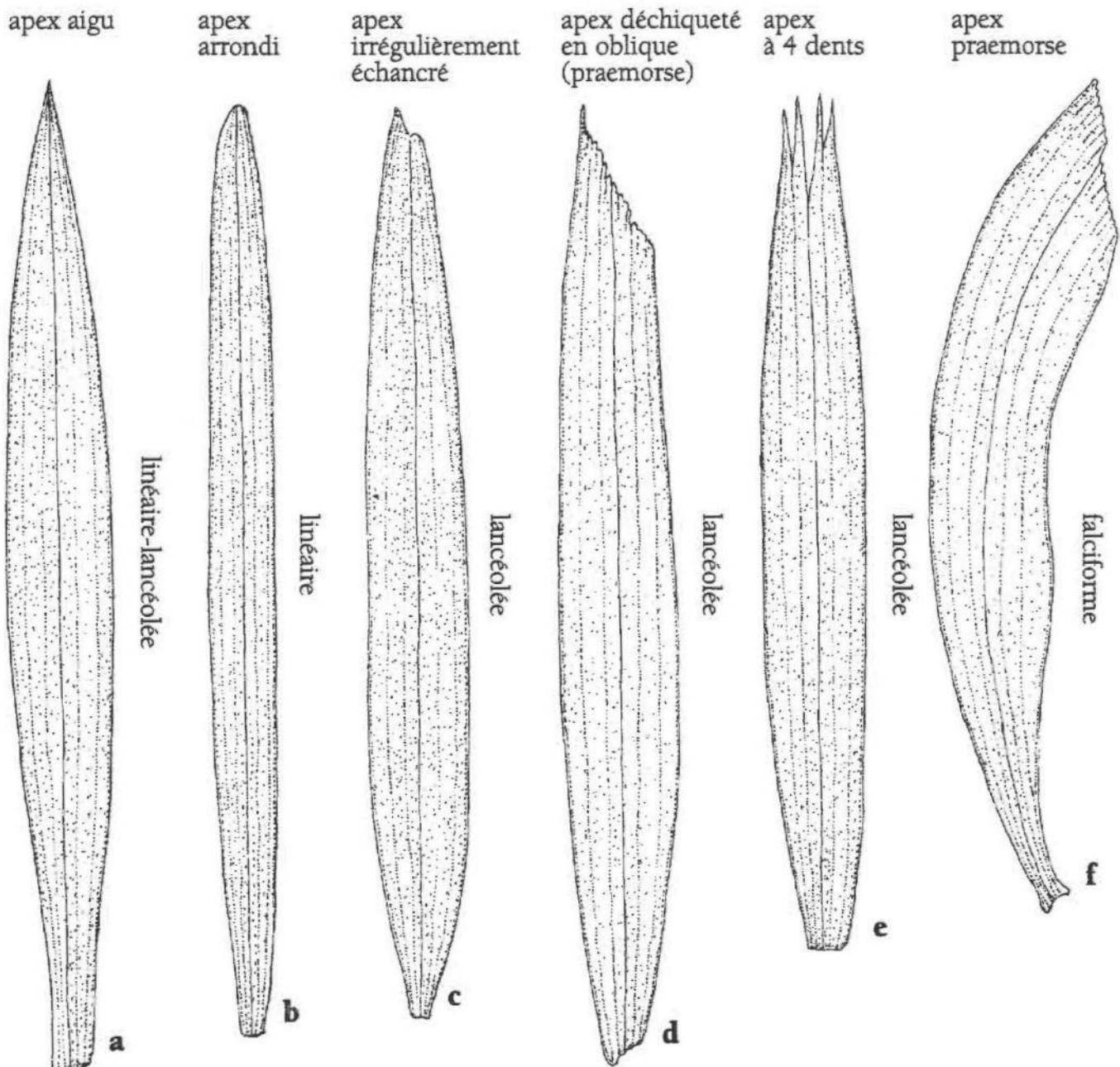






Drawn by Marion Ruff Sheehan

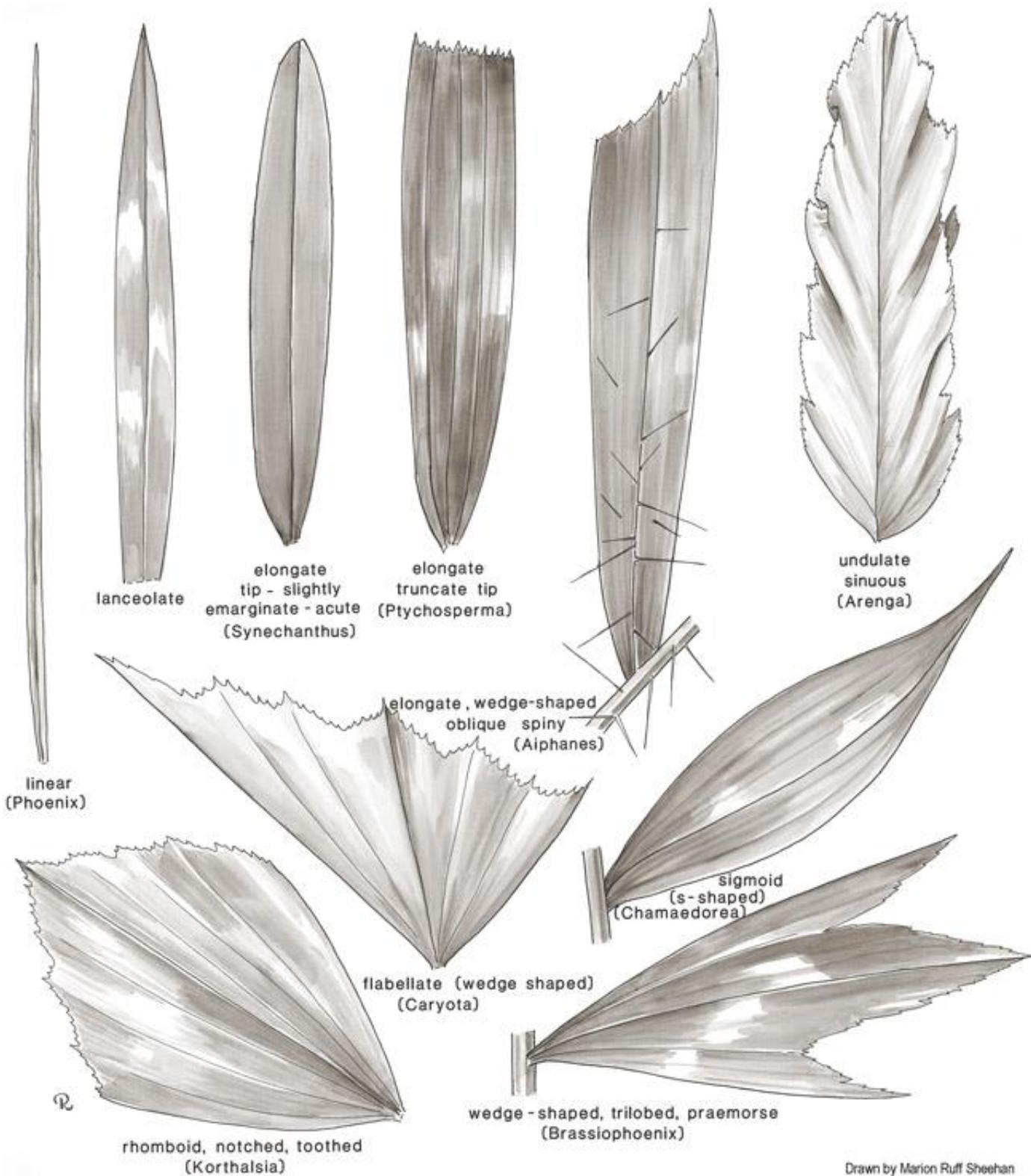
# LEAFLET SHAPES TIPS



a) *Archontophoenix cunninghamiana*  
b) *Chamaedorea seifrizii*

c) *Veitchia montgomeryana*  
d) *Ptychosperma elegans*

e) *Carpentaria acuminata*  
f) *Hydriastele wendlandiana*



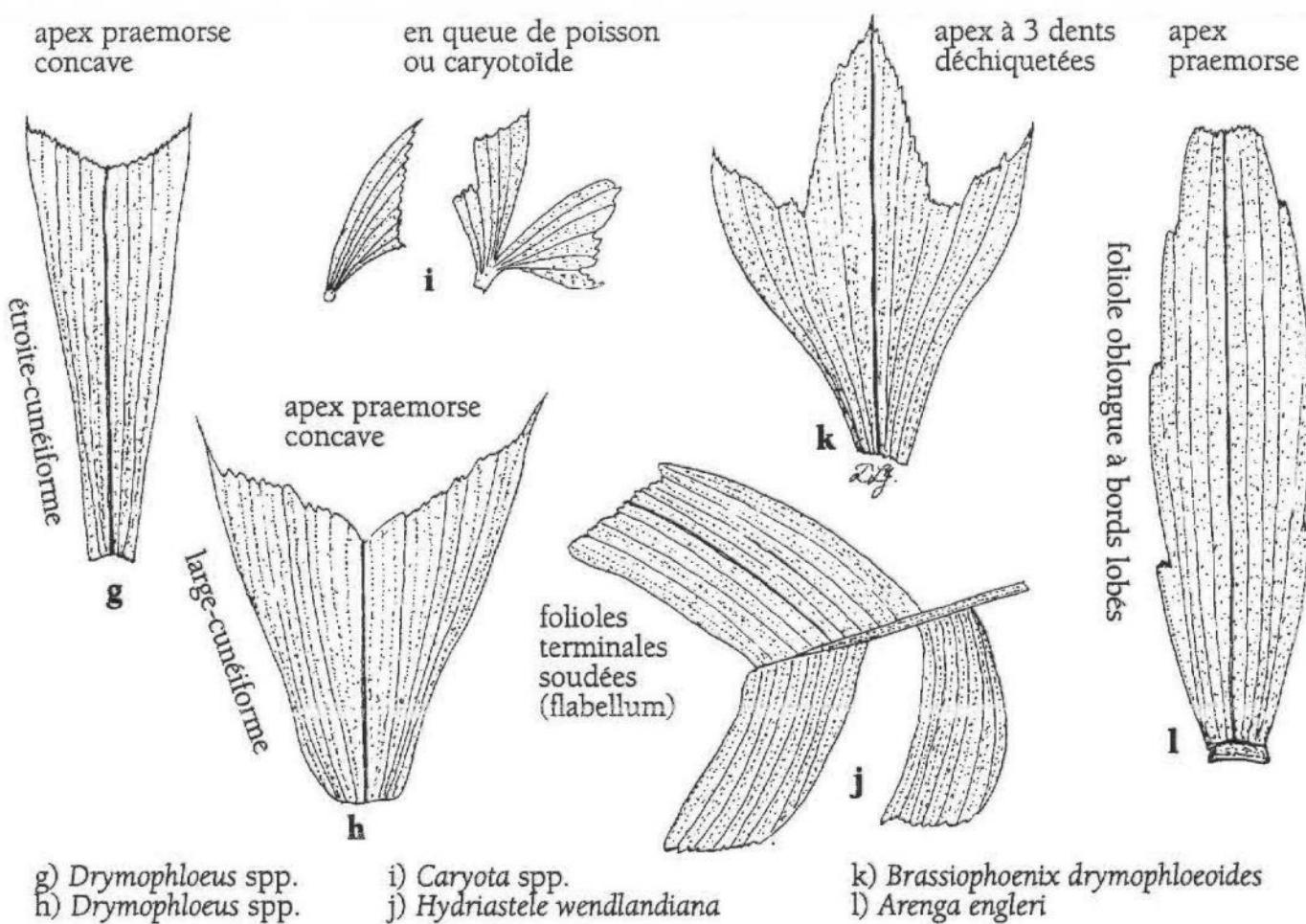
Drawn by Marion Ruff Sheehan

## Leaflet shapes



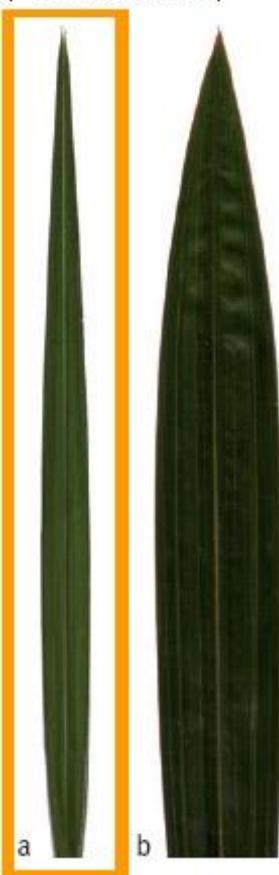
All photos C.E. Lewis

a, linear (*Pseudophoenix vinifera*)b, linear, spiny (*Acrocomia crispa*)c, lanceolate (*Archontophoenix tuckeri*)d, lanceolate, with tail-like projection (*Desmoncus cirrhiferus*)e, undulate, sinuous (*Arenga undulatifolia*)f, truncate tip (*Ptychosperma lauterbachii*)g, multi-fold, sigmoid (*Pinanga coronata*)h, flabellate, praemorse (*Caryota rumphiana*)i, rhomboid, praemorse (*Arenga caudata*)j, concavely praemorse (*Ptychosperma cuneata*)k, tri-lobed, praemorse (*Brassia phoenix drymophloeoides*)



## Leaf tips

**linear acuminate**  
(*Phoenix reclinata*)



a

b

**acuminate notched**  
(*Brahea sp.*)



c

d

**acuminate with intersegmental fibres**  
(*Washingtonia filifera*)



e

f

g

h



i



j



k



l



m

All photos C.E. Lewis

a, linear acuminate (*Phoenix reclinata*)b, acute (*Hyophorbe lagenicaulis*)c, acuminate notched (*Brahea sp.*)d, deeply bifid (*Nannorrhops ritchiana*)e, deeply bifid with persistent fibre (*Sabal palmetto*)f, acuminate with intersegmental fibres (*Washingtonia filifera*)g, oblique (*Kentiopsis oliviformis*)h, oblique, notched (*Attalea crassispatha*)i, bifid emarginated acute (*Chamaedorea metallica*)j, praemorse truncate (*Reinhardtia sp.*)k, rhomboid, toothed (*Wallichia oblongifolia*)l, concavely praemorse (*Ptychosperma macarthurii*)m, unevenly praemorse (*Hydriastele pleurocarpa*)

## Leaf tips

linear acuminate  
(*Phoenix reclinata*)acuminate notched  
(*Brahea sp.*)acuminate with intersegmental fibres  
(*Washingtonia filifera*)a, linear acuminate (*Phoenix reclinata*)b, acute (*Hyophorbe lagenicaulis*)c, acuminate notched (*Brahea sp.*)d, deeply bifid (*Nannorrhops ritchiana*)e, deeply bifid with persistent fibre (*Sabal palmetto*)f, acuminate with intersegmental fibres (*Washingtonia filifera*)g, oblique (*Kentropyx oliviformis*)h, oblique, notched (*Attalea crassispatha*)i, bifid emarginated acute (*Chamaedorea metallica*)j, praemorse truncate (*Reinhardtia sp.*)k, rhomboid, toothed (*Wallichia oblongifolia*)l, concavely praemorse (*Ptychosperma macarthurii*)m, unevenly praemorse (*Hydriastele pleurocarpa*)*Phoenix reclinata*  
(C.E. Lewis)

## Leaf tips

**acute***(Hyophorbe lagenicaulis)*

All photos C.E. Lewis

a, linear acuminatae (*Phoenix reclinata*)b, acute (*Hyophorbe lagenicaulis*)c, acuminatae notched (*Brahea sp.*)d, deeply bifid (*Nannorrhops ritchiana*)e, deeply bifid with persistent fibre (*Sabal palmetto*)f, acuminatae with intersegmental fibres (*Washingtonia filifera*)g, oblique (*Kentiopsis oliviformis*)h, oblique, notched (*Attalea crassispatha*)i, bifid emarginated acute (*Chamaedorea metallica*)j, praemoise truncate (*Reinhardtia sp.*)k, rhomboid, toothed (*Wallitchia oblongifolia*)l, concavely praemoise (*Ptychosperma macarthurii*)m, unevenly praemoise (*Hydiastele pleurocarpa*)*Hyophorbe lagenicaulis*  
(C.E. Lewis)

## Leaf tips

**bifid emarginated acute***(Chamaedorea metallica)*

All photos C.E. Lewis

a, linear acuminata (*Phoenix reclinata*)b, acute (*Hyophorbe lagenicaulis*)c, acuminata notched (*Brahea* sp.)d, deeply bifid (*Nannorrhops ritchiana*)e, deeply bifid with persistent fibre (*Sabal palmetto*)f, acuminata with intersegmental fibres (*Washingtonia filifera*)g, oblique (*Kentiopsis oliviformis*)h, oblique, notched (*Attalea crassispatha*)i, bifid emarginated acute (*Chamaedorea metallica*)j, praemoise truncate (*Reinhardtia* sp.)k, rhomboid, toothed (*Wallichia oblongifolia*)l, concavely praemorse (*Ptychosperma macarthurii*)m, unevenly praemorse (*Hydriastele pleurocarpa*)

## Leaflet shapes

a, linear (*Pseudophoenix vinifera*)b, linear, spiny (*Acrocomia crispa*)c, lanceolate (*Archontophoenix tuckeri*)d, lanceolate, with tail-like projection (*Desmoncus cirrhiferus*)e, undulate, sinuous (*Arenga undulatifolia*)f, truncate tip (*Ptychosperma lauterbachii*)g, multi-fold, sigmoid (*Pinanga coronata*)h, flabellate, praemorse (*Caryota rumphiana*)i, rhomboid, praemorse (*Arenga caudata*)j, concavely praemorse (*Ptychosperma cuneata*)k, tri-lobed, praemorse (*Brassiaophoenix drymophloeoides*)

All photos C.E. Lewis

*Caryota rumphiana* (C.E. Lewis)

## Leaflet shapes

lanceolate

*(Archontophoenix tuckeri)*

lanceolate with tail-like projection

*(Desmoncus cirriferus)*

All photos C.E. Lewis

a, linear (*Pseudophoenix unifera*)b, linear, spiny (*Acrocomia crispa*)c, lanceolate (*Archontophoenix tuckeri*)d, lanceolate, with tail-like projection (*Desmoncus cirriferus*)e, undulate, sinuous (*Arenga undulatifolia*)f, truncate tip (*Ptychosperma lauterbachii*)g, multi-fold, sigmoid (*Pinanga coronata*)h, flabellate, praemorse (*Caryota rumphiana*)i, rhomboid, praemorse (*Arenga caudata*)j, concavely praemorse (*Ptychosperma cuneata*)k, tri-lobed, praemorse (*Brassiocephalum drymophloeoides*)*Archontophoenix tuckeri*  
(C.E. Lewis)*Desmoncus cirriferus* (C.E. Lewis)

## Leaflet shapes

linear

(Pseudophoenix  
vinifera)

linear, spiny

(Acrocomia crispa)

a, linear (*Pseudophoenix vinifera*)b, linear, spiny (*Acrocomia crispa*)c, lanceolate (*Archontophoenix tuckeri*)d, lanceolate, with tail-like projection (*Desmoncus cirriferus*)e, undulate, sinuous (*Arenga undulatifolia*)f, truncate tip (*Ptychosperma lauterbachii*)g, multi-fold, sigmoid (*Pinanga coronata*)h, flabellate, praemorse (*Caryota rumphiana*)i, rhomboid, praemorse (*Arenga caudata*)j, concavely praemorse (*Ptychosperma cuneata*)k, tri-lobed, praemorse (*Brassia phoenicoides*)

All photos C.E. Lewis



*Pseudophoenix vinifera*  
(C.E. Lewis)

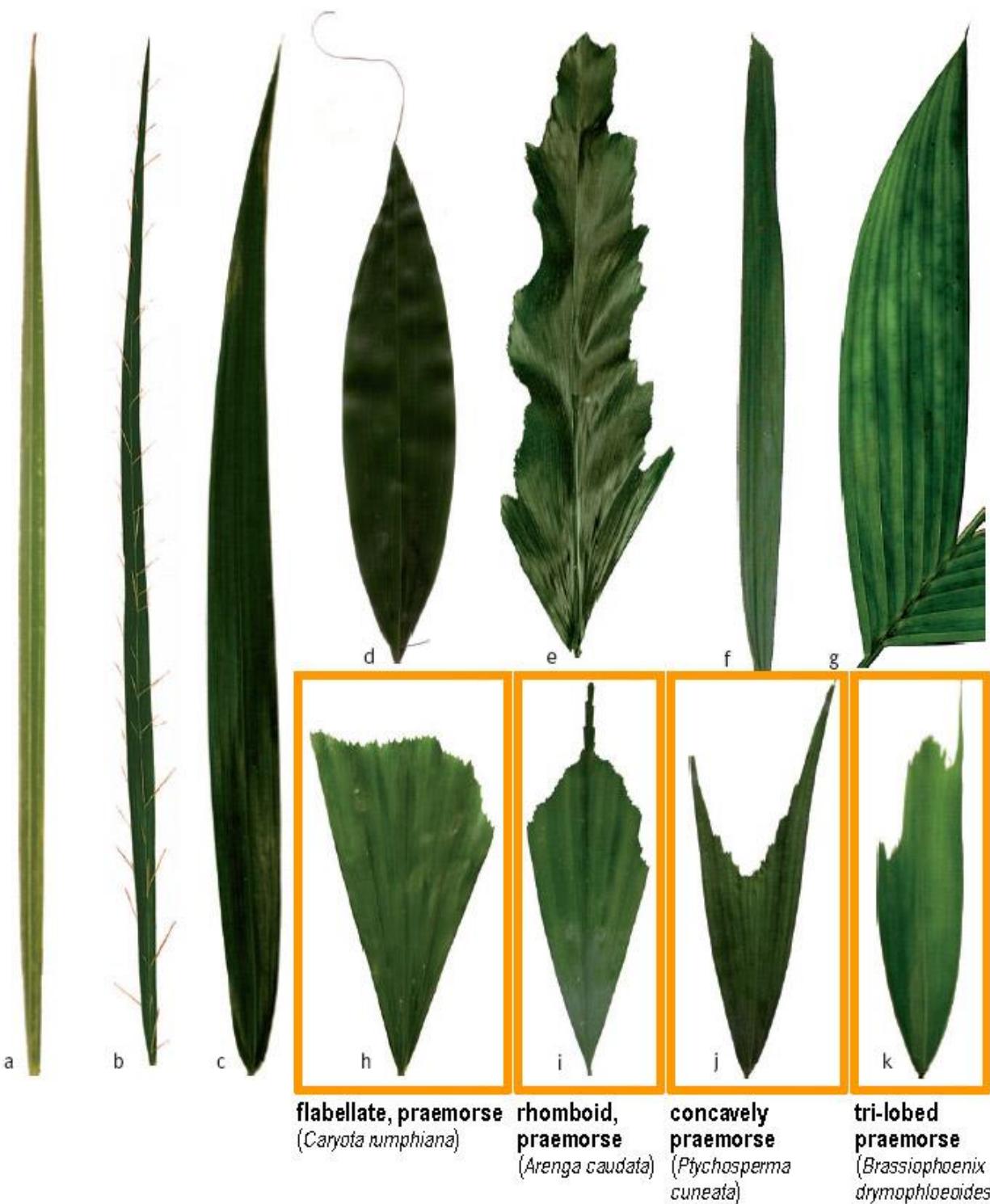


*Acrocomia crispa*  
(C.E. Lewis)



*Phoenix reclinata*  
(C.E. Lewis)

## Leaflet shapes



All photos C.E. Lewis

- a, linear (*Pseudophoenix vinifera*)  
 b, linear, spiny (*Acrocomia crispa*)  
 c, lanceolate (*Archontophoenix tuckeri*)  
 d, lanceolate, with tail-like projection (*Desmoncus cirriferus*)  
 e, undulate, sinuous (*Arenga undulatifolia*)  
 f, truncate tip (*Ptychosperma lauterbachii*)

- g, multi-fold, sigmoid (*Pinanga coronata*)  
 h, flabellate, praemorse (*Caryota rumphiana*)  
 i, rhomboid, praemorse (*Arenga caudata*)  
 j, concavely praemorse (*Ptychosperma cuneata*)  
 k, tri-lobed, praemorse (*Brassiphoenix drymophloeoides*)

## Leaf tips



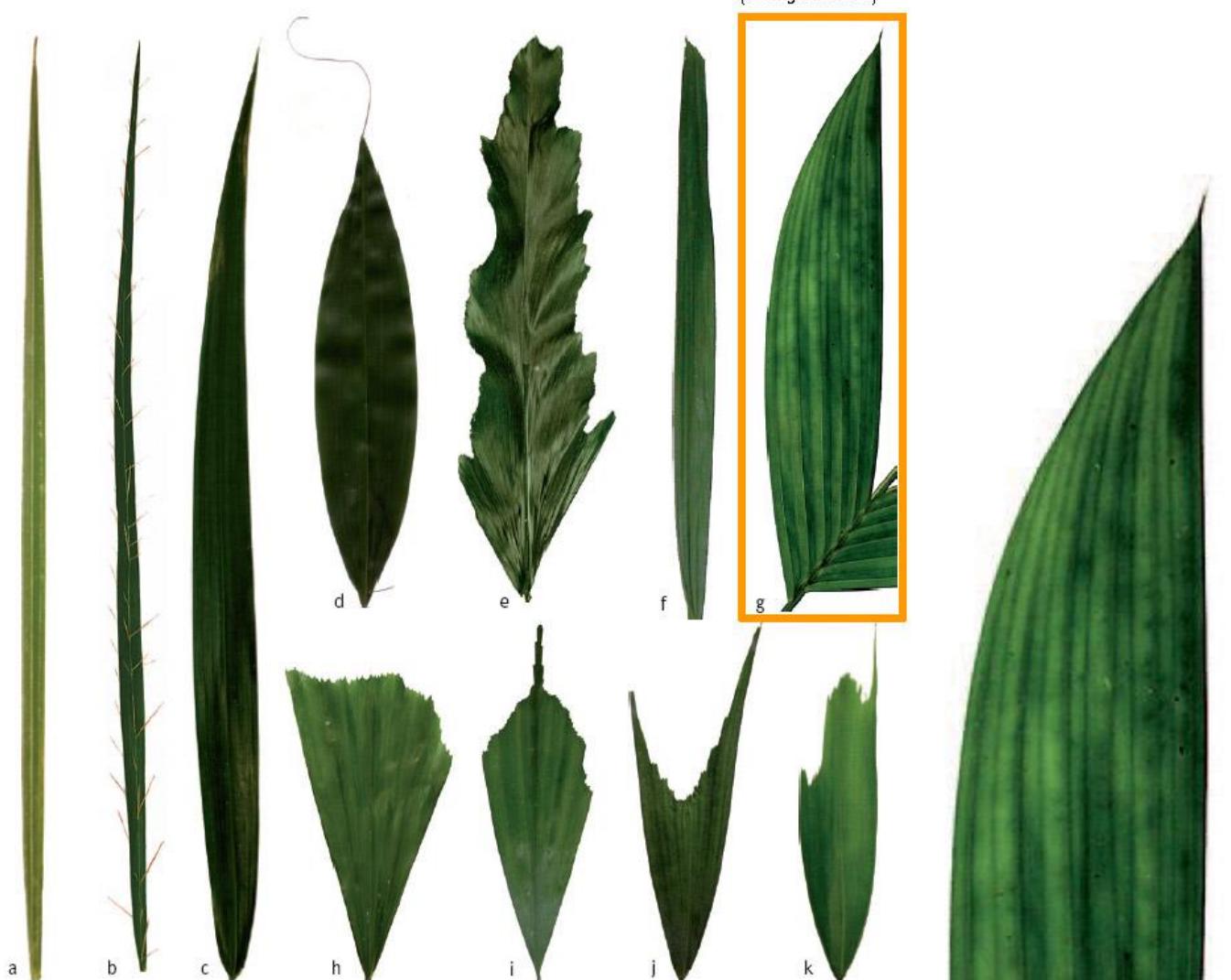
**praemorse truncated**  
(*Reinhardtia* sp.)

**concavely praemorse**    **unevenly praemorse**  
(*Ptychosperma macarthurii*) (*Hydriastele pleurocarpa*)

All photos C.E. Lewis

- a, linear acuminate (*Phoenix reclinata*)
- b, acute (*Hyophorbe lagenicaulis*)
- c, acuminate notched (*Brahea* sp.)
- d, deeply bifid (*Nannorrhops ritchiana*)
- e, deeply bifid with persistent fibre (*Sabal palmetto*)
- f, acuminate with intersegmental fibres (*Washingtonia filifera*)
- g, oblique (*Kentiopsis oliviformis*)

- h, oblique, notched (*Attalea crassispatha*)
- i, bifid emarginated acute (*Chamaedorea metallica*)
- j, praemorse truncate (*Reinhardtia* sp.)
- k, rhomboid, toothed (*Wallichia oblongifolia*)
- l, concavely praemorse (*Ptychosperma macarthurii*)
- m, unevenly praemorse (*Hydriastele pleurocarpa*)



All photos C.E. Lewis

*Pinanga coronata* (C.E. Lewis)





All photos C.E. Lewis

- a, linear (*Pseudophoenix vinifera*)
- b, linear, spiny (*Acrocomia crispa*)
- c, lanceolate (*Archontophoenix tucken*)
- d, lanceolate, with tail-like projection (*Desmoncus cirrhiferus*)
- e, undulate, sinuous (*Arenga undulatifolia*)
- f, truncate tip (*Ptychosperma lauterbachii*)

- g, multi-fold, sigmoid (*Pinanga coronata*)
- h, flabellate, praemorse (*Caryota rumphiana*)
- i, rhomboid, praemorse (*Arenga caudata*)
- j, concavely praemorse (*Ptychosperma cuneata*)
- k, tri-lobed, praemorse (*Brassaiophoenix drymophloeoides*)

*Ptychosperma lauterbachii* (C.E. Lewis)

## Leaf tips



All photos C.E. Lewis

- a, linear acuminata (*Phoenix reclinata*)  
 b, acute (*Hyophorbe lagenicaulis*)  
 c, acuminate notched (*Brahea sp.*)  
 d, deeply bifid (*Nannorrhops ritchiana*)  
 e, deeply bifid with persistent fibre (*Sabal palmetto*)  
 f, acuminate with intersegmental fibres (*Washingtonia filifera*)  
 g, oblique (*Kentropyx oliviformis*)

- h, oblique, notched (*Attalea crassispatha*)  
 i, bifid emarginated acute (*Chamaedorea metallica*)  
 j, praemorse truncate (*Reinhardtia sp.*)  
 k, rhomboid, toothed (*Wallitchia oblongifolia*)  
 l, concavely praemorse (*Ptychosperma macarthurii*)  
 m, unevenly praemorse (*Hydnastele pleurocarpa*)

*Reinhardtia sp.* (C.E. Lewis)



All photos C.E. Lewis

*Arenga undulatifolia* (C.E. Lewis)



# BOTANY GLOSSARY INFLORESCENCES

**ARECACEAE**

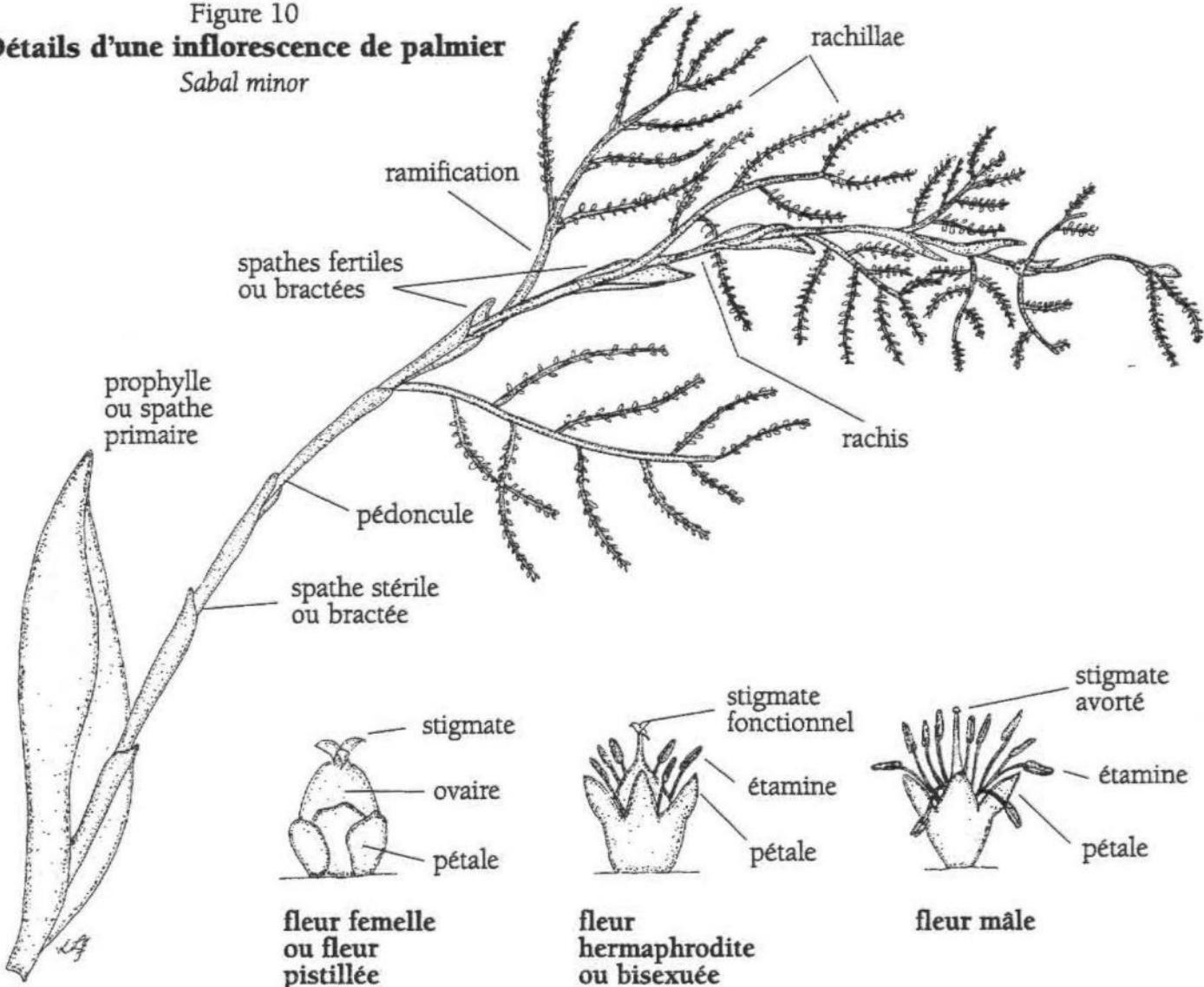


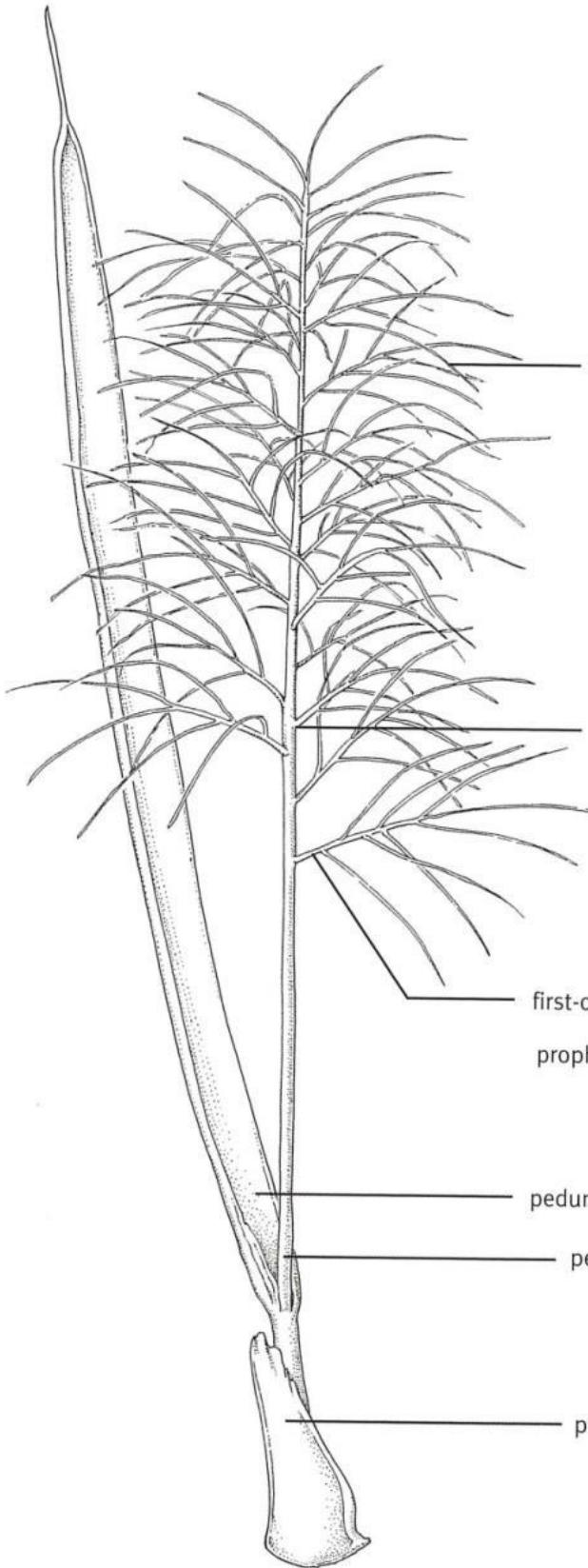
Hervé Rey, 2016

# **INFLORESCENCES**

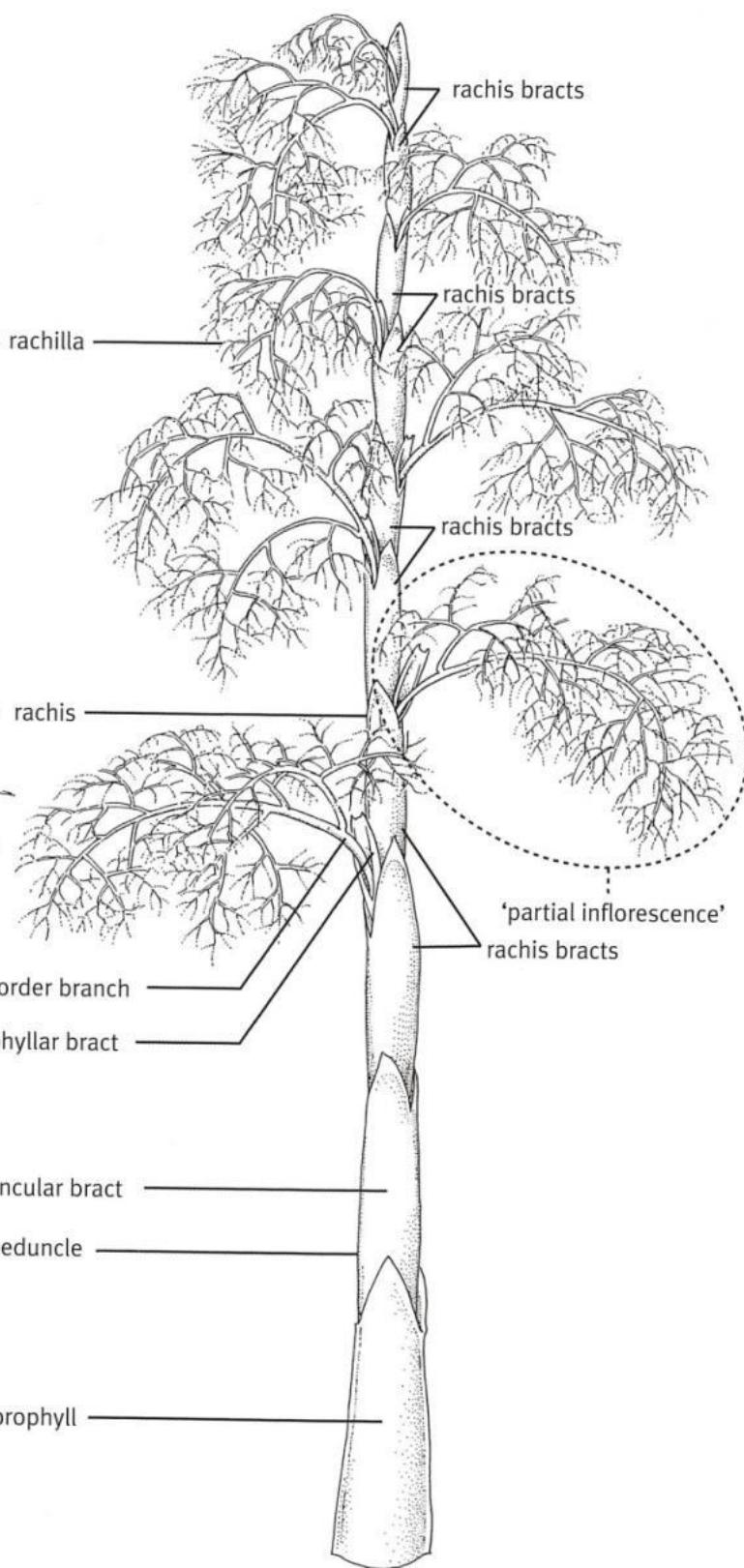
Figure 10

Détails d'une inflorescence de palmier  
*Sabal minor*

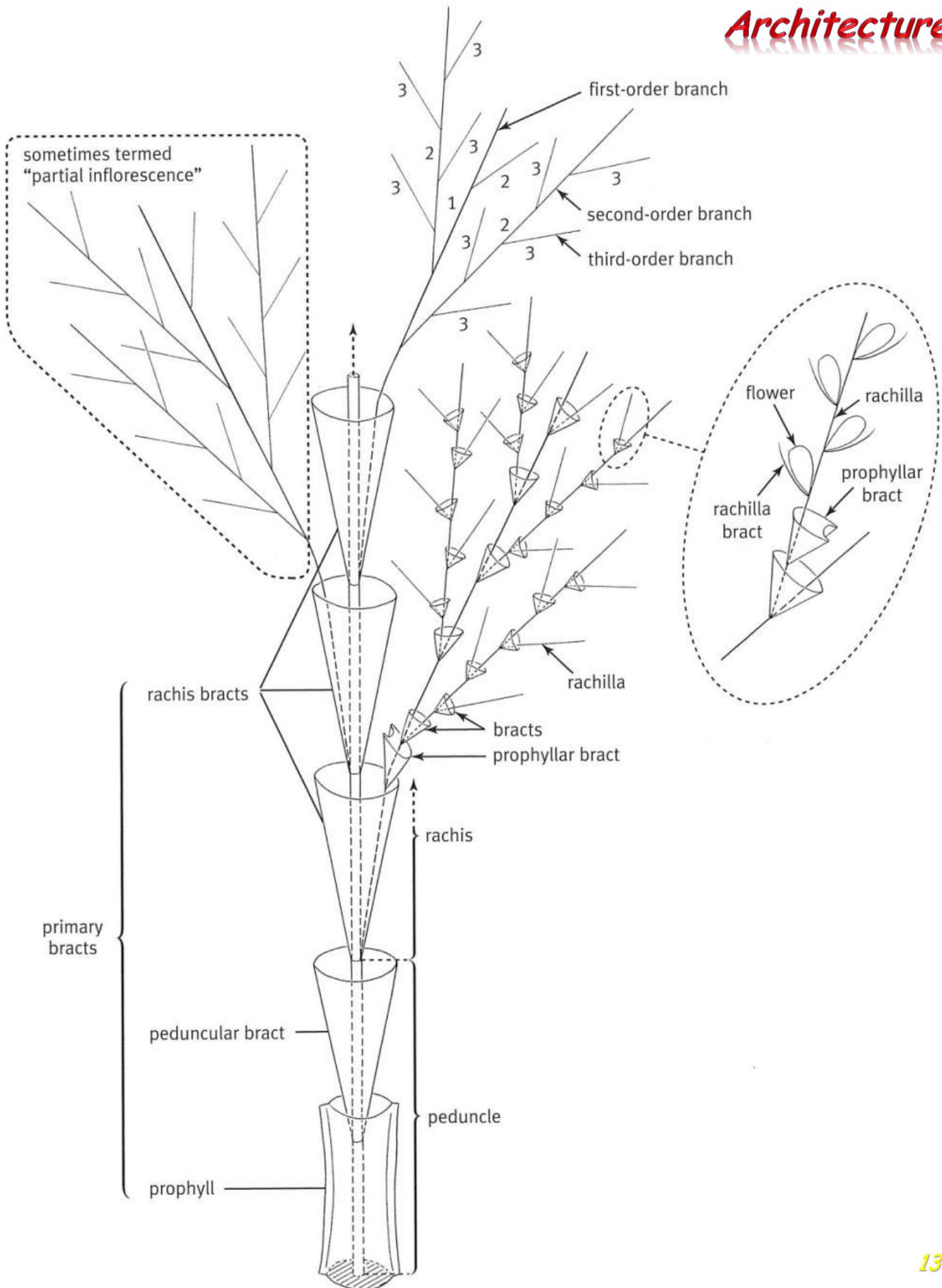


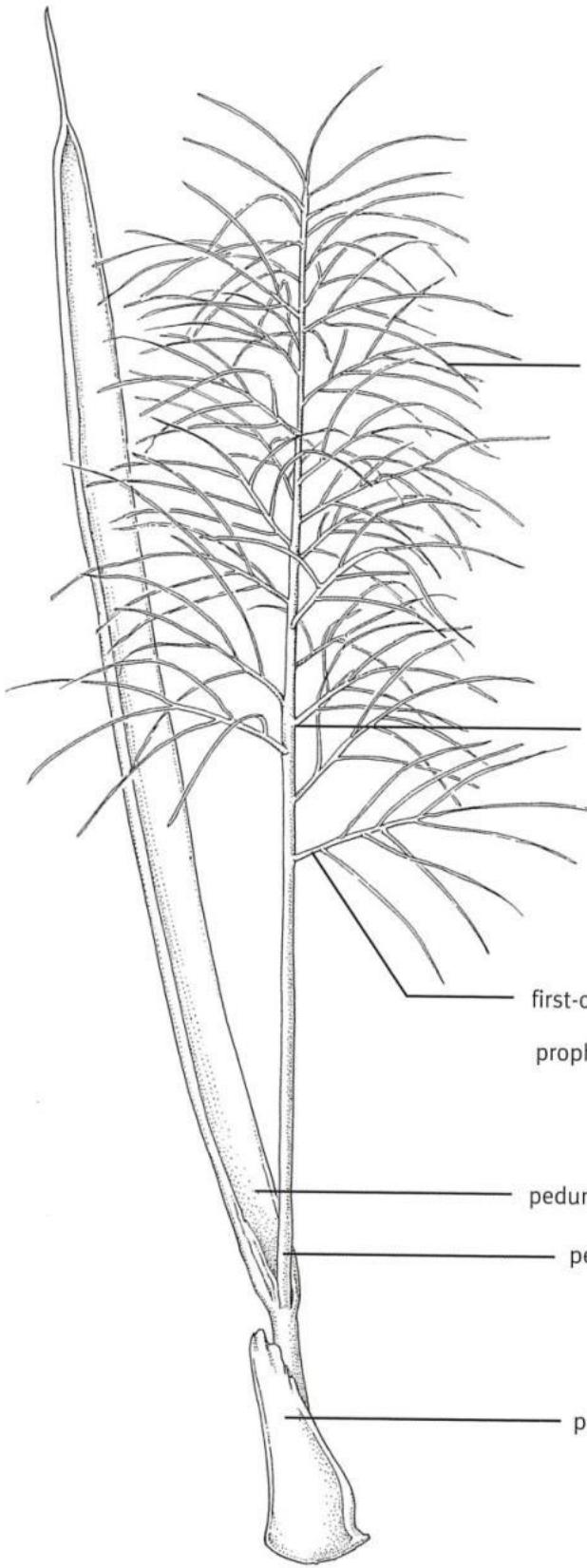


*Orania* (Arecoideae)  
Inflorescence branched to 2 orders

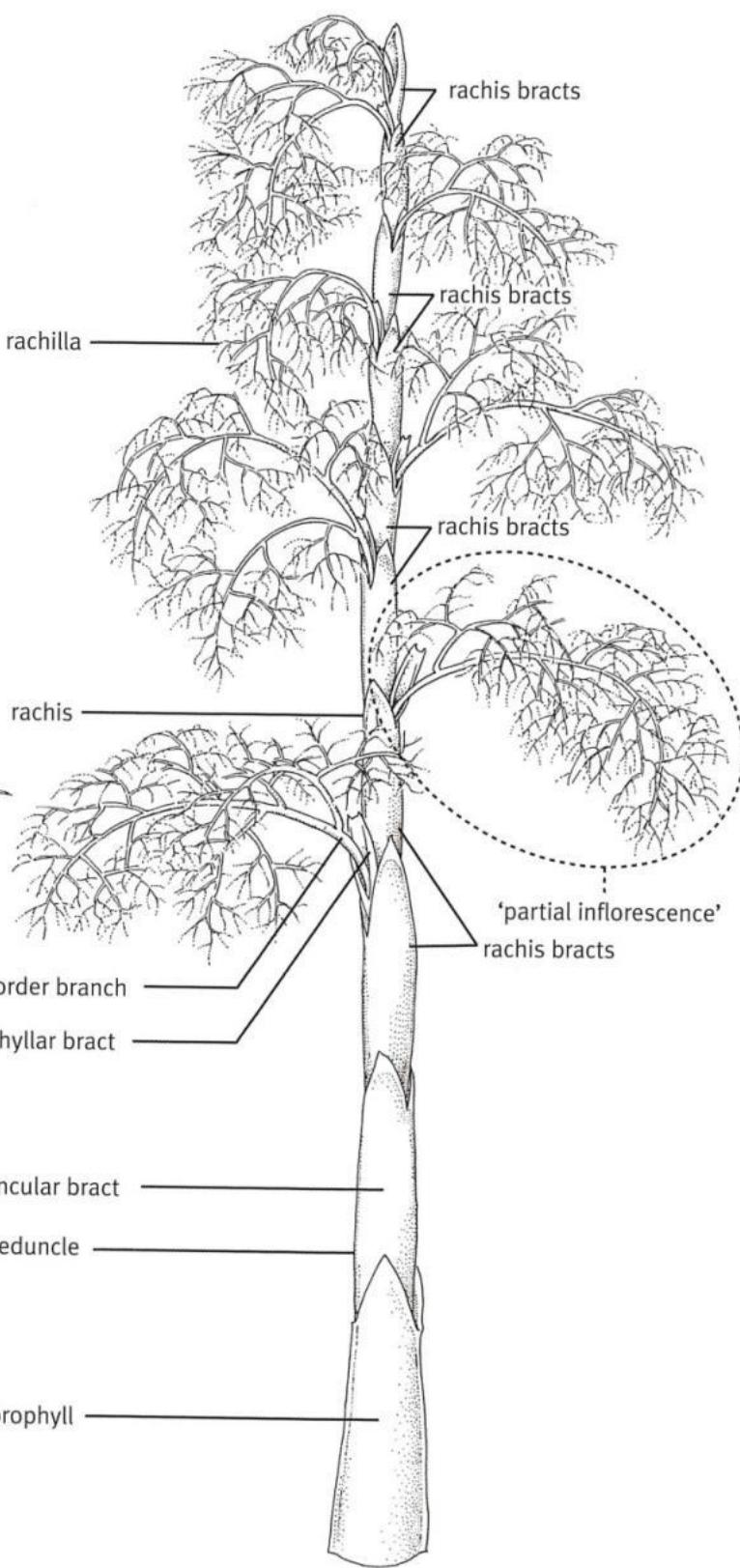


*Livistona* (Coryphoideae)  
Inflorescence branched to 5 orders

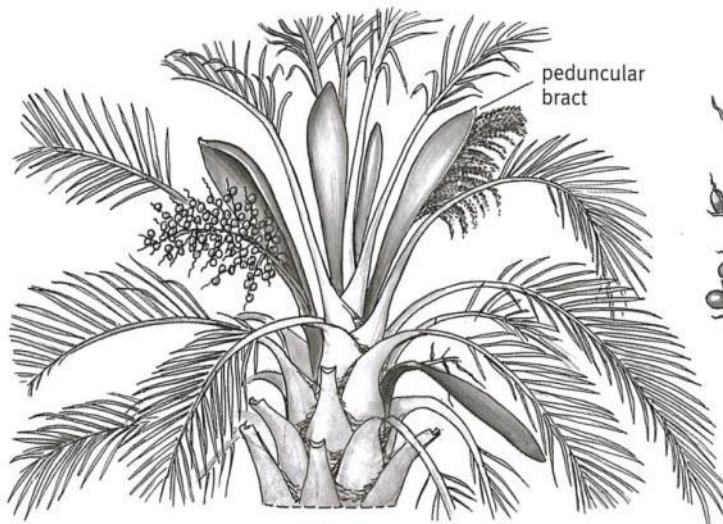




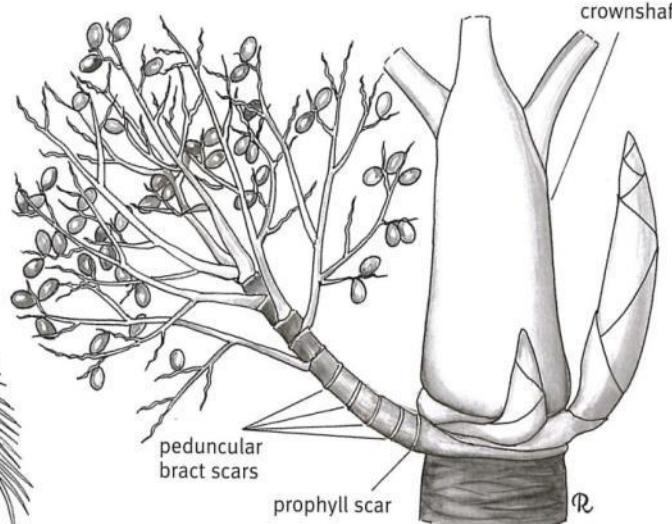
*Orania* (Arecoideae)  
Inflorescence branched to 2 orders



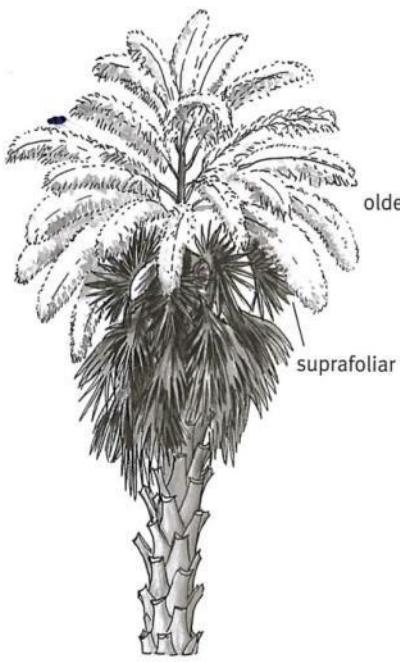
*Livistona* (Coryphoideae)  
Inflorescence branched to 5 orders



*Butia*  
Pleonanthic, with interfoliar inflorescences



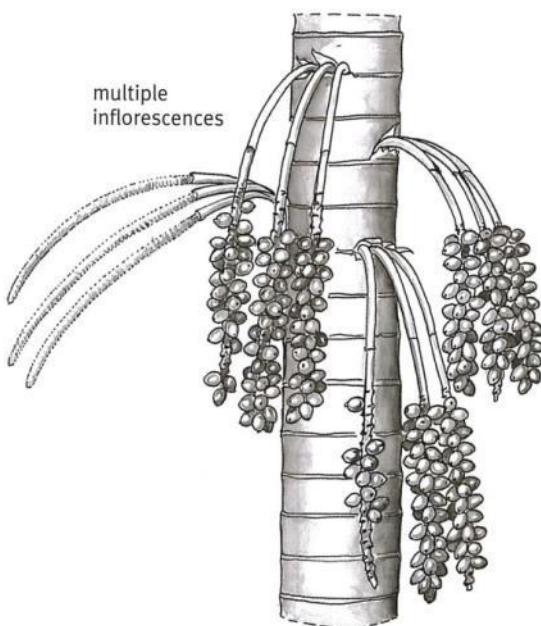
*Hyophorbe*  
Pleonanthic with infrafoliar inflorescences



*Corypha*  
Hapaxanthic, with acropetal maturation

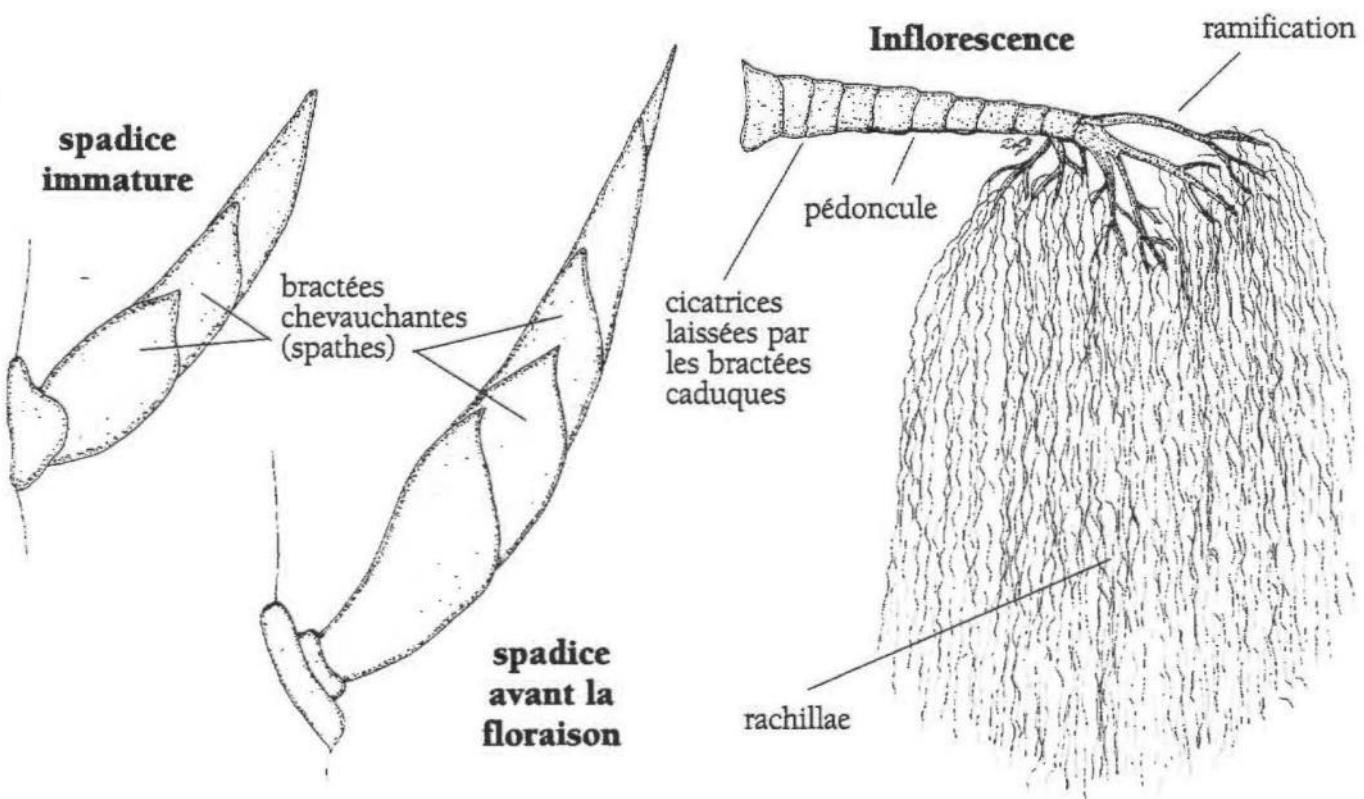


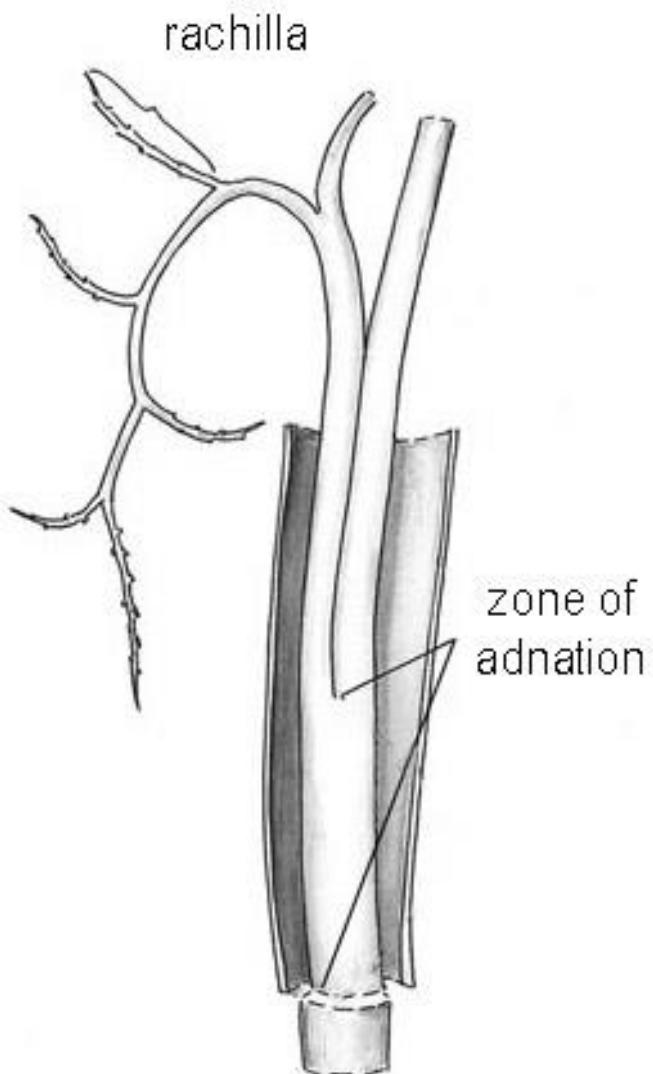
*Caryota*  
Hapaxanthic, with basipetal maturation



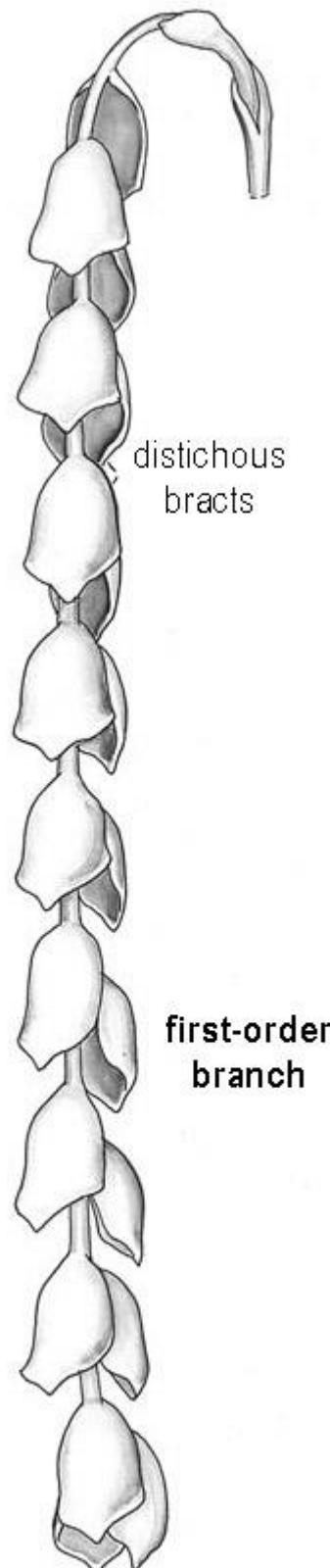
*Howea*  
Pleonanthic, interfoliar inflorescences  
(becoming infrafoliar)

Développement de l'inflorescence de *Hyophorbe verschaffeltii*





Drawn by Marion Ruff Sheehan



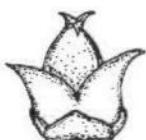
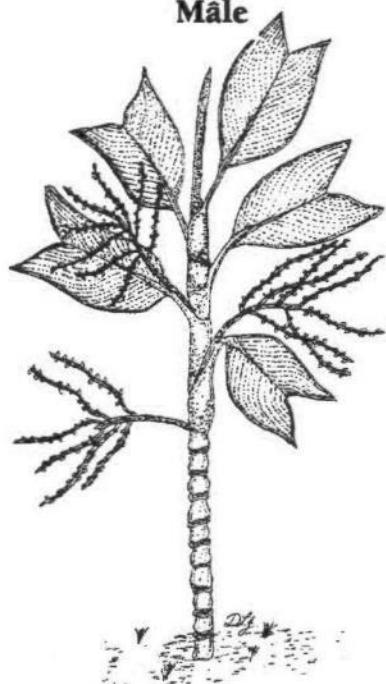
*Plectocomia*

Drawn by Marion Ruff Sheehan

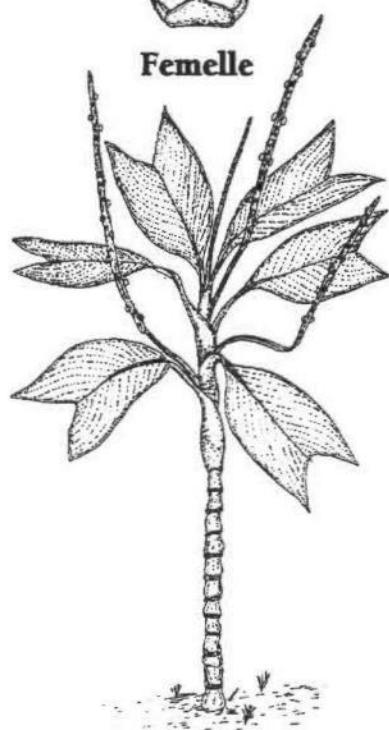
Dimorphisme  
sexuel chez  
*Chamaedorea*  
*geonomiformis*



Mâle

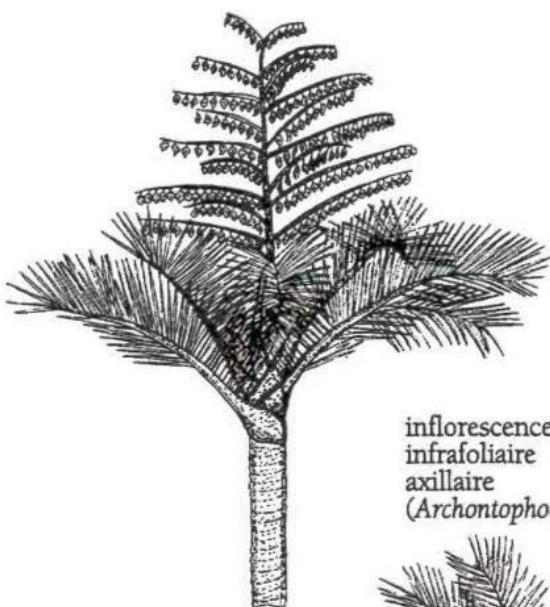


Femelle



## Disposition des inflorescences chez les palmiers

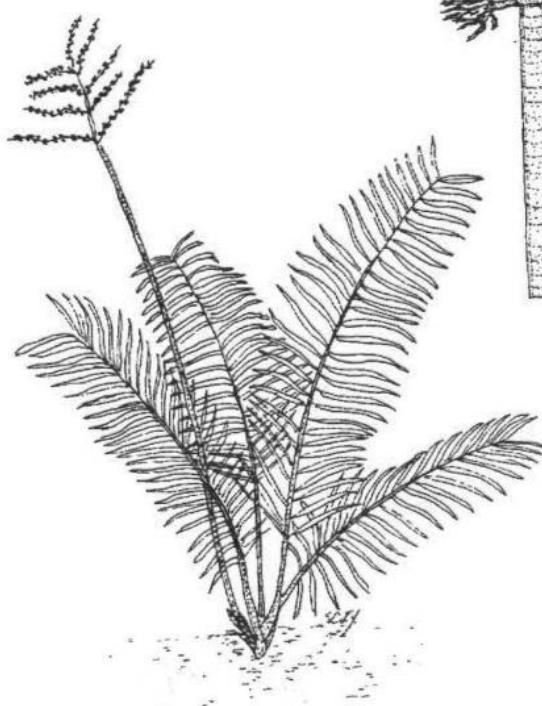
terminale ou suprafoliaire  
(*Metroxylon salomonense*)



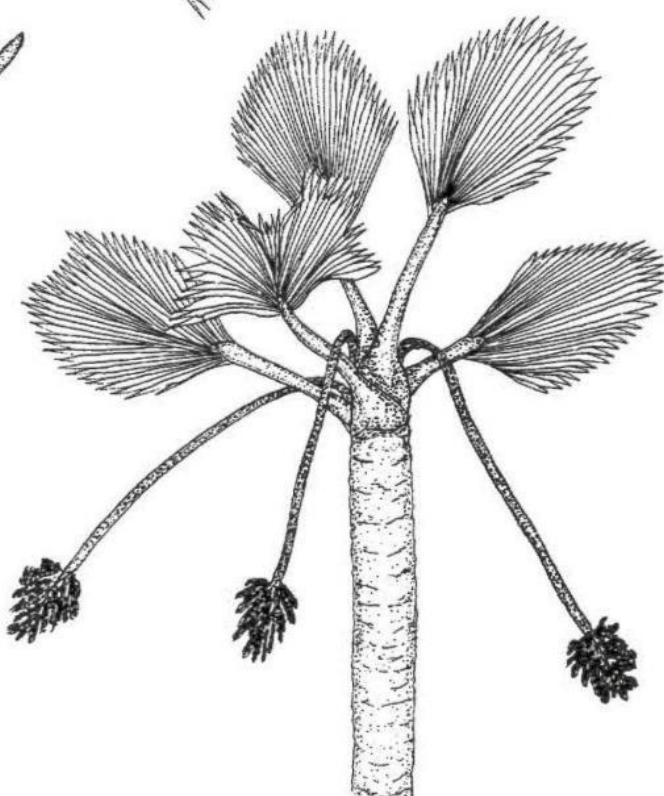
inflorescence interfoliaire axillaire courte (*Pritchardia pacifica*)



inflorescence  
infrafoliaire  
axillaire  
(*Archontophoenix*)

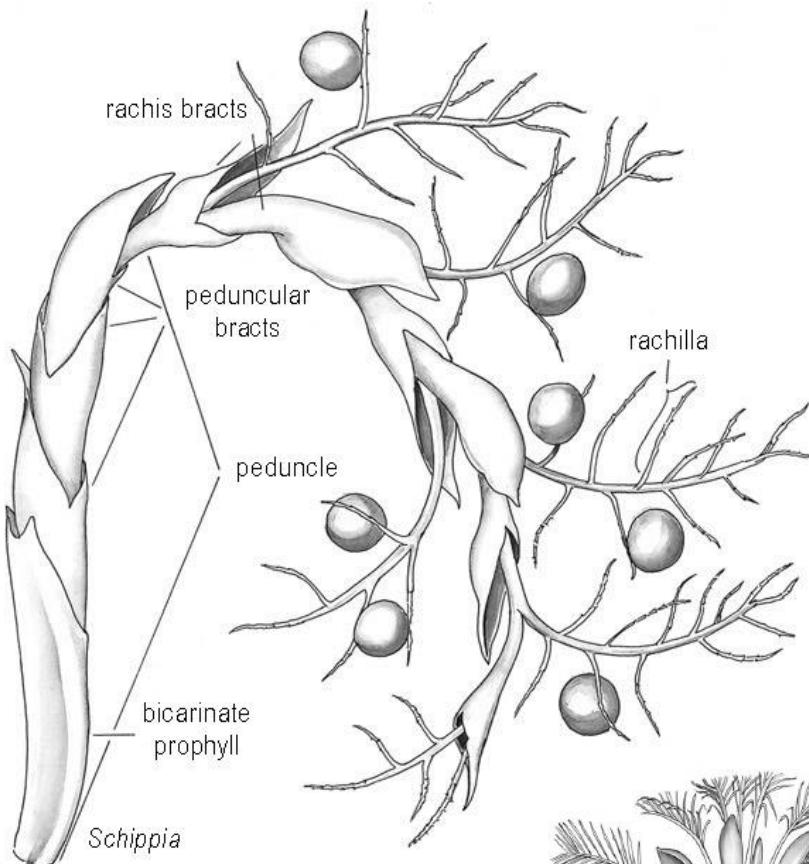


inflorescence radicale ou basale,  
axillaire (*Chamaedorea radicalis*)

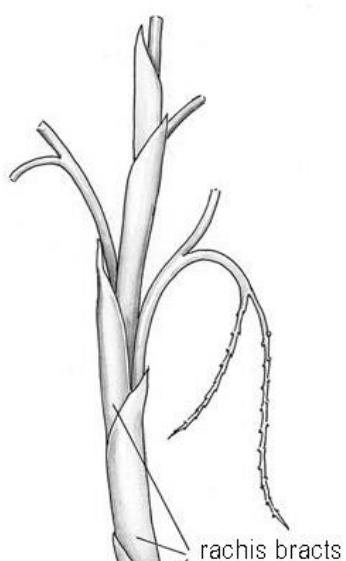


inflorescence interfoliaire axillaire  
longue (*Pritchardia thurstonii*)

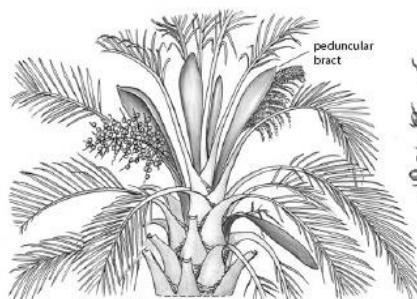
# Peduncle Peduncular Bract



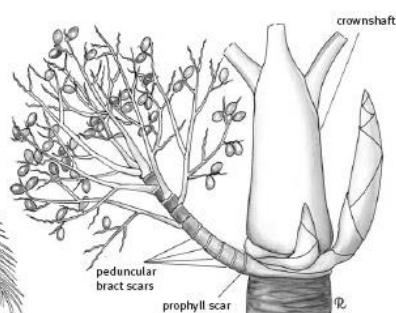
*Schipia*



rachis bracts



*Butia*  
Pleonanthic, with interfoliar inflorescences



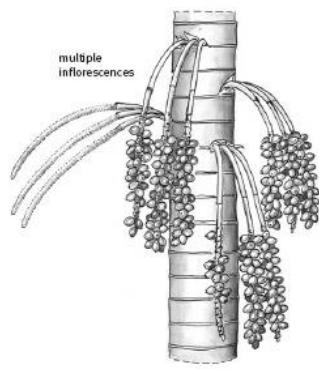
*Hypophloe*  
Pleonanthic with infrafoliar inflorescences



*Corypha*  
Hapaxanthic, with acropetal maturation

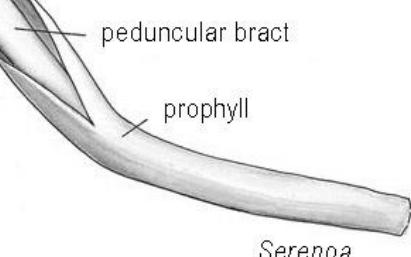


*Caryota*  
Hapaxanthic, with basipetal maturation



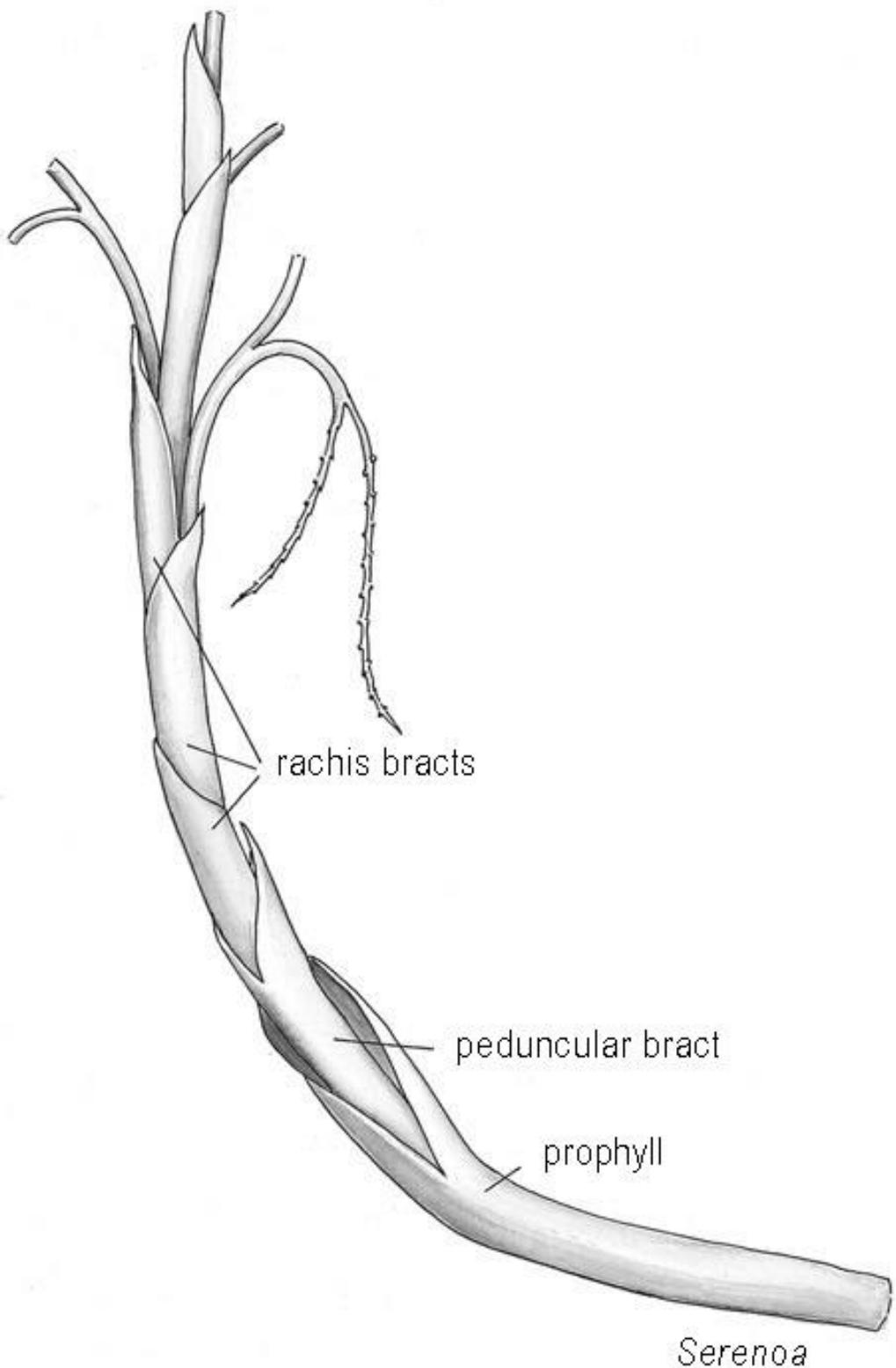
*Howea*  
Pleonanthic, interfoliar inflorescences (becoming infrafoliar)

Variation in inflorescence presentation in palms. (Drawn by Marion Ruff Sheehan)

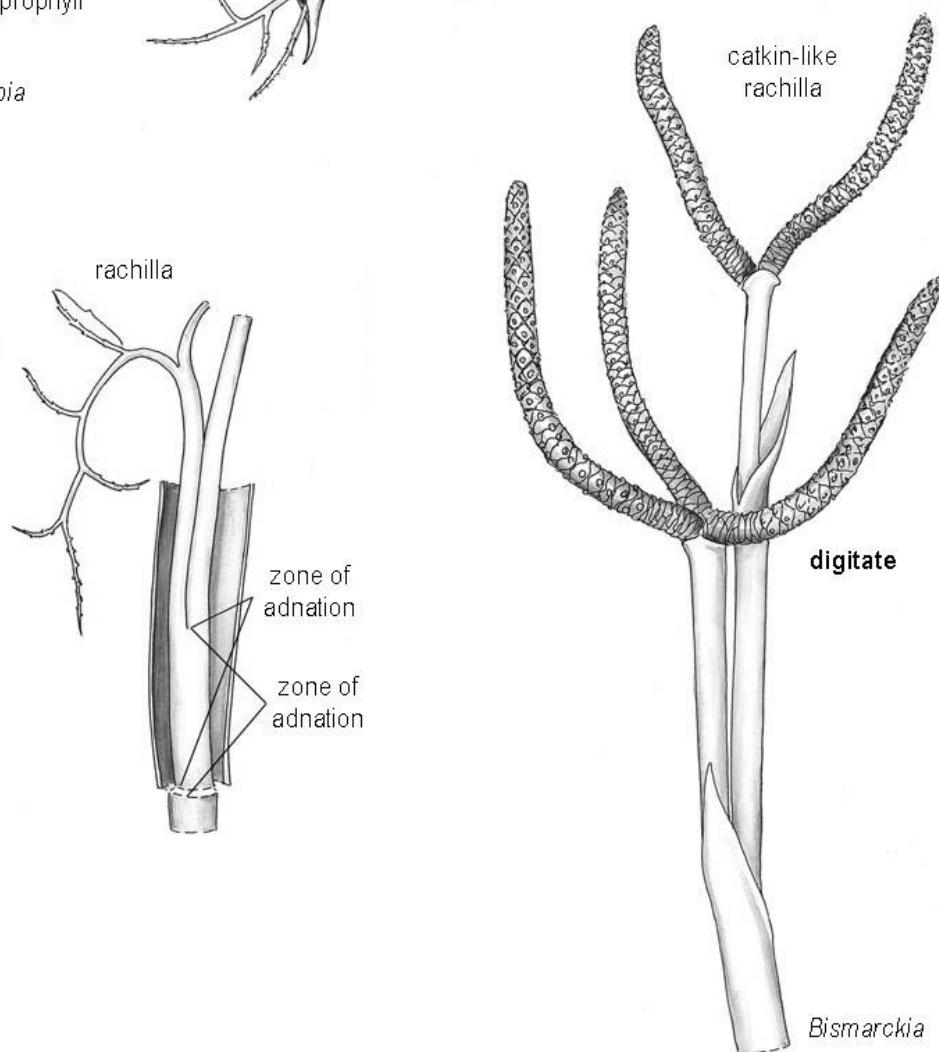
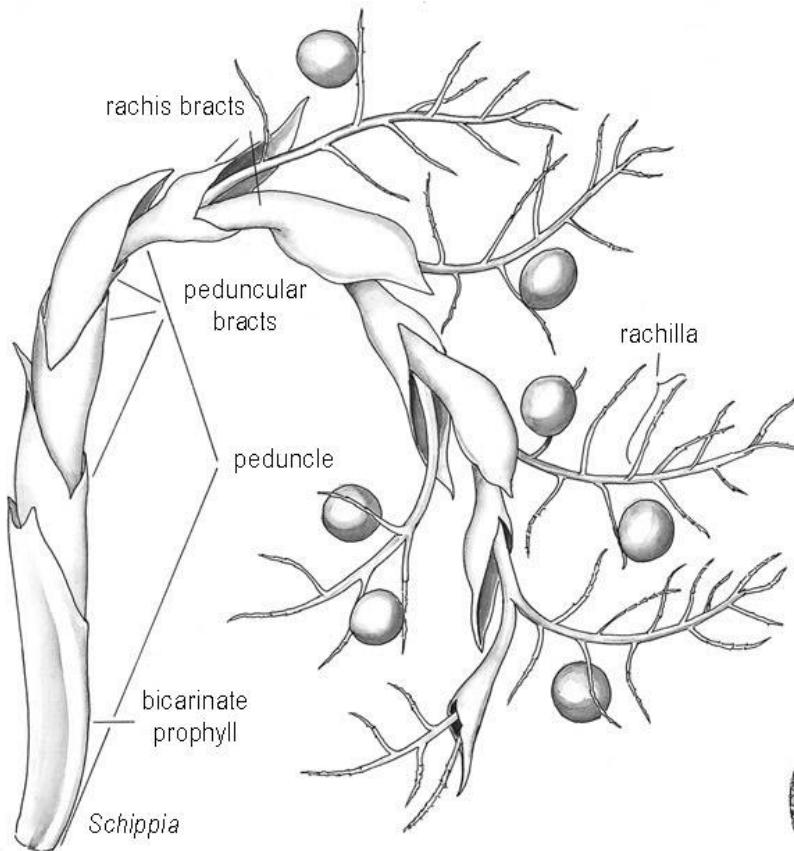


*Serenoa*

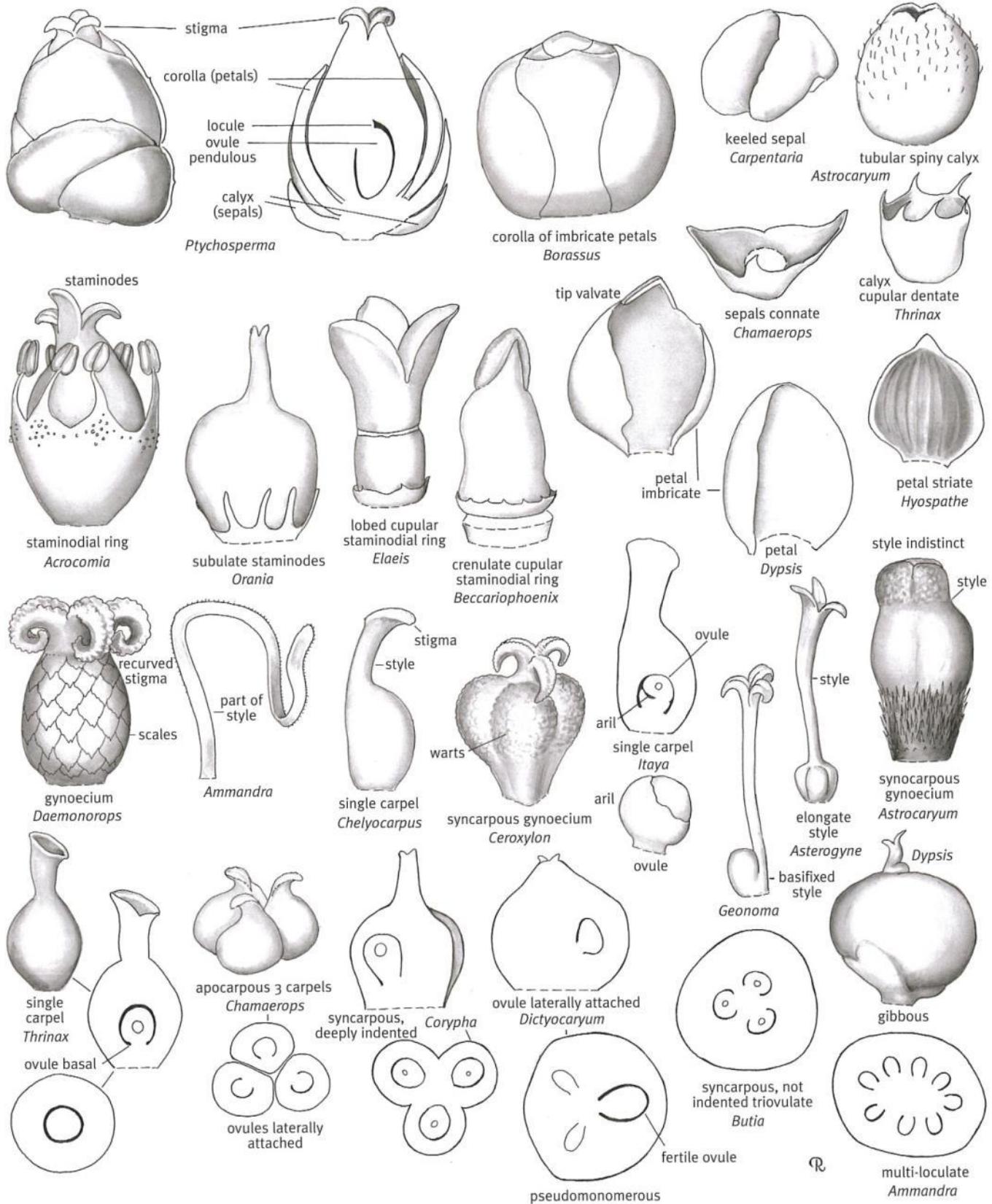
*Prophyll*  
*Rachis Bract*

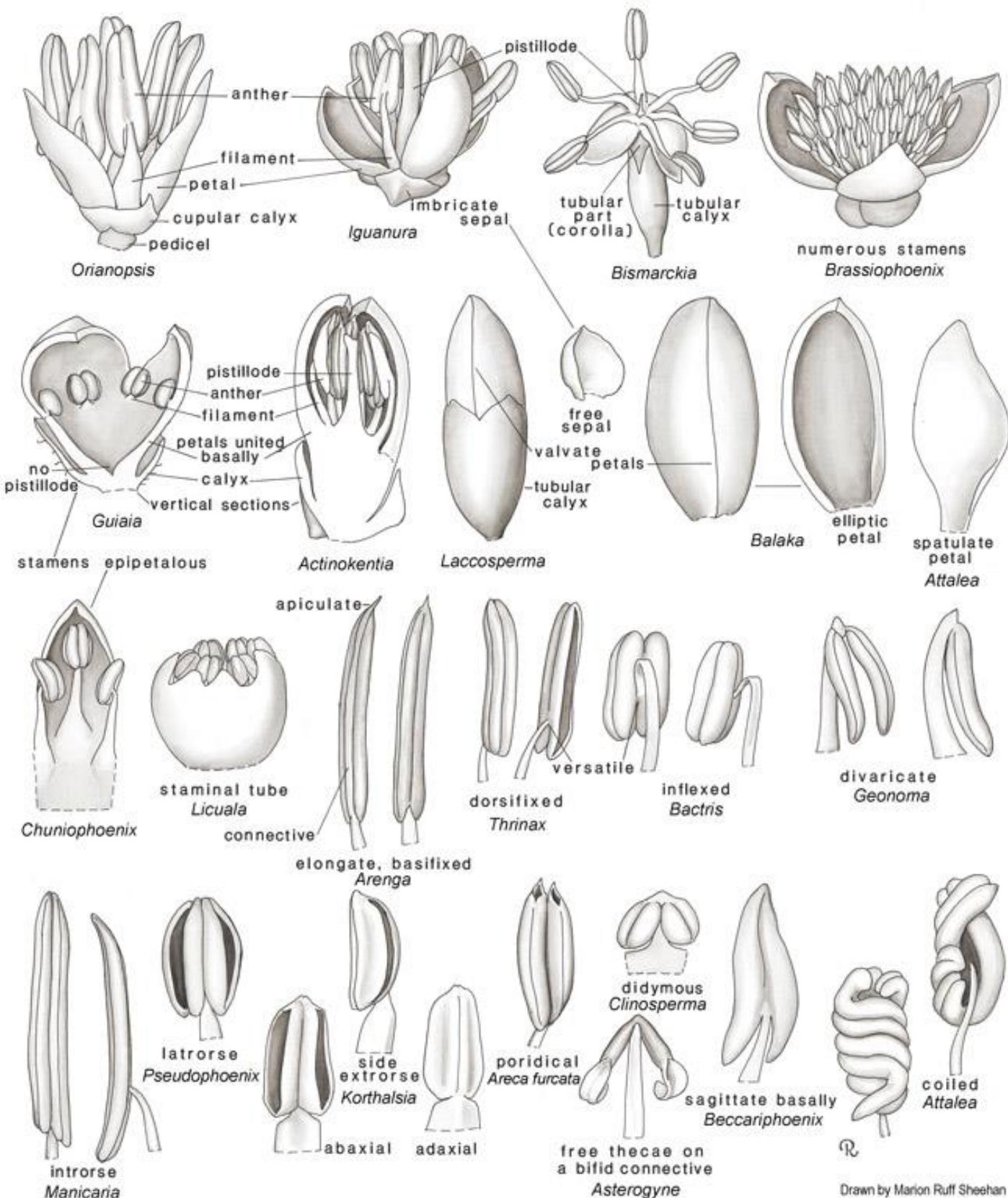


Drawn by Marion Ruff Sheehan

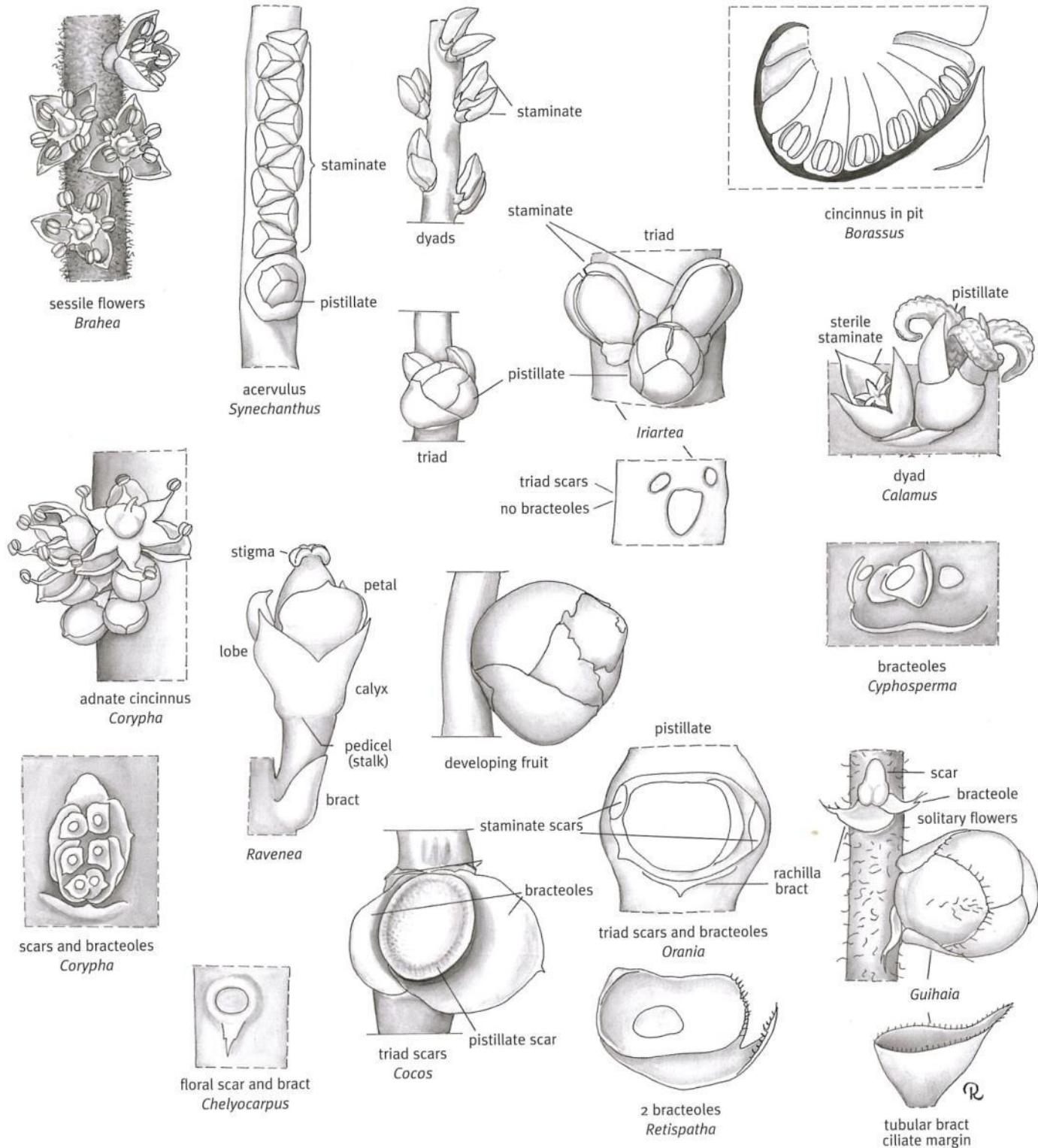


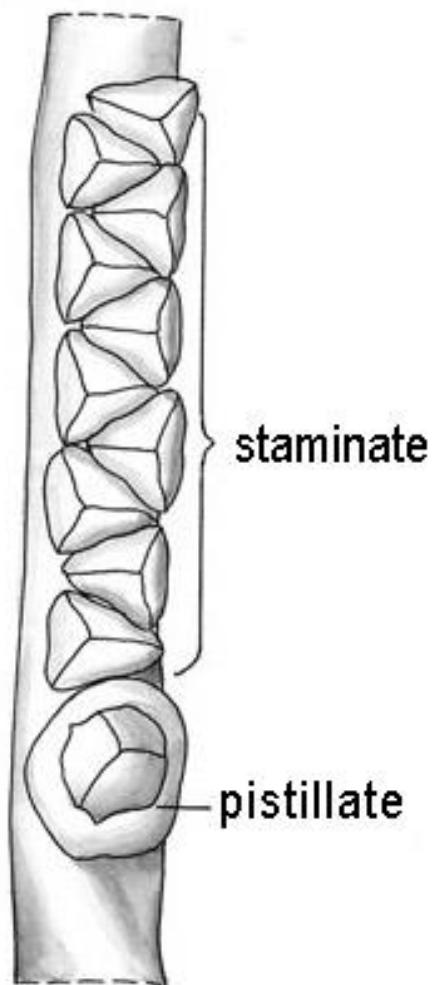
# FLOWERS





Drawn by Marion Ruff Sheehan

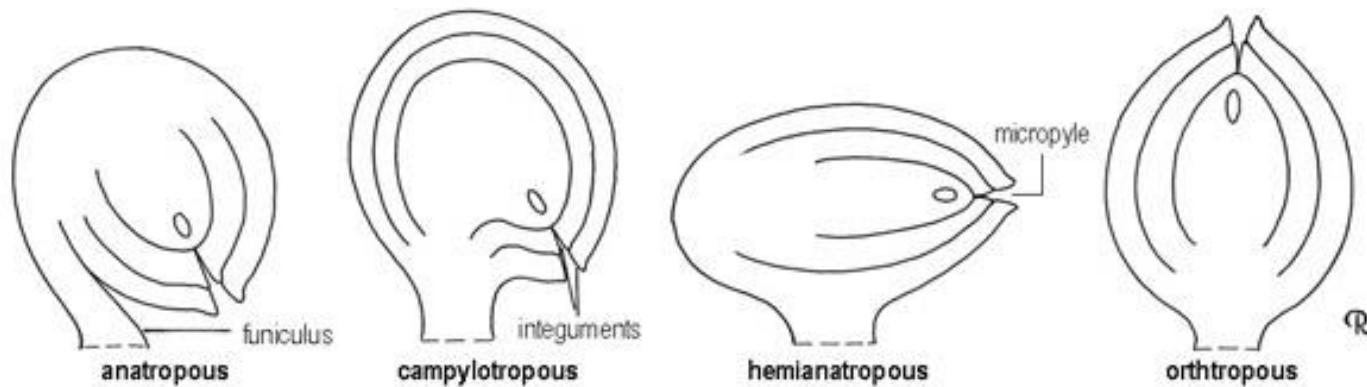




*acervulus*  
*Synechanthus*

Drawn by Marion Ruff Sheehan

*Anatropous*  
*Campylotropous*  
*Funiculus*  
*Hemianatropous*  
*Integument*  
*Micropyle*  
*Orthotrope*



Drawn by Marion Ruff Sheehan



## Floral diversity in palms

### Calamoideae:

a, *Mauritiella armata* (Lepidocaryeae), pistillate flower, gynoecium, note reflexed scales.

### Nypoideae

b–c, *Nypa fruticans*, b, staminate flower, perianth partially removed to reveal three connate stamens; c, one carpel isolated from pistillate flower

### Coryphoideae:

d, *Lecythis mimosifolia* (Cryosophileae), hermaphroditic flower, stamens and perianth partially removed to show unicarpellate gynoecium

e, *Cryosophila warscewiczii* (Cryosophileae), hermaphroditic flower, perianth removed to show staminal tube and exerted stigmas

f–g, *Chelyocarpus ulmoides* (Cryosophileae), hermaphroditic flower, f, androecium and g apocarpous gynoecium

h, *Rhapis subtilis* (Trachycarpeae), staminate flower, androecium

i, *Rhapis excelsa* (Trachycarpeae), pistillate flower, apocarpous gynoecium surrounded by conspicuous staminodes

j, *Licuala pilata* (Trachycarpeae), hermaphroditic flower, corolla removed to show stamens and exerted style

k–l, *Copernicia ? burritoana* (Trachycarpeae), hermaphroditic flower, k, perianth and androecium partially removed to reveal gynoecium comprising three carpels free at the base, united distally, l, gynoecium with one carpel dislodged to reveal darker distal area of carpel connection and united style

m, *Hypaheea coriacea* (Borasseae), pistillate flower, perianth removed, syncarpous gynoecium with conspicuous staminodes

n, *Aphendix natalia* (Phytolopheae), staminate flower, note reduced, irregular perianth and multistamine androecium containing 400–650 stamens

o, *Phytelephas macrocarpa* (Phytolopheae), pistillate flower, perianth partially removed, note the large size of this flower, the numerous staminodes surrounding the ovary, the syncarpous pentamerous gynoecium (4–10 carpels in Phytolopheae) comprising rounded ovary, and elongate style and stigmas

### Arecoideae:

p, *Synechanthus warscewiczianus* (Chamaedoreeae), staminate flower sepal removed, androecium comprising three stamens only

q, *Chamaedorea hooperiana* (Chamaedoreeae), staminate flower, one petal removed

r, *Chamaedorea brachypoda* (Chamaedoreeae), staminate flower, one petal removed, note variation in stamen and pistilode morphology in q and r

s, *Astergyne martiana* (Geonomeatae), staminate flower

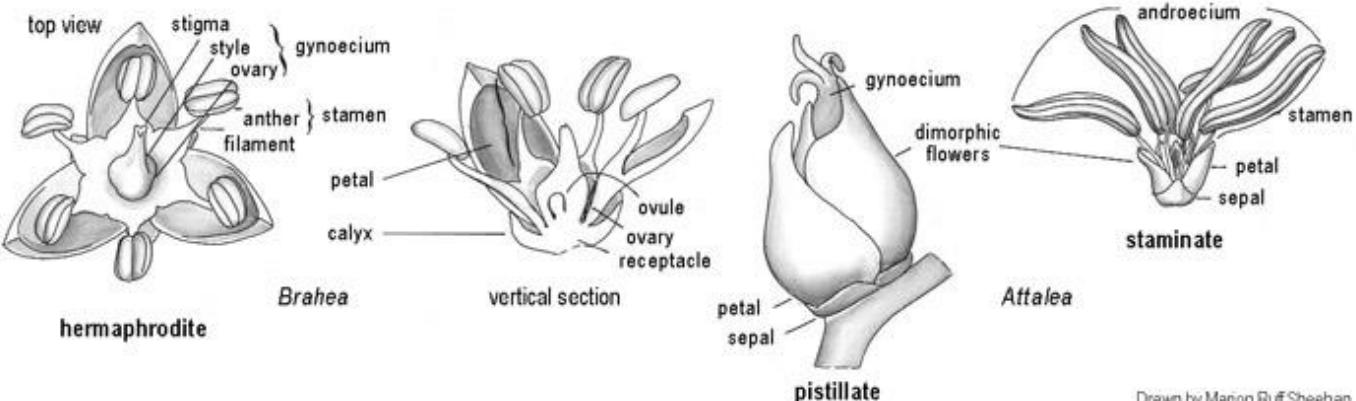
t, *Calyptogyne ghiesbreghtiana* (Geonomeatae), pistillate flower, trimerous gynoecium (see u)

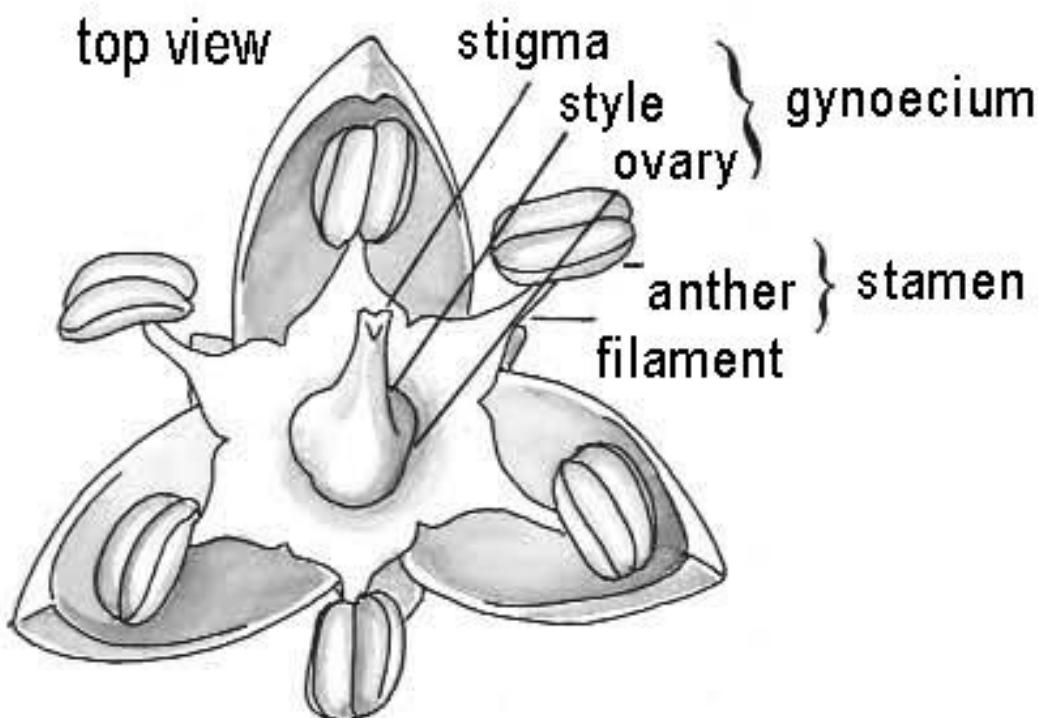
u, *Geonoma simpliciflora* (Geonomeatae), pistillate flower, pseudomonomerous gynoecium (see t, w)

v–w, *Pelagodoxa henryana* (Pelagodoxeae), v, pistillate flower, perianth removed to show androecium and pistilode, w, pistillate flower, perianth and androecium removed to show pseudomonomerous gynoecium (see u) and staminodes

Scale bars: a–c, i, q–s = 1 mm; d–l, k–m, p, t–w = 500 µm; n, o = 1 cm.

Photos: a, L. Guevara; b–c, J.A.S. Barfod & F.W. Staufer; d, k–m, p, R. Ryder & P. Rudall; e–g, F. Castaño & F.W. Staufer; h–i, A. Gidley & F.W. Staufer; n–o, A. S. Barfod; q–r, A. Askgaard; s–w, F.W. Staufer.

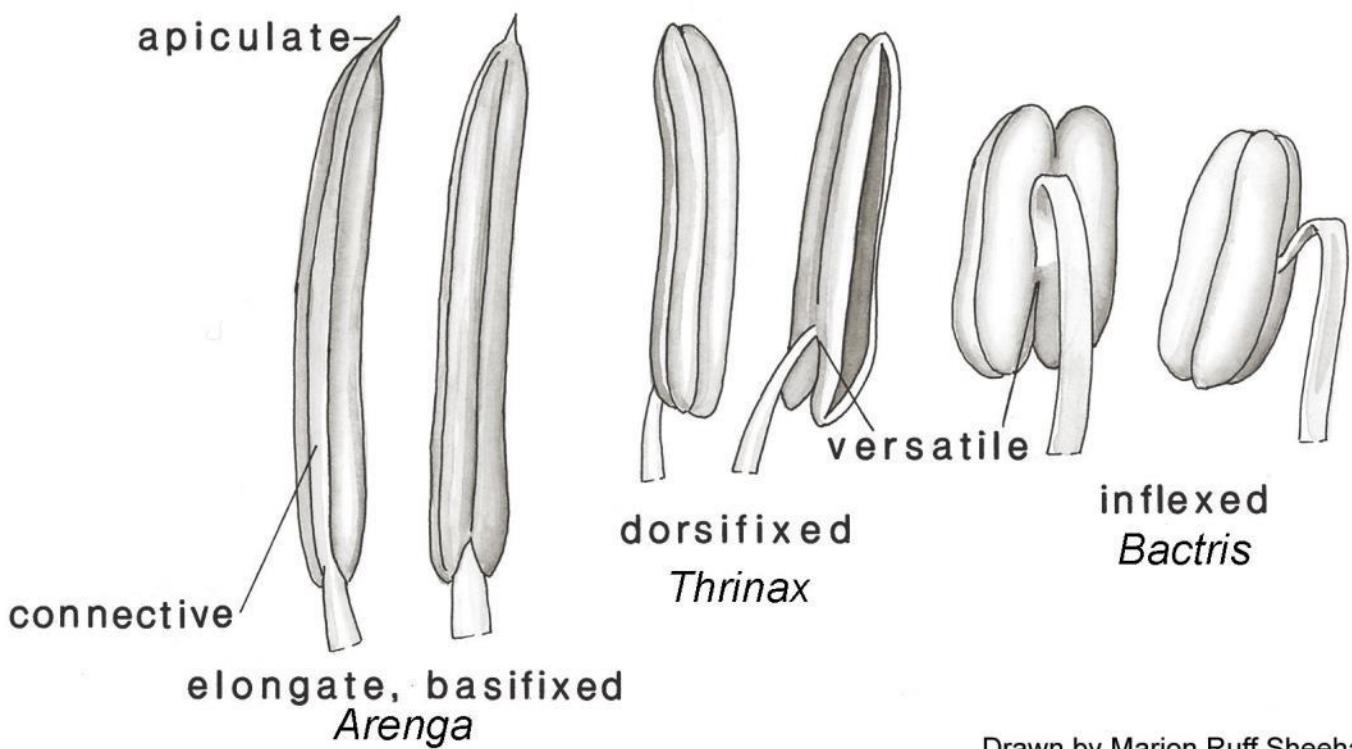




*Brahea*

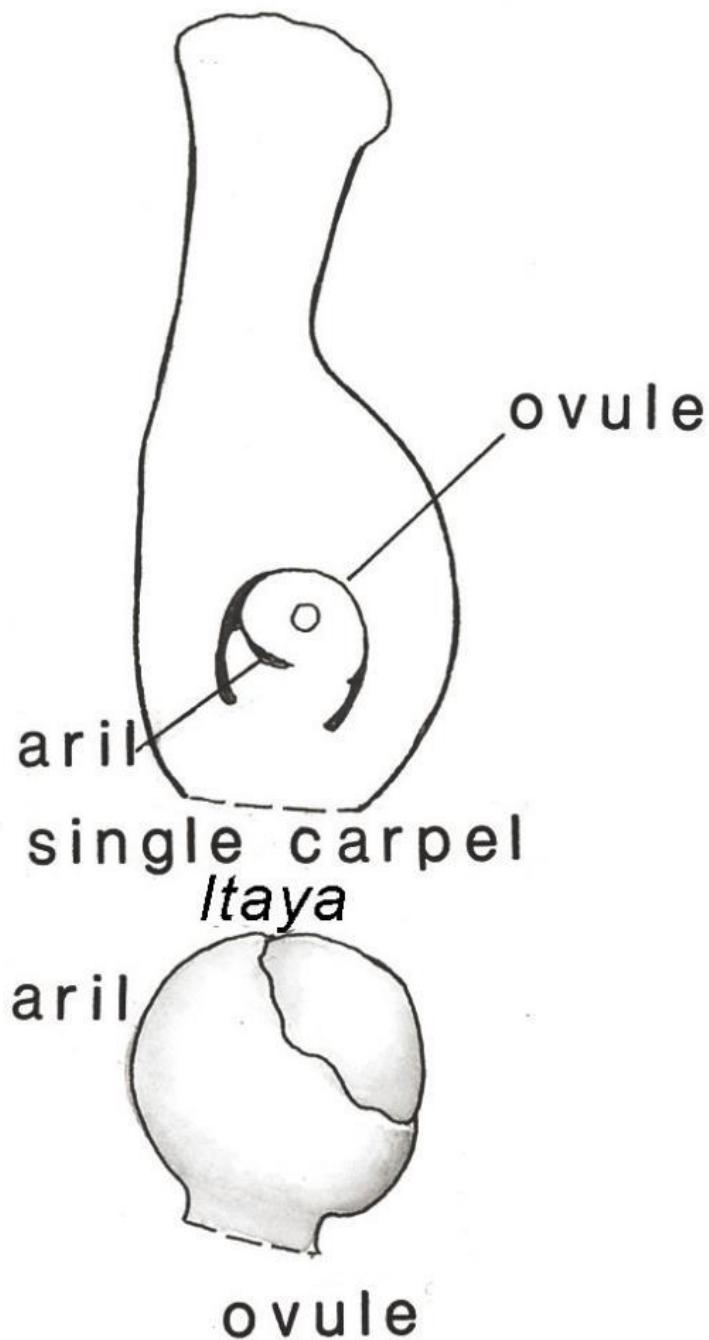
Drawn by Marion Ruff Sheehan

**Apiculate  
Basifixed  
Connective**

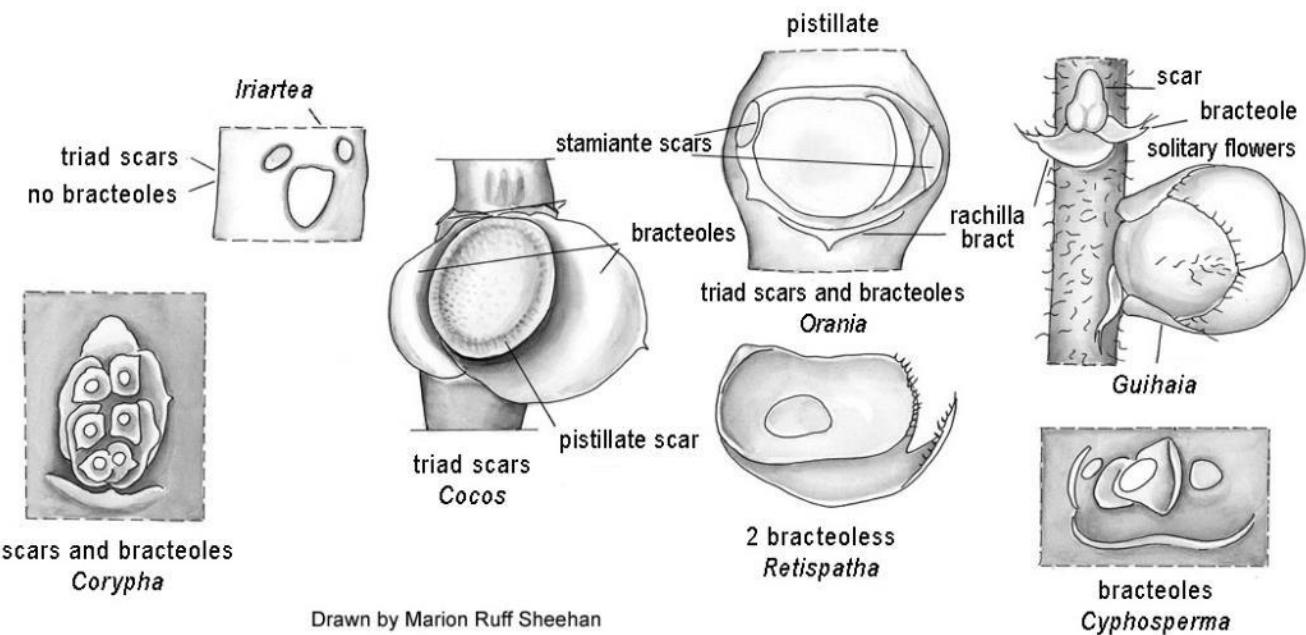


Drawn by Marion Ruff Sheehan

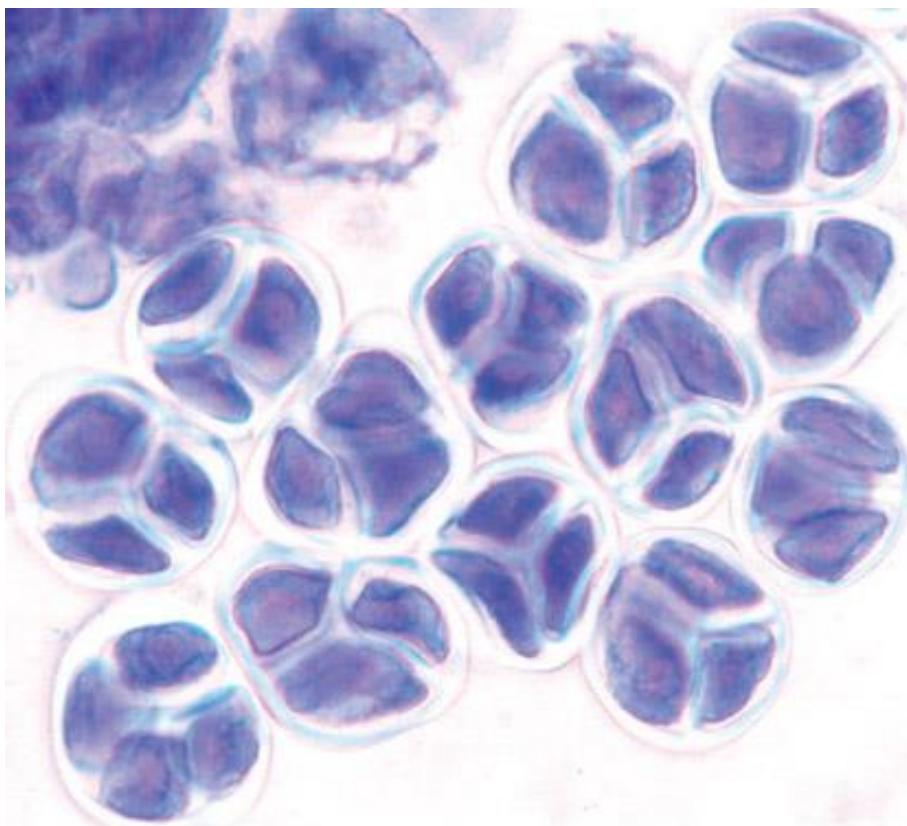




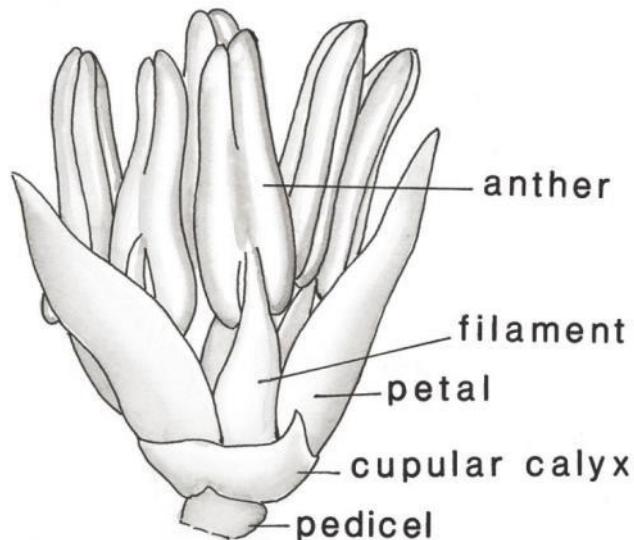
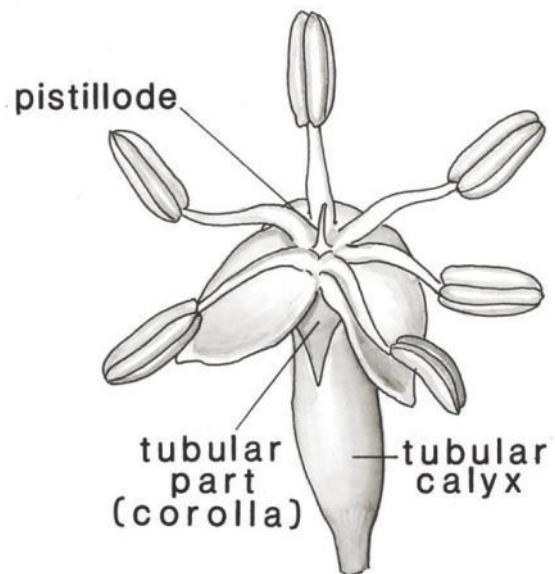
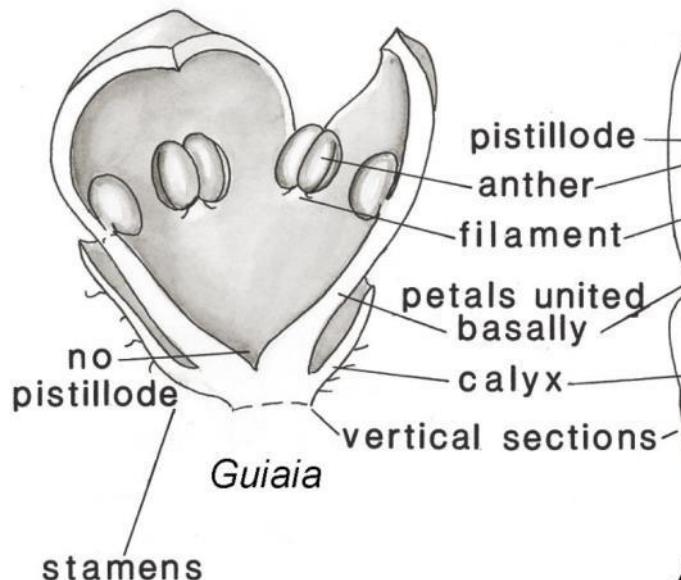
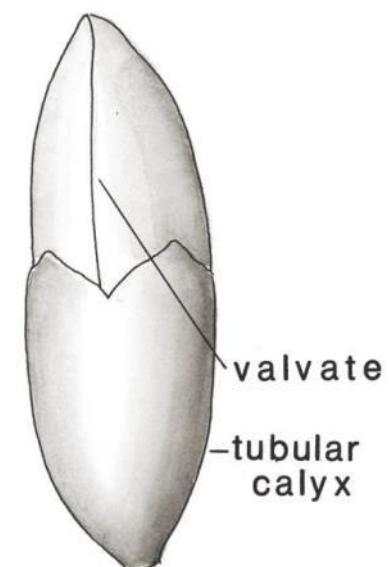
Drawn by Marion Ruff Sheehan



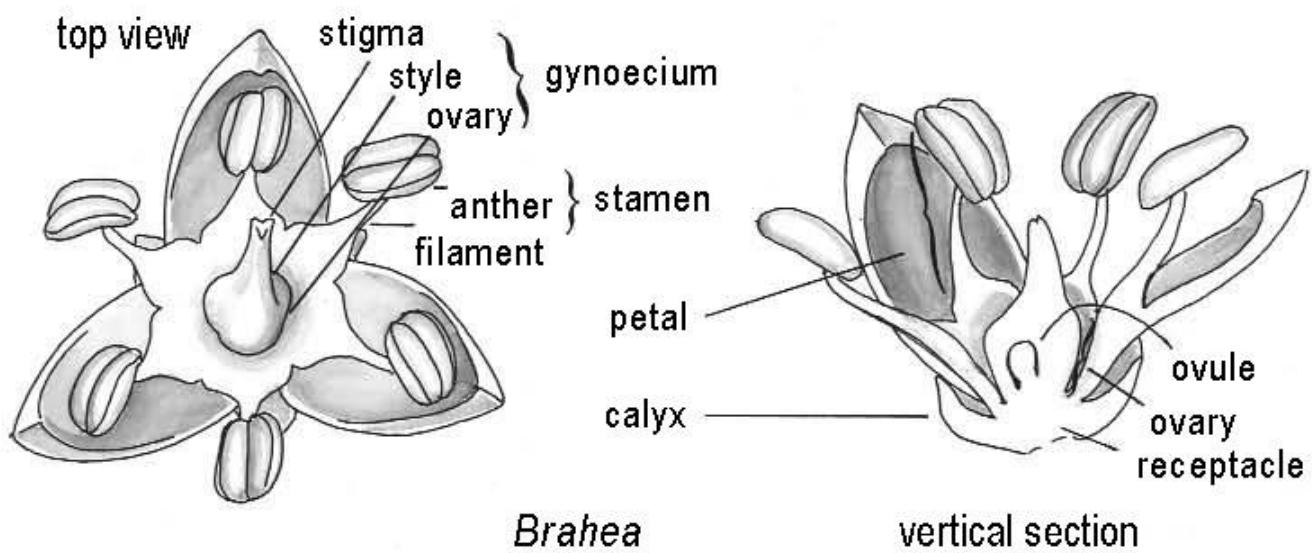
Drawn by Marion Ruff Sheehan



*Chamaedorea seifrizii* tetrahedral tetrads with the 4 daughter cells still enclosed within the callose envelope of the pollen mother cell LM  $\times 500$  [fourth daughter cell is concealed from view]. Cultivated RBG Kew 362-66.36221.

*Orianopsis**Bismarckia**Guiaia**Actinokentia**Laccosperma*

Drawn by Marion Ruff Sheehan



Drawn by Marion Ruff Sheehan

## Floral diversity in palms



## Calamoideae:

**a.** *Mauritiella armata* (Lepidocaryeae), pistillate flower, gynoecium, note reflexed scales.

## Nypoideae:

**b-c.** *Nypha fruticans*, **b.** staminate flower, perianth partially removed to reveal three connate stamens; **c.** one carpel isolated from pistillate flower.

## Cynocephalidae:

**d.** *Leucosthinax morrisii* (Cryosophileae), hermaphroditic flower, stamens and perianth partially removed to show unicarpellate gynoecium**e.** *Cryosophila warscewiczii* (Cryosophileae), hermaphroditic flower, perianth removed to show staminal tube and exerted stigmas**f-g.** *Chelyocarpus ulei* (Cryosophileae), hermaphroditic flower, **f.** androecium and **g.** apocarous gynoecium;**h.** *Rhapis subtilis* (Trachycarpeae), staminate flower, androecium**i.** *Rhapis excelsa* (Trachycarpeae), pistillate flower, apocarous gynoecium surrounded by conspicuous staminodes**j-k.** *Cyperocarpia ? burrieliana* (Trachycarpeae), hermaphroditic flower, corolla removed to show stamens and exerted style**k-l.** *Cyperocarpia ? burrieliana* (Trachycarpeae), hermaphroditic flower, **k.** perianth and androecium partially removed to reveal gynoecium comprising three carpels free at the base, united distally; **l.** gynoecium with one carpel dislodged to reveal darker distal area of carpel connation and united style**m.** *Hyphaene coriacea* (Borasseae), pistillate flower, perianth removed, syncarpous gynoecium with conspicuous staminodes

## Ceroxyloideae:

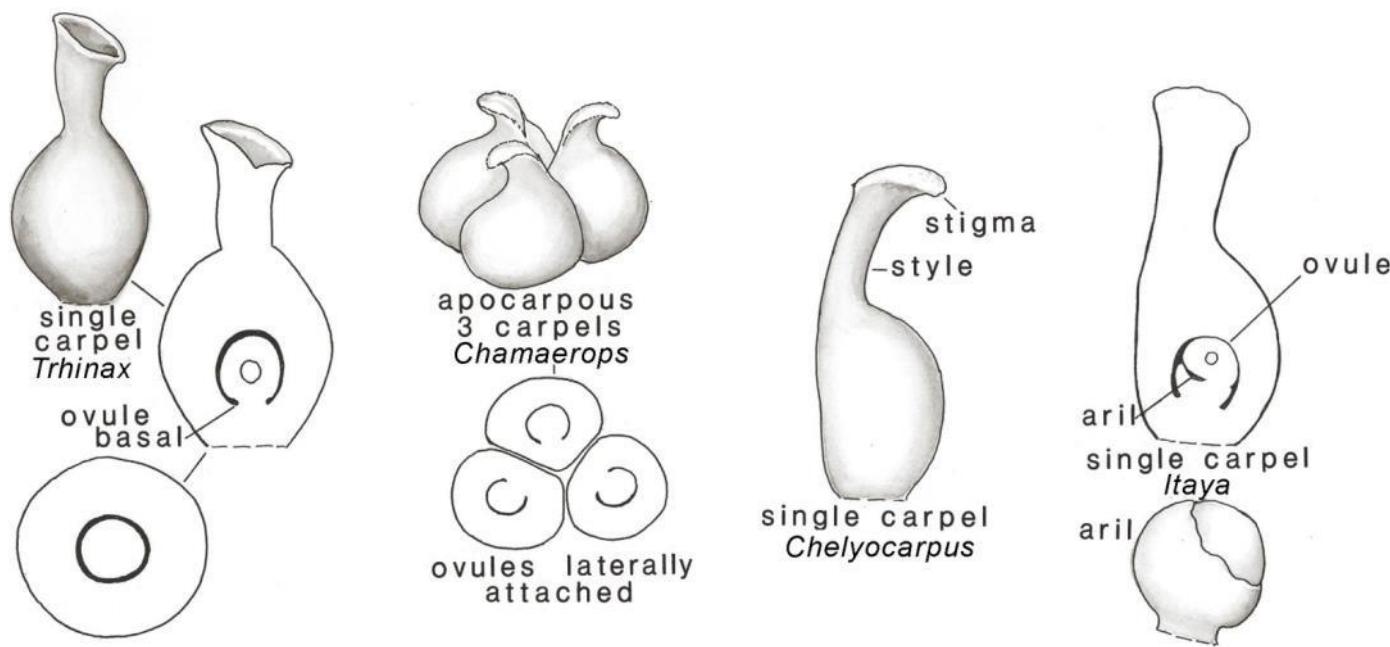
**n.** *Aphandra natalia* (Phytelephaeae), staminate flower, note reduced, irregular perianth and multistamine androecium containing 400–650 stamens**o.** *Phytelephas macrocarpa* (Phytelephaeae), pistillate flower, perianth partially removed, note the large size of this flower, the numerous staminodes surrounding the ovary, the syncarpous pentamerous gynoecium (4–10 carpels in Phytelephas) comprising rounded ovary, and elongate style and stigmas

## Arecoideae:

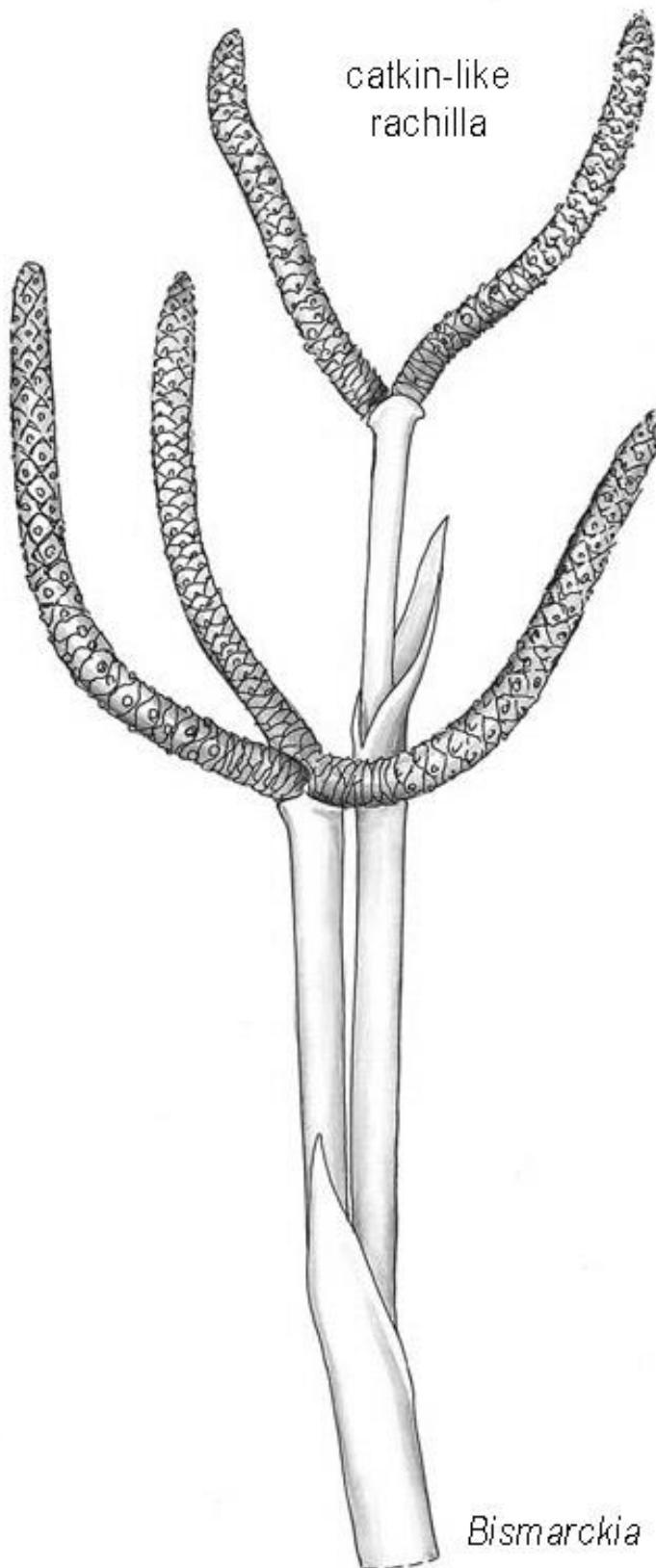
**p.** *Synechanthus warszewiczianus* (Chamaedoreeae), staminate flower sepal removed, androecium comprising three stamens only**q-t.** *Chamaedorea hooperiana* (Chamaedoreeae), staminate flower, one petal removed**r.** *Chamaedorea brachypoda* (Chamaedoreeae), staminate flower, one petal removed, note variation in stamen and pistillode morphology in **q** and **r****s.** *Asterogyne martiana* (Geonomeatae), staminate flower**t.** *Calyptrogyne ghiesbreghtiana* (Geonomeatae), pistillate flower, trimerous gynoecium (see **u**)**u.** *Geonoma simplicifrons* (Geonomeatae), pistillate flower, pseudomonomerous gynoecium (see **t, w**)**v-w.** *Pelagodoxa henryana* (Pelagodoxeae), **v.** staminate flower, perianth removed to show androecium and pistillode, **w.** pistillate flower, perianth and androecium removed to show pseudomonomerous gynoecium (see **u**) and staminodes

Scale bars: a–c, j, q–s = 1 mm; d–l, k–m, p, t–w = 500 µm; n, o = 1 cm.

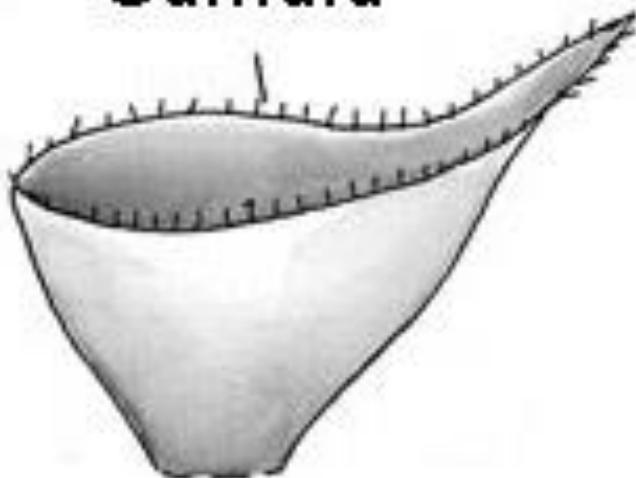
Photos: a, L. Guevara; b–c, J.A.S. Barfod &amp; F.W. Stauffer; d, k–m, p, R. Ryder &amp; P. Rudall; e–g, F. Castaño &amp; F.W. Stauffer; h–l, A. Gidley &amp; F.W. Stauffer; n–o, A. S. Barfod; q–r, A. Askgaard; s–w, F.W. Stauffer.



Drawn by Marion Ruff Sheehan



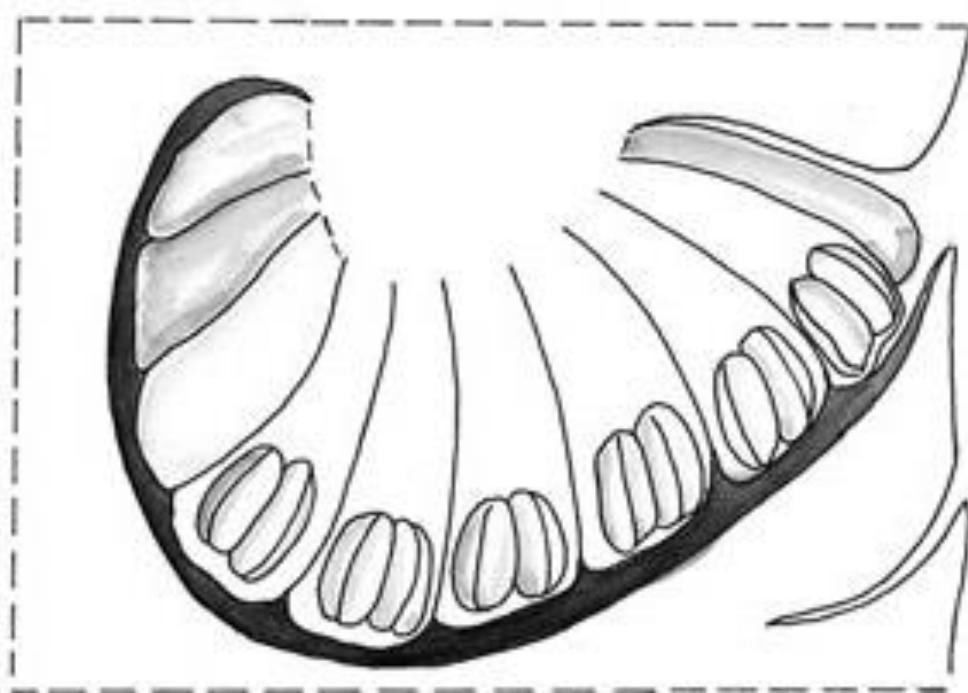
*Guishaia*



**tubular bract  
ciliate margin**

Drawn by Marion Ruff Sheehan

Drawn by Marion Ruff Sheehan



**cincinnus in pit**  
*Borassus*

## Floral diversity in palms



## Calamoideae:

**a.** *Mauritiella armata* (Lepidocaryeae), pistillate flower, gynoecium, note reflexed scales.

## Nypoideae:

**b-c.** *Nypa fruticans*, **b.** staminate flower, perianth partially removed to reveal three **connate** stamens; **c.** one carpel isolated from pistillate flower.

## Coryphoideae:

**d.** *Leucothrinax morrisii* (Cryosophileae), hermaphroditic flower, stamens and perianth partially removed to show unicarpellate gynoecium**e.** *Cryosophila warscewiczii* (Cryosophileae), hermaphroditic flower, perianth removed to show staminal tube from pistillate flower.**f-g.** *Chelyocarpus ulei* (Cryosophileae), hermaphroditic flower, **f.** androecium and **g.** apocarpos gynoecium;**h.** *Rhapis subtilla* (Trachycarpeae), staminate flower, androecium**i.** *Rhapis excelsa* (Trachycarpeae), pistillate flower, apocarpos gynoecium surrounded by conspicuous staminodes**j.** *Licuala petiata* (Trachycarpeae), hermaphroditic flower, corolla removed to show stamens and exerted style**k-l.** *Copernicia ? burelana* (Trachycarpeae), hermaphroditic flower, **k.** perianth and androecium partially removed to reveal gynoecium comprising three carpels free at the base, united distally; **l.** gynoecium with one carpel dislodged to reveal darker distal area of carpel **connation** and united style**m.** *Hyphaene coriacea* (Borasseae), pistillate flower, perianth removed, syncarpous gynoecium with conspicuous staminodes

## Ceroxyloideae:

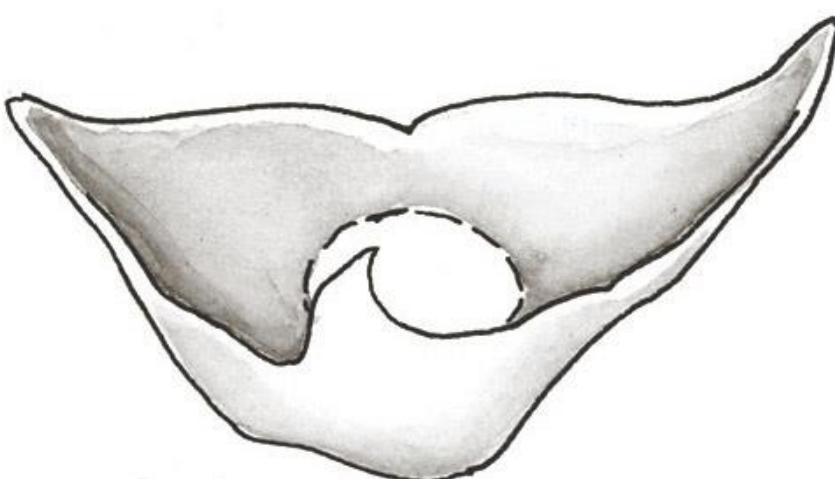
**n.** *Aphandra natalia* (Phytelepheae), staminate flower, note reduced, irregular perianth and multistamine androecium containing 400–650 stamens**o.** *Phytelephas macrocarpa* (Phytelepheae), pistillate flower, perianth partially removed, note the large size of this flower, the numerous staminodes surrounding the ovary, the syncarpous pentamerous gynoecium (4–10 carpels in Phytelephas) comprising rounded ovary, and elongate style and stigmas

## Arecoideae:

**p.** *Synechanthus warscewiczianus* (Chamaedoreeae), staminate flower sepal removed, androecium comprising three stamens only**q.** *Chamaedorea hooperiana* (Chamaedoreeae), staminate flower, one petal removed**r.** *Chamaedorea brachypoda* (Chamaedoreeae), staminate flower, one petal removed, note variation in stamen and pistillode morphology in **q** and **r****s.** *Astrophyne mariana* (Geonomeatae), staminate flower**t.** *Calyptrogyne ghiesbreghtiana* (Geonomeatae), pistillate flower, trimerous gynoecium (see **u**)**u.** *Geonoma simplicifrons* (Geonomeatae), pistillate flower, pseudomonomerous gynoecium (see **t, w**)**v-w.** *Pelagodoxa henniana* (Pelagodoxeae), **v.** staminate flower, **v.** perianth removed to show androecium and pistillode, **w.** pistillate flower, perianth and androecium removed to show pseudomonomerous gynoecium (see **u**) and staminodes

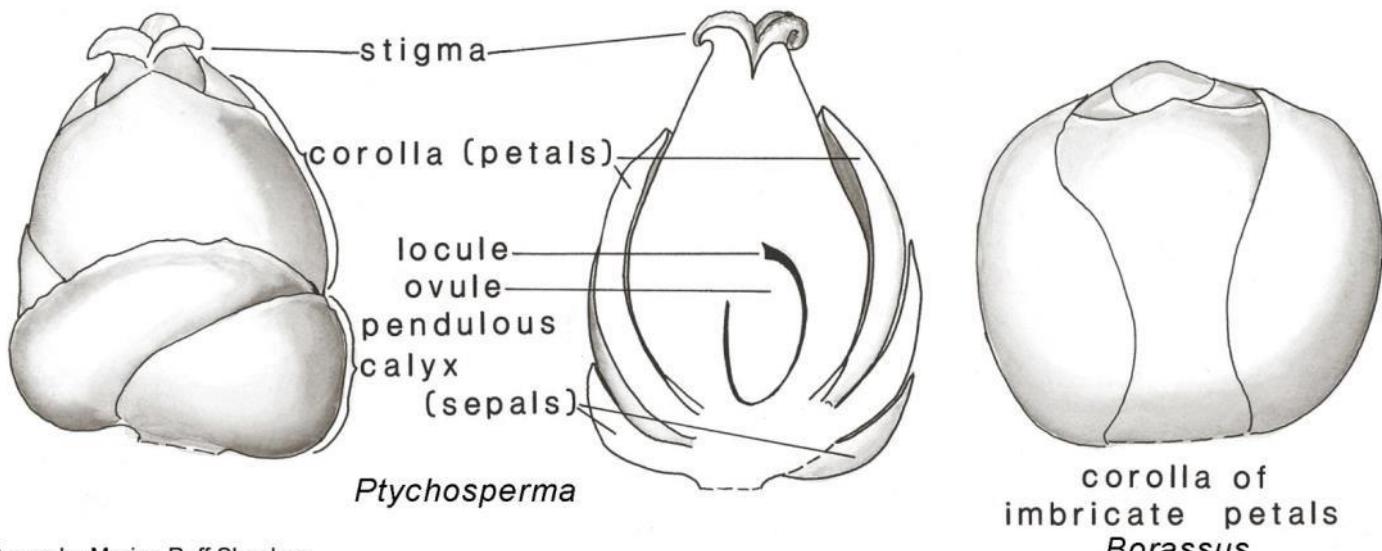
Scale bars: a-c, i, n-s = 1 mm; d-l, k-m, p, t-w = 500 µm; n, o = 1 cm.

Photos: a, L. Guevara, b-c, J.A. S. Barfod &amp; F. W. Stauffer; d, k-m, p, R. Ryder &amp; P. Rudall; e-g, F. Castaño &amp; F. W. Stauffer; h-i, A. Gidley &amp; F. W. Stauffer; n-o, A. S. Barfod; q-r, A. Askgaard; s-w, F. W. Stauffer.

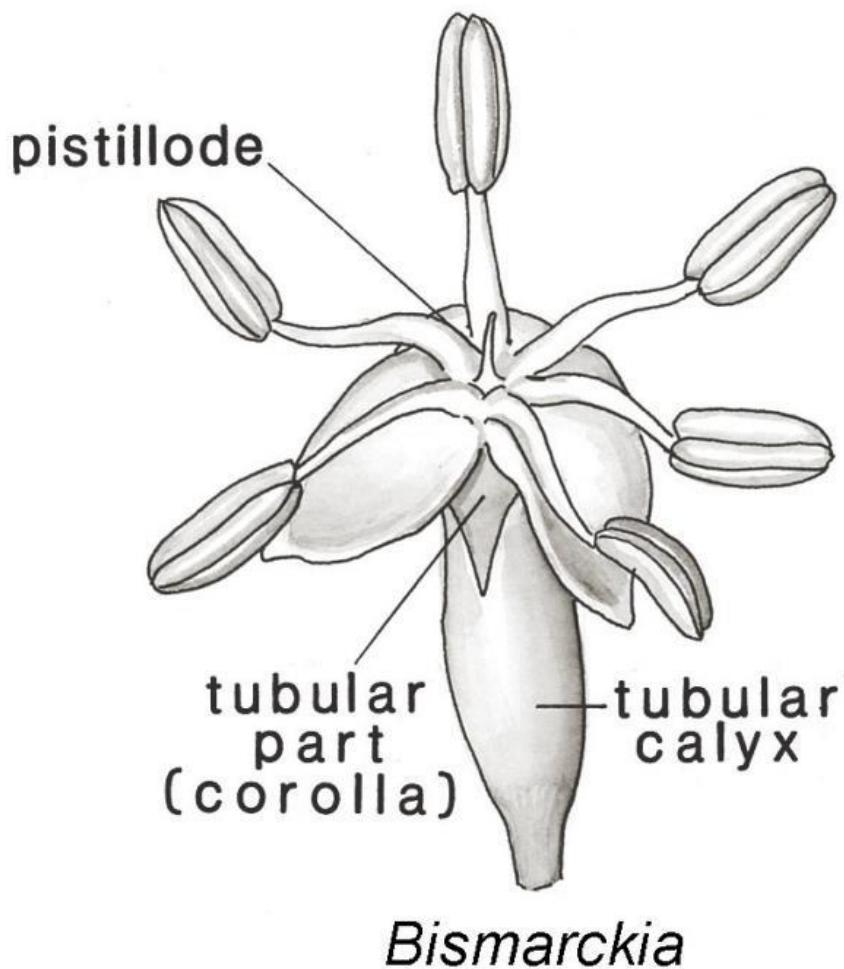


sepals connate  
*Chamaerops*

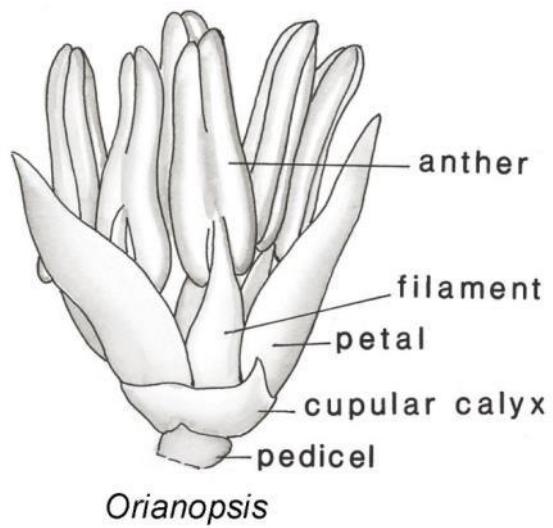
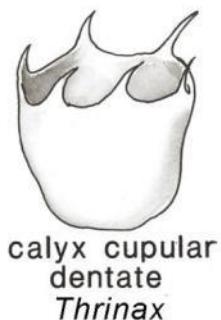
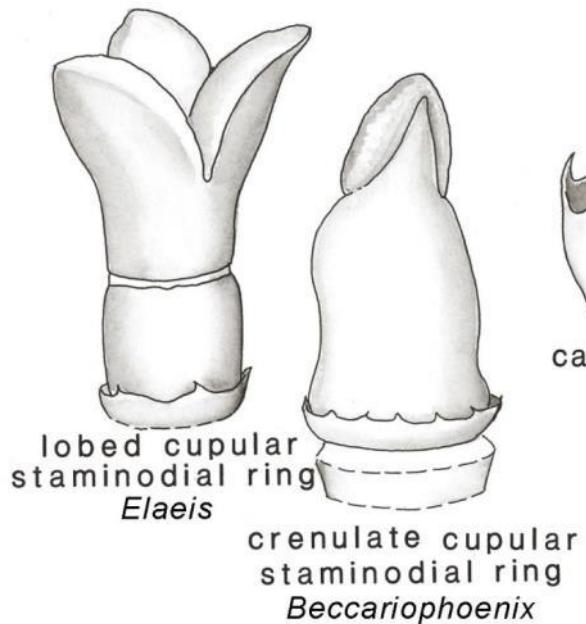
Drawn by Marion Ruff Sheehan



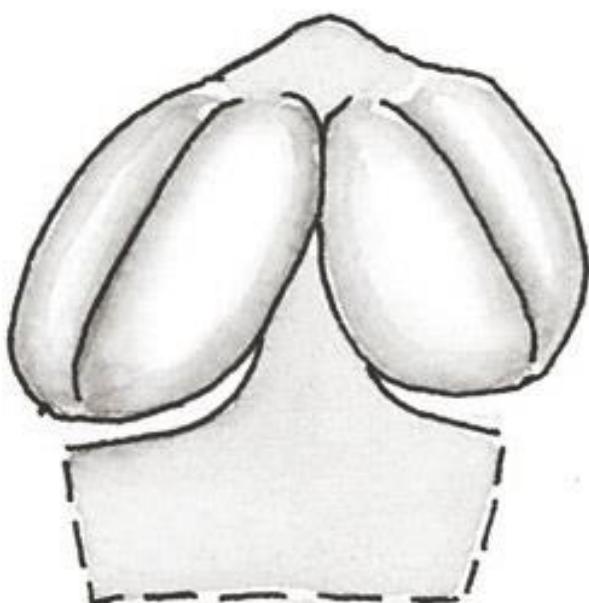
Drawn by Marion Ruff Sheehan



Drawn by Marion Ruff Sheehan

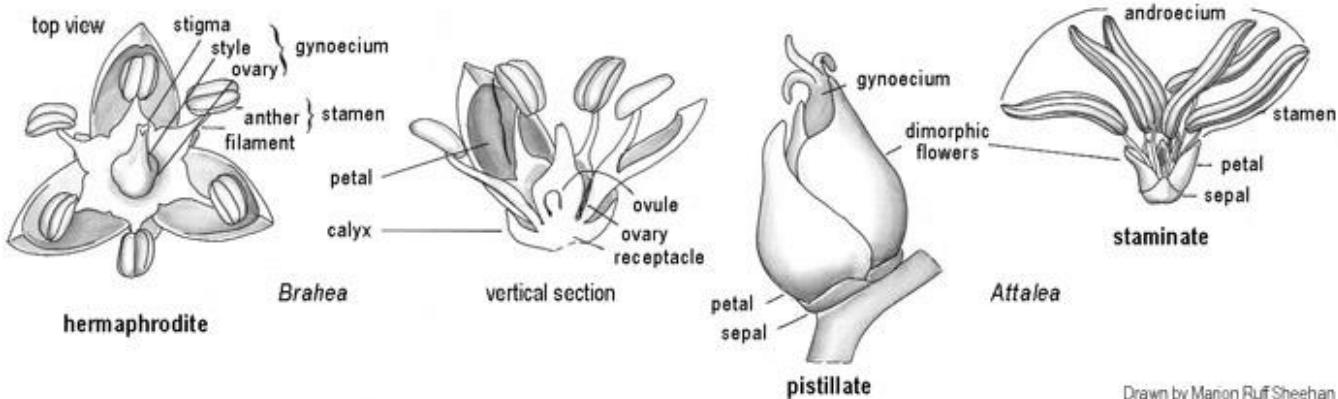


Drawn by Marion Ruff Sheehan



**didymous**  
*Clinosperma*

Drawn by Marion Ruff Sheehan



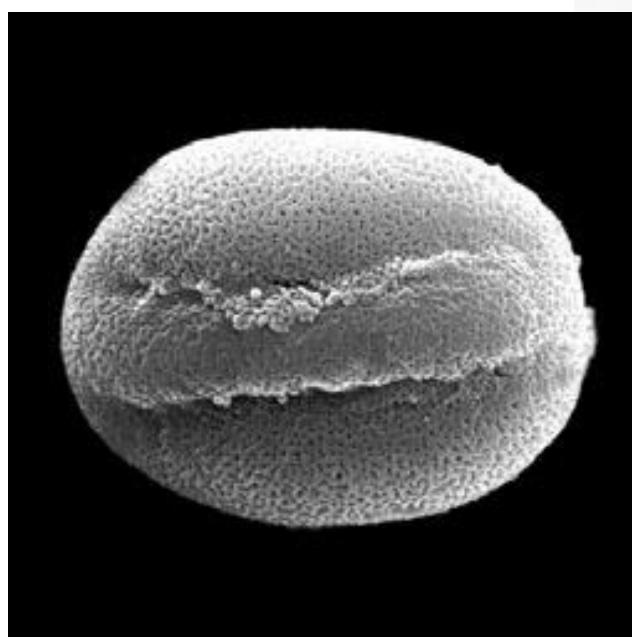
Drawn by Marion Ruff Sheehan



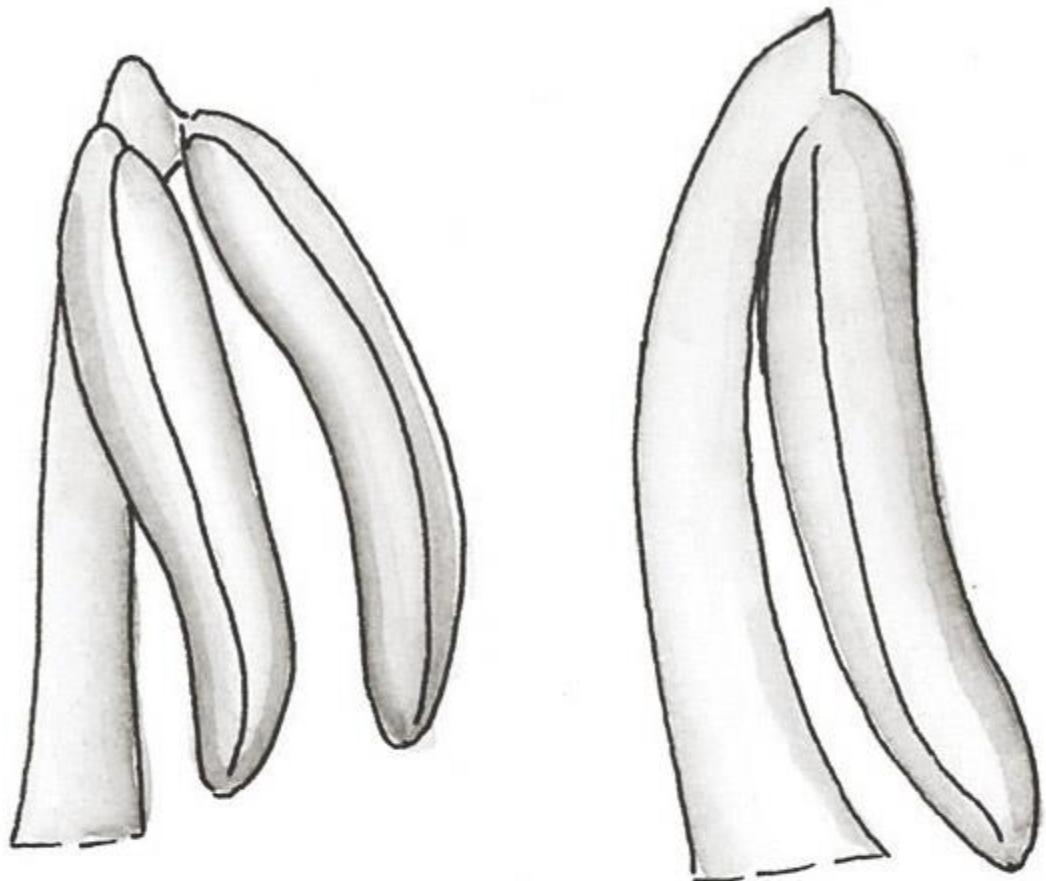
*Eleiodoxa conferta*: diporate pollen grain, proximal face SEM  $\times 2000$ . Whitmore et al. TCW 3104.



*Eleiodoxa conferta*: diporate pollen grain, equatorial view, mid-focus LM  $\times 2000$ . Whitmore et al. TCW 3104.

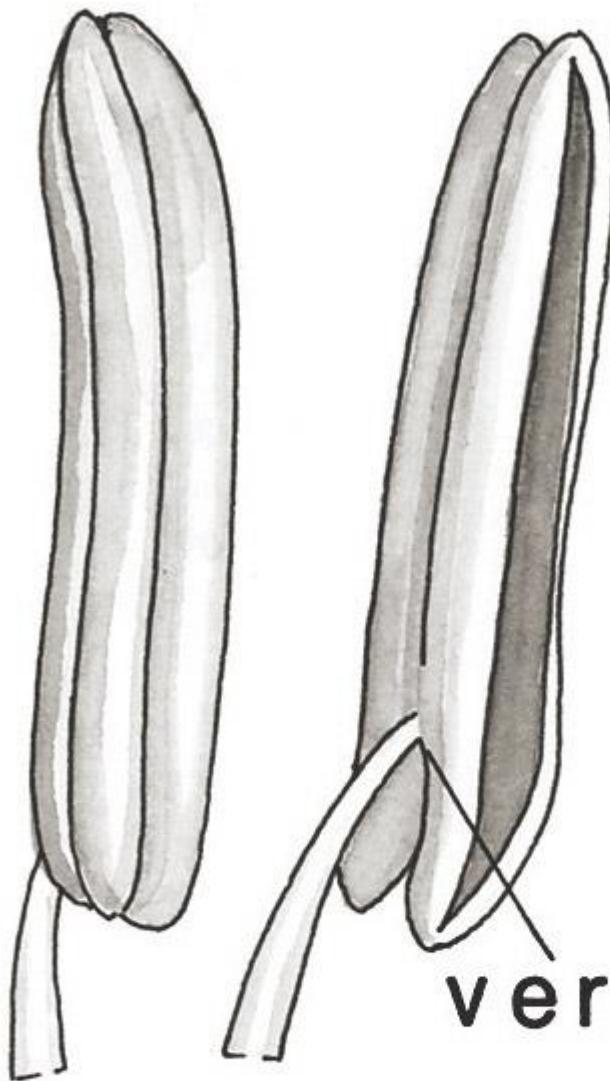


*Chamaerops humilis*: distal disulcate pollen grain, distal face SEM  $\times 2000$ . Moris s.n.



divaricate  
*Geonoma*

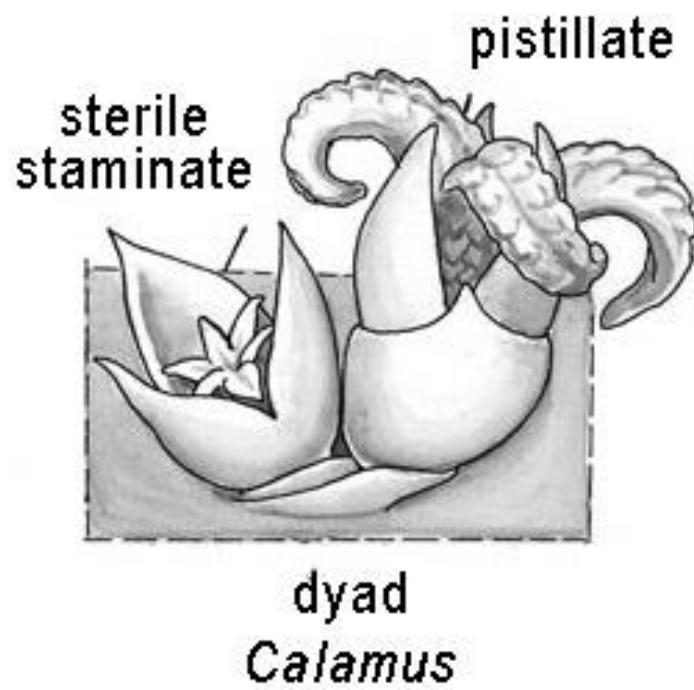
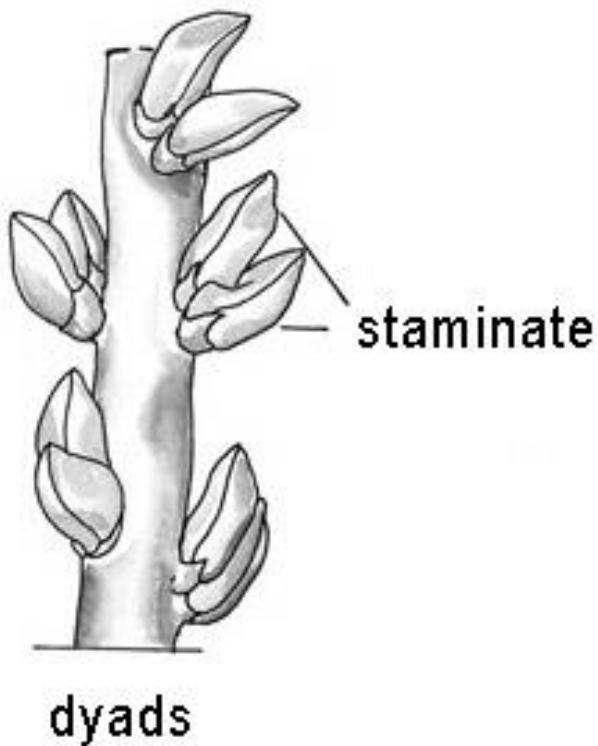
Drawn by Marion Ruff Sheehan



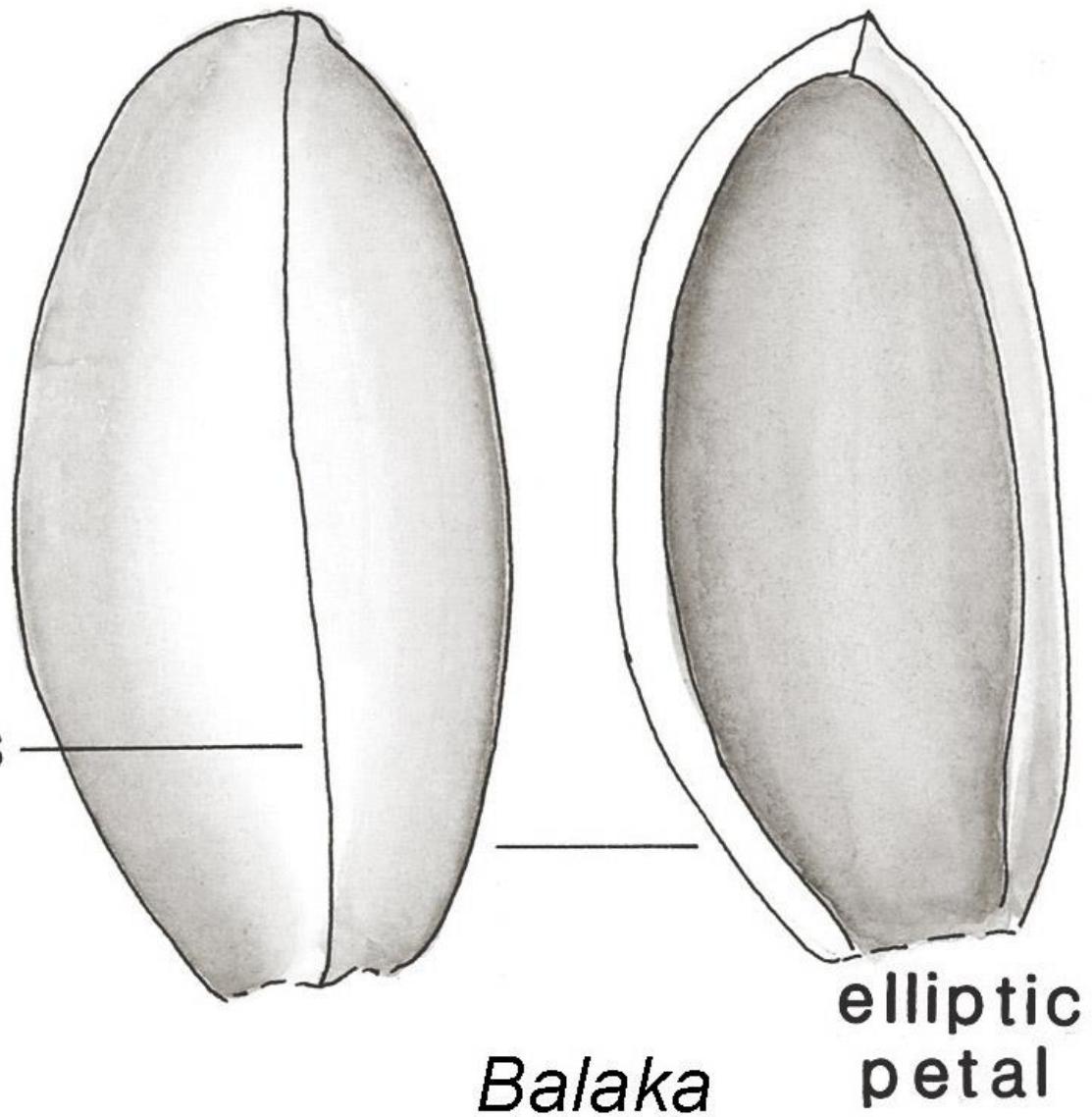
versatile

dorsifixed  
*Thrinax*

Drawn by Marion Ruff Sheehan

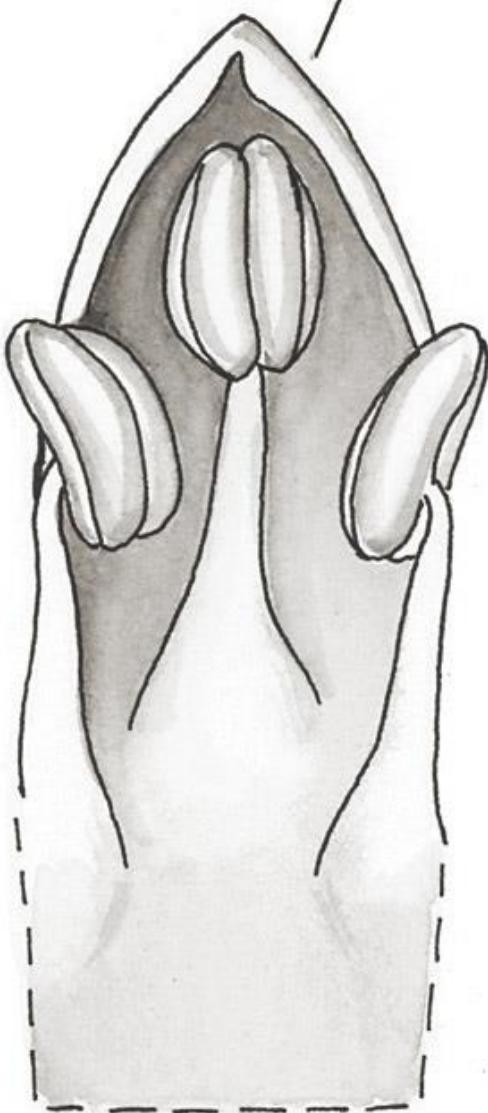


Drawn by Marion Ruff Sheehan



Drawn by Marion Ruff Sheehan

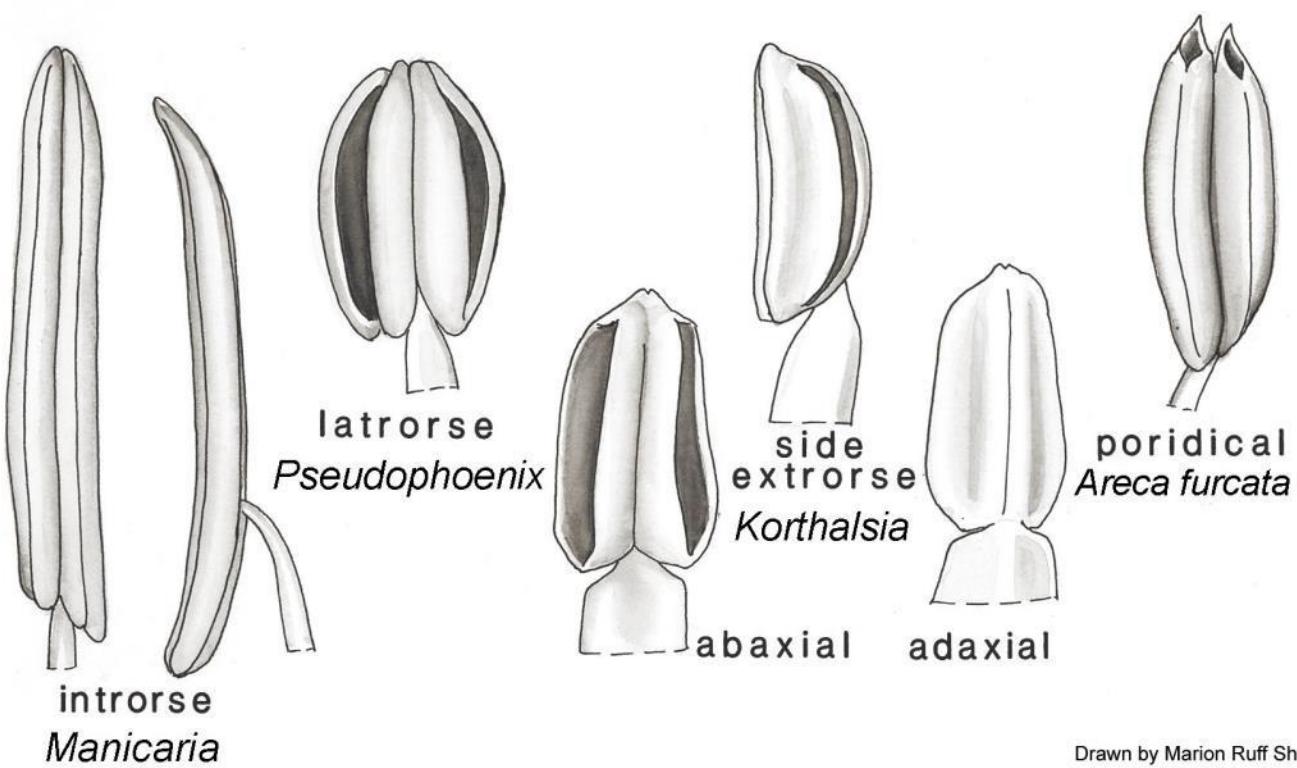
epipetalous



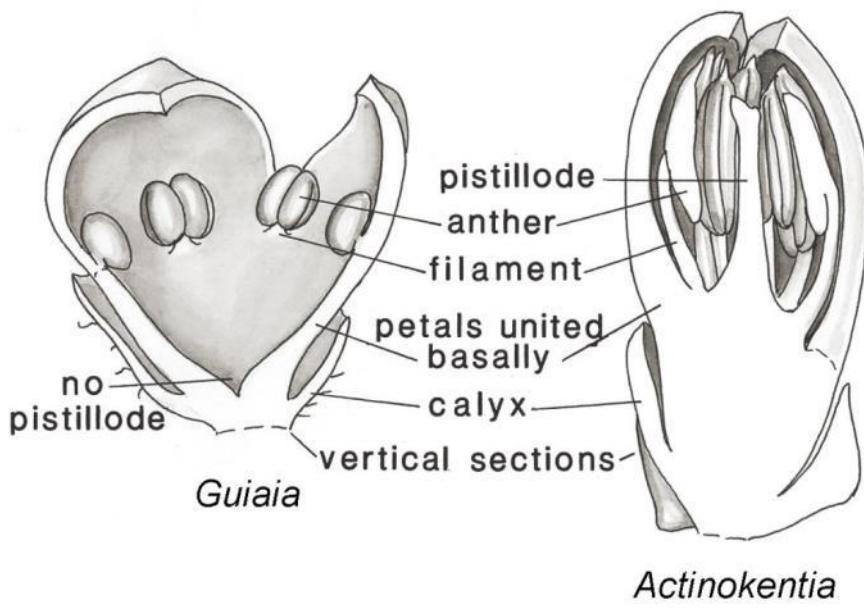
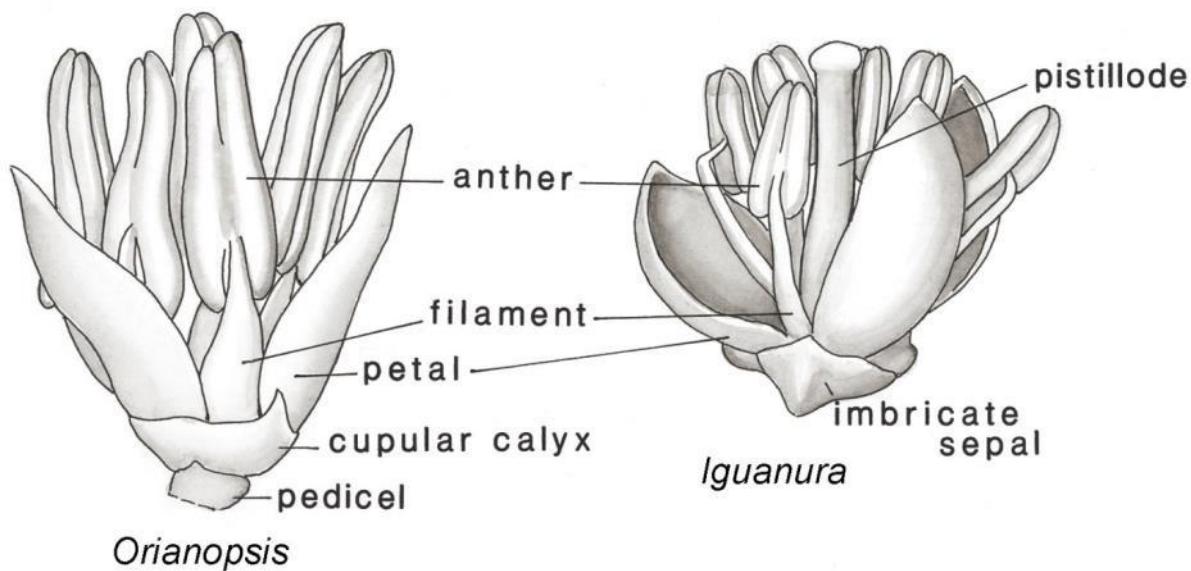
*Chuniophoenix*

Drawn by Marion Ruff Sheehan

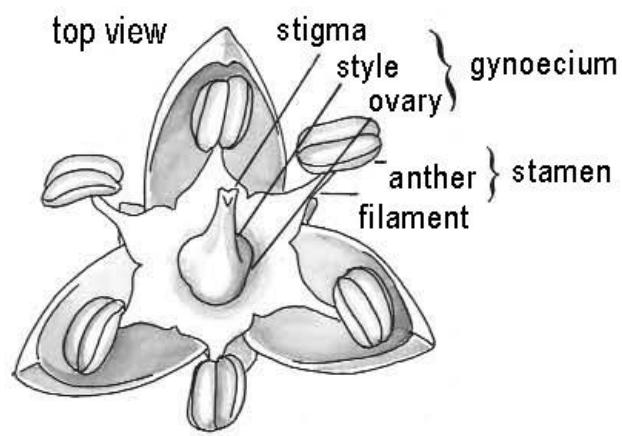
**Extrorse**  
**Introrse**  
**Latrorse**  
**Porical**



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Drawn by Marion Ruff Sheehan



*Brahea*

Drawn by Marion Ruff Sheehan

## Floral diversity in palms



Calamoideae:

**a**, *Mountiella armata* (Lepidocaryeae), pistillate flower, **gynoecium**, note reflexed scales.

Nypoideae:

**b-c**, *Nyphaea truticans*, **b**, staminate flower, perianth partially removed to reveal three connate stamens; **c**, one carpel isolated from pistillate flower.

Coryphoideae:

**d**, *Leucothrinax mortisii* (Cryosophileae), hermaphroditic flower, stamens and perianth partially removed to show unicarpellate **gynoecium**

**e**, *Cyathosperma warscewiczii* (Cryosophileae), hermaphroditic flower, perianth removed to show staminal tube and exerted stigmas

**f-g**, *Cheilocarpus vlei* (Cryosophileae), hermaphroditic flower, **f**, androecium and **g** apocarpos gynoecium;

**h**, *Rhapis subtilla* (Trachycarpeae), staminate flower, androecium

**i**, *Rhipis excelsa* (Trachycarpeae), pistillate flower, apocarpos **gynoecium** surrounded by conspicuous staminodes

**j**, *Lcuila peitata* (Trachycarpeae), hermaphroditic flower, corolla removed to show stamens and exerted style

**k-l**, *Copernicia ? burretiana* (Trachycarpeae), hermaphroditic flower, **k**, perianth and androecium partially removed to reveal **gynoecium** comprising three carpels free at the base, united distally; **l**, **gynoecium** with one carpel dislodged to reveal darker distal area of carpel connation and united style

**m**, *Hyphaene coriacea* (Borasseae), pistillate flower, perianth removed, syncarpous **gynoecium** with conspicuous staminodes

Ceroxyloideae:

**n**, *Aphandra natalia* (Phytelepheae), staminate flower, note reduced, irregular perianth and multistamine androecium containing

400–650 stamens

**o**, *Phytelephas macrocarpa* (Phytelepheae), pistillate flower, perianth partially removed, note the large size of this flower, the numerous staminodes surrounding the ovary, the syncarpous pentamerous **gynoecium** (4–10 carpels in *Phytelephas*) comprising rounded ovary, and elongate style and stigmas

**p**, *Synechanthus warscewiczianus* (Chamaedoreeae), staminate flower sepal removed, androecium comprising three stamens only

**q**, *Chamaedorea hoopeniana* (Chamaedoreeae), staminate flower, one petal removed

**r**, *Chamaedorea brachypoda* (Chamaedoreeae), staminate flower, one petal removed, note variation in stamen and pistilode morphology in **q** and **r**

**s**, *Asteroxyne maritima* (Geonomatae), staminate flower

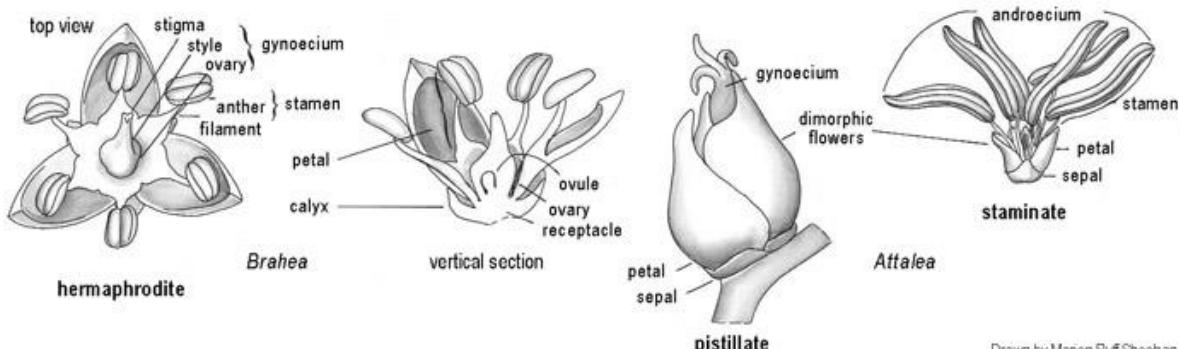
**t**, *Calyptrogyne ghiesbreghtiana* (Geonomatae), pistillate flower, trimorous **gynoecium** (see **u**)

**u**, *Geonoma simplicifrons* (Geonomatae), pistillate flower, pseudomonomerous **gynoecium** (see **t**, **w**)

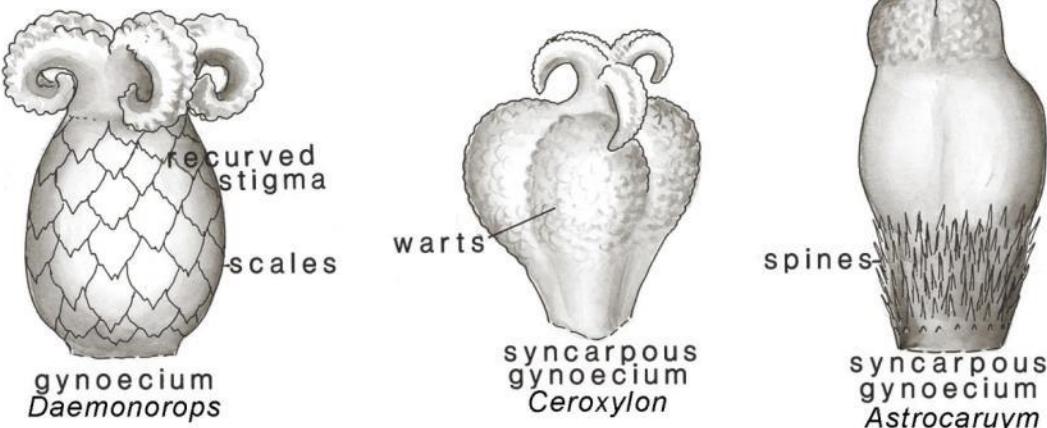
**v-w**, *Pelagodoxa henryana* (Pelagodoxeae), **v**, staminate flower, perianth removed to show androecium and pistillode, **w**, pistillate flower, perianth and androecium removed to show pseudomonomerous **gynoecium** (see **u**) and staminodes

Scale bars: a–c, i, q–s = 1 mm; d–l, k–m, p, t–w = 500 µm; n, o = 1 cm.

Photos: a, L. Guevara; b–c, J. A. S. Barfod & F. W. Stauffer; d, k–m, p, R. Ryder & P. Rudall; e–g, F. Castaño & F. W. Stauffer; h–i, A. Glidley & F. W. Stauffer; n–o, A. S. Barfod; q–r, A. Askgaard; s–w, F. W. Stauffer.



Drawn by Marion Ruff Sheehan



Drawn by Marion Ruff Sheehan

## Floral diversity in palms



### Calamoideae:

a, *Mauritiella armata* (Lepidocaryeae), pistillate flower, gynoecium, note reflexed scales.

### Nypoideae:

b–c, *Nypa fruticans*, b, staminate flower, perianth partially removed to reveal three connate stamens; c, one carpel isolated from pistillate flower.

### Coryphoidae:

d, *Leucothrinax morrisii* (Cryosophileae), **hermaphroditic** flower, stamens and perianth partially removed to show unicarpellate gynoecium

e, *Cryosophila warscewiczii* (Cryosophileae), **hermaphroditic** flower, perianth removed to show staminal tube and exerted stigmas

f–g, *Cheilocarpus ulei* (Cryosophileae), **hermaphroditic** flower, f, androecium and g apocarous gynoecium;

h, *Rhipis subtilis* (Trachycarpeae), staminate flower, androecium

i, *Rhipis excelsa* (Trachycarpeae), pistillate flower, apocarous gynoecium surrounded by conspicuous staminodes

j, *Licuala pektala* (Trachycarpeae), **hermaphroditic** flower, corolla removed to show stamens and exerted style

k–l, *Copernicia ? burritoana* (Trachycarpeae), hermaphroditic flower, k, perianth and androecium partially removed to reveal gynoecium comprising three carpels free at the base, united distally, l, gynoecium with one carpel distended to reveal darker distal area of carpel connation and united style

m, *Hyphaene coriacea* (Borasseae), pistillate flower, perianth removed, syncarpous gynoecium with conspicuous staminodes

n, *Aphandra natalia* (Phytelephae), staminate flower, note reduced, irregular perianth and multistamine androecium containing 400–850 stamens

o, *Phytelephas macrocarpa* (Phytelephae), pistillate flower, perianth partially removed, note the large size of this flower, the numerous staminodes surrounding the ovary, the syncarpous pentamerous gynoecium (4–10 carpels in *Phytelephas*) comprising rounded ovary, and elongate style and stigmas

### Ceroxyloideae:

p, *Synechanthus warscewiczianus* (Chamaedoreeae), staminate flower, sepal removed, androecium comprising three stamens only

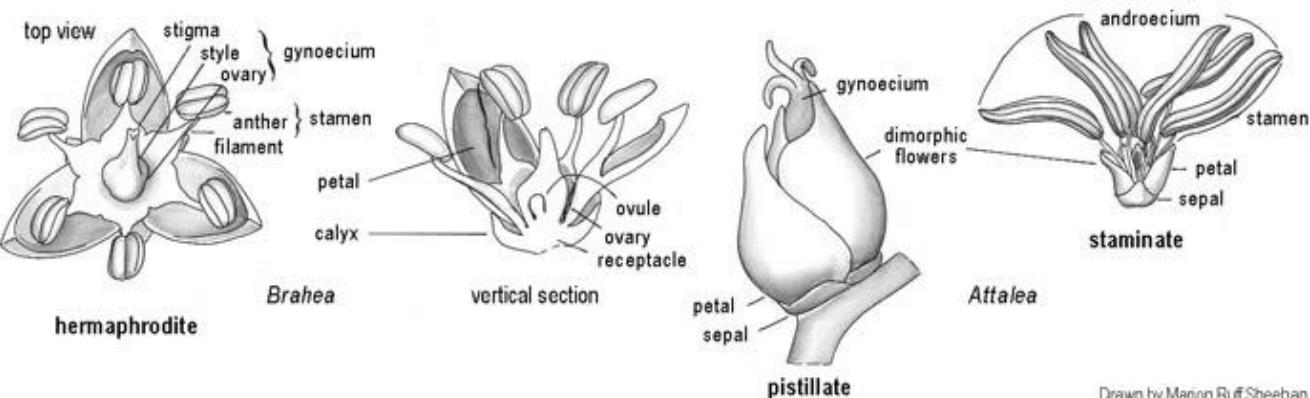
t, *Calyptrogyne ghiesbreghtiana* (Geonomeatae), pistillate flower, trimerous gynoecium (see u)

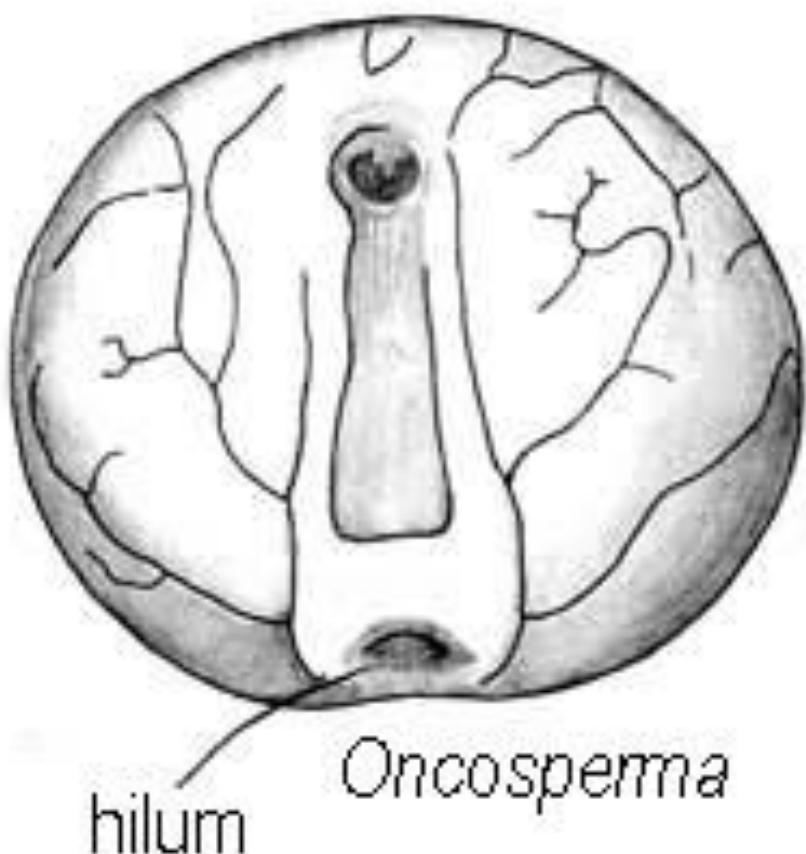
u, *Geonoma simpliciflora* (Geonomeatae), pistillate flower, pseudomonomerous gynoecium (see t, w)

v–w, *Pelagodoxa henryana* (Pelagodoxeae), v, staminate flower, perianth removed to show androecium and pistillode, w, pistillate flower, perianth and androecium removed to show pseudomonomerous gynoecium (see u) and staminodes

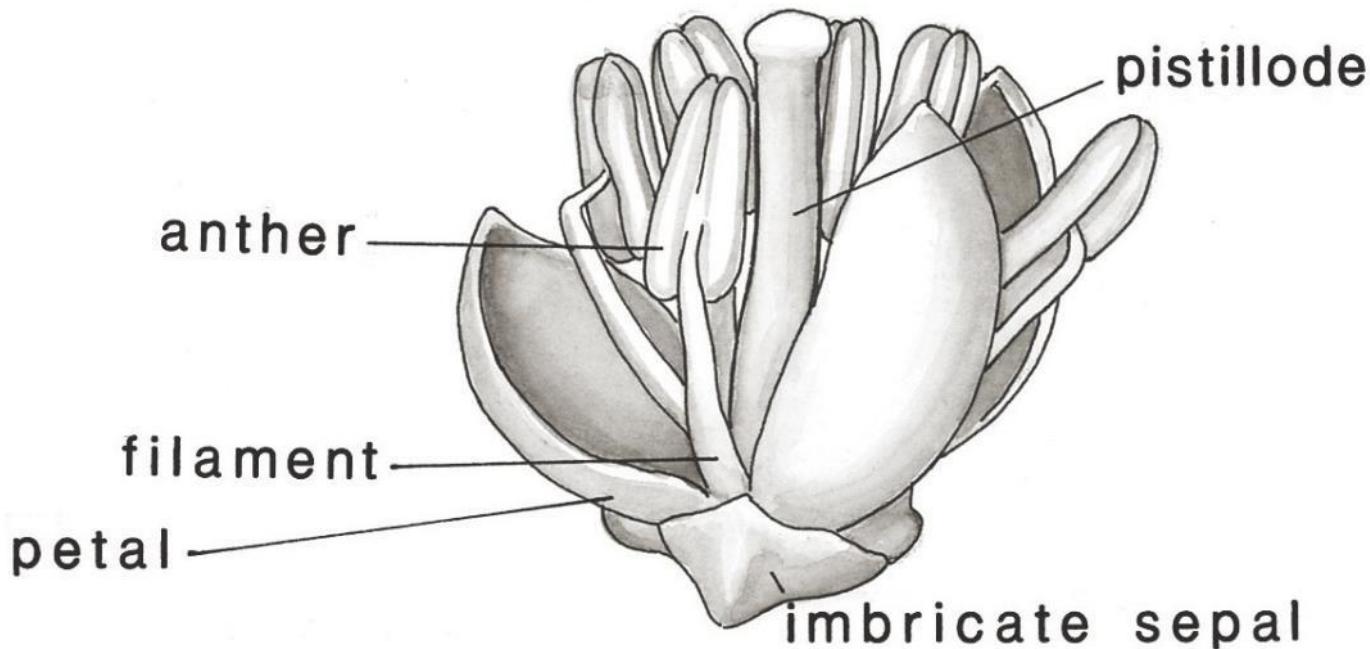
Scale bars: a–c, i, q–s = 1 mm; d–l, k–m, p, t–w = 500 µm; n, o = 1 cm.

Photos: a, L. Guevara; b–c, J. A. S. Barfod & F. W. Stauffer; d, k–m, p, R. Ryder & P. Rudall; e–g, F. Castaño & F. W. Stauffer; h–l, A. Gidley & F. W. Stauffer; n–o, A. S. Barfod; q–r, A. Askgaard; s–w, F. W. Stauffer.





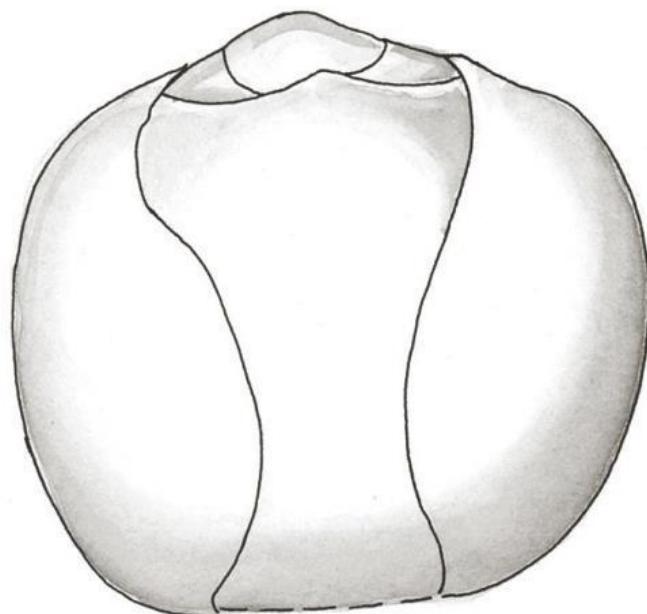
Drawn by Marion Ruff Sheehan



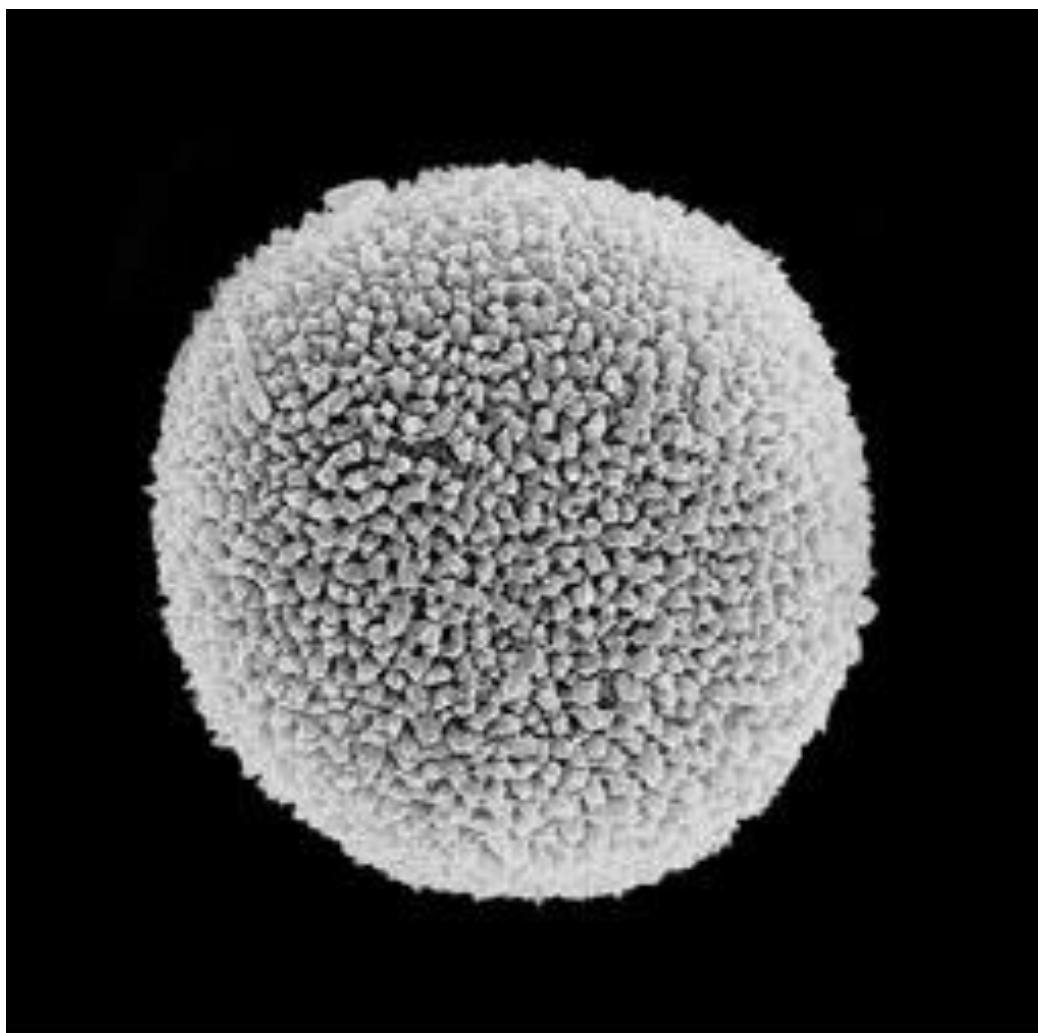
*Iguanura*

Drawn by Marion Ruff Sheehan

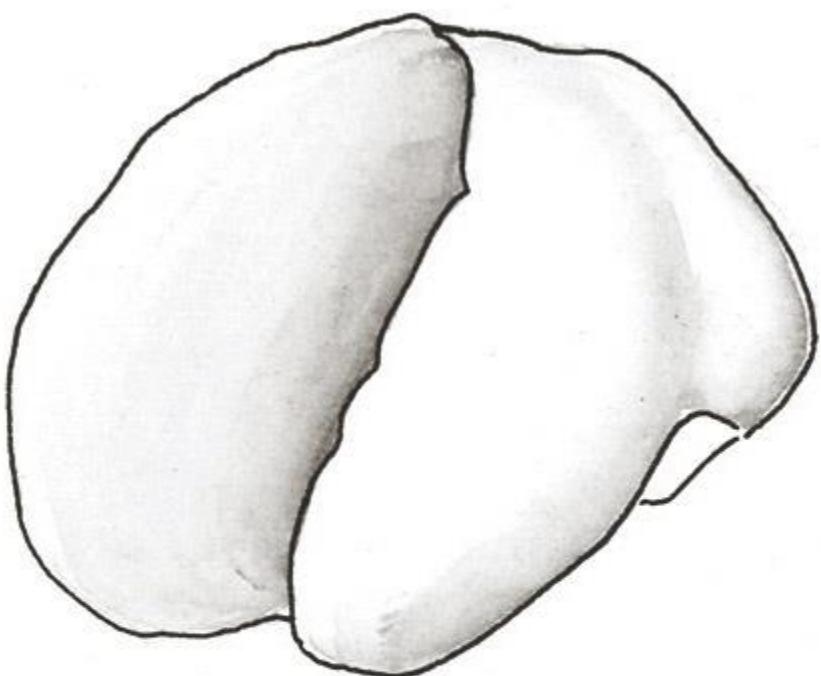
Drawn by Marion Ruff Sheehan



corolla of  
imbricate petals  
*Borassus*

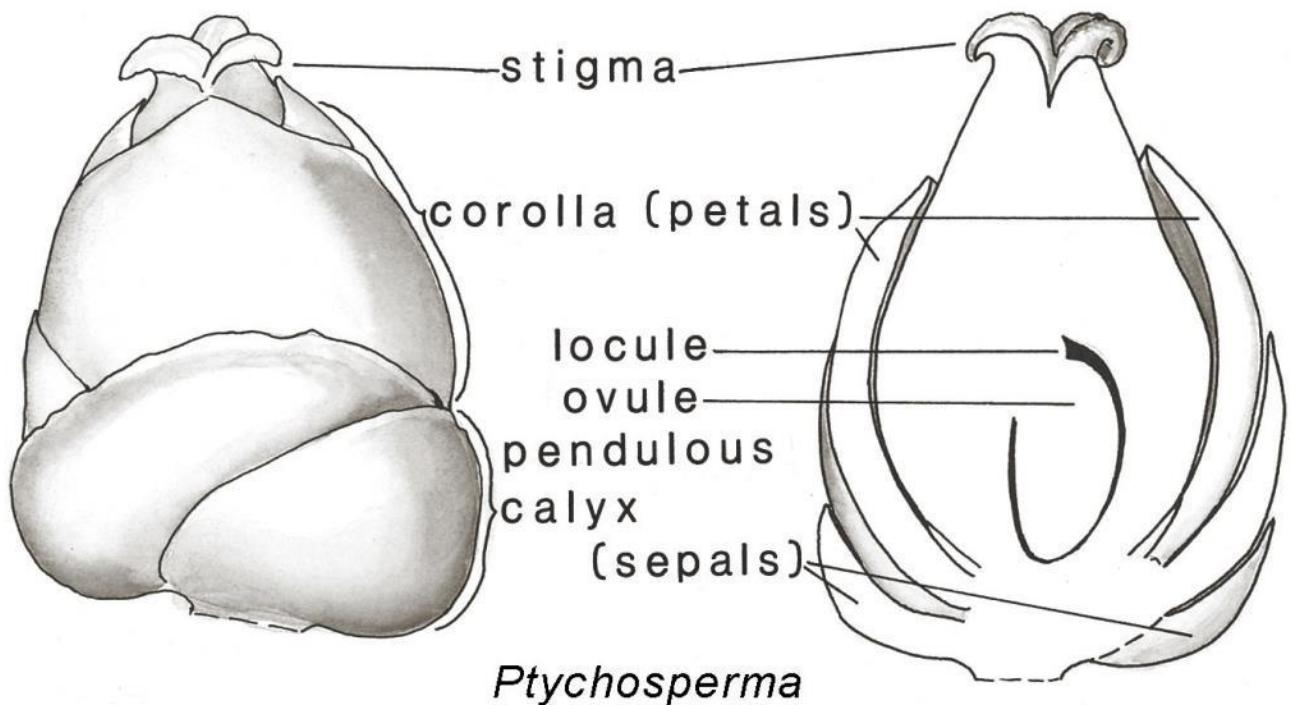


*Pigafetta elata*: close-up, pollen surface.  
SEM × 7500 . Migliaccio s.n.



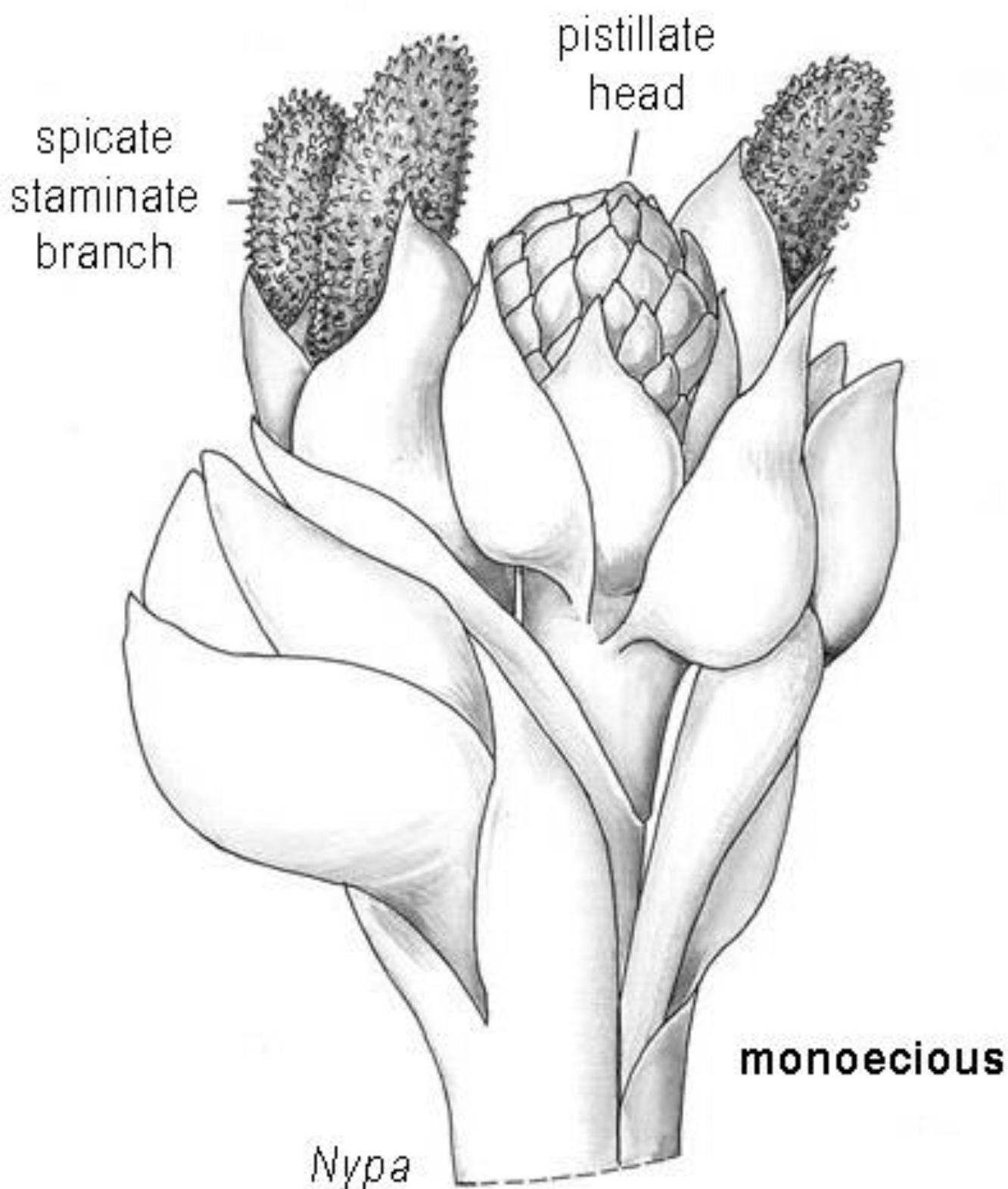
keeled sepal  
*Carpentaria*

Drawn by Marion Ruff Sheehan

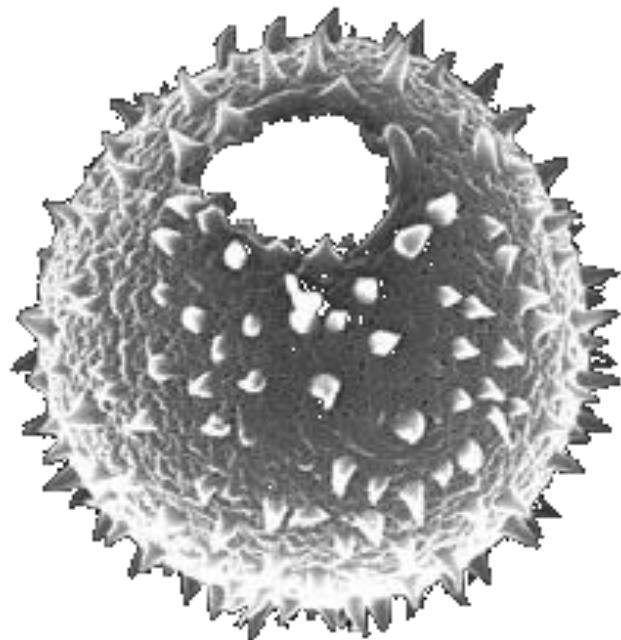


Drawn by Marion Ruff Sheehan

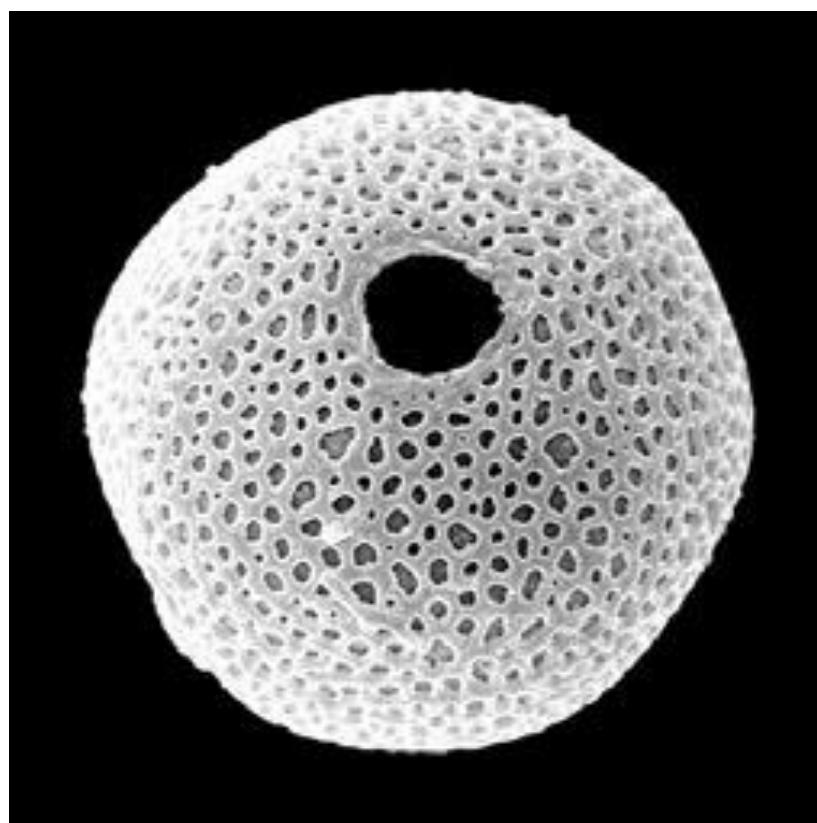
**Monoecious**



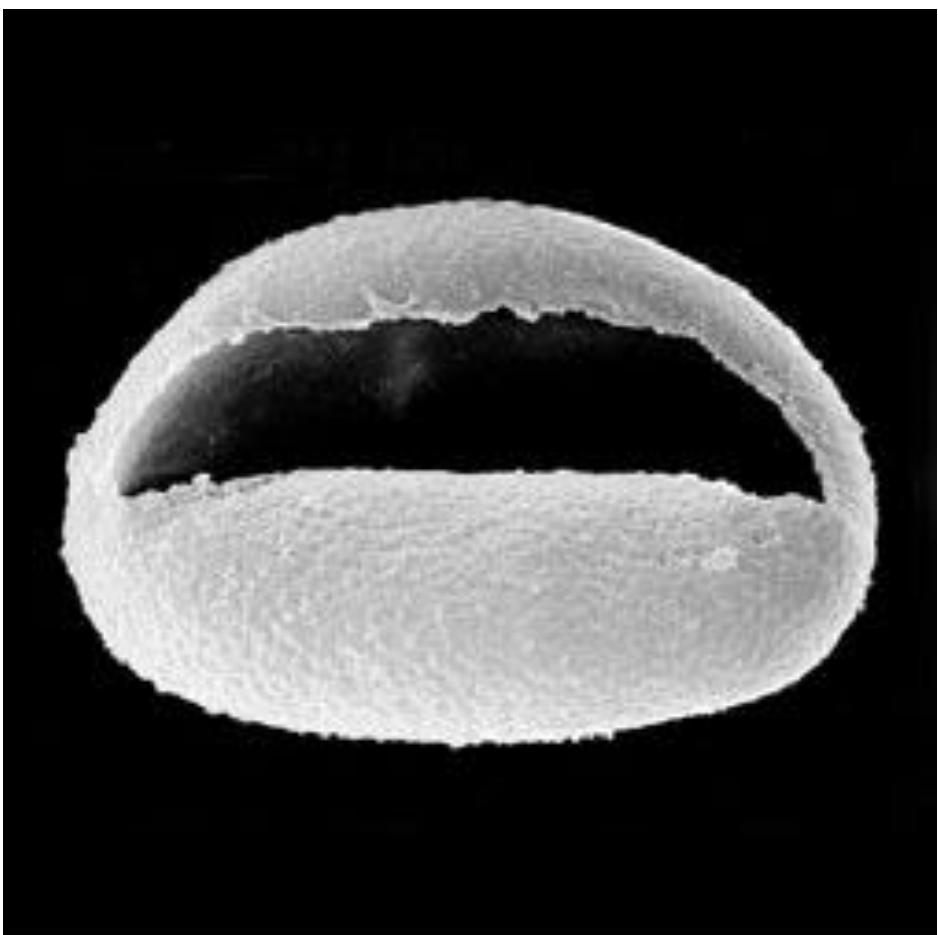
*Nypa*



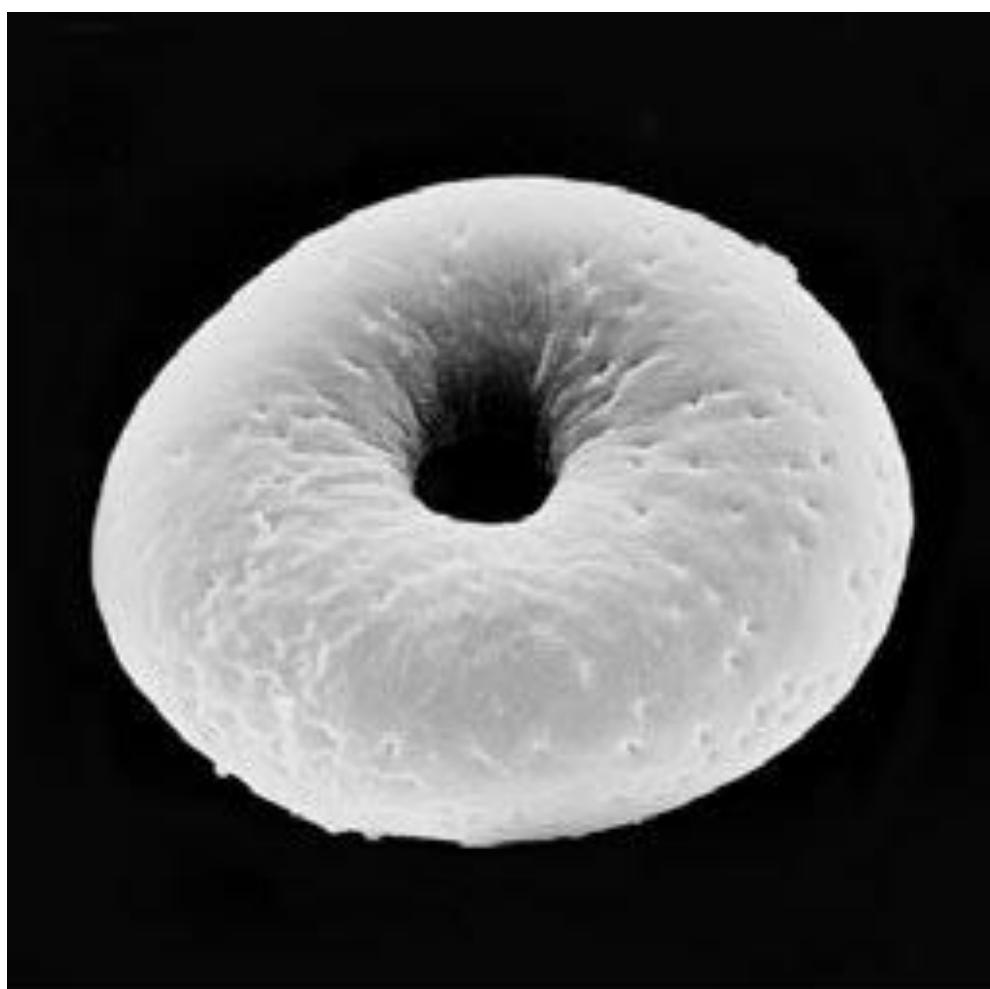
*Ravenea madagascariensis*: monoporate pollen  
grain, tilted equatorial face with distal pore in view  
SEM  $\times 2000$ . Dransfield JD6430/



*Ravenea albicans*: monoporate pollen grain, distal  
face SEM  $\times 1500$ . Perrier de la Bathie 11939.



*Sabal minor* symmetric monosulcate pollen  
grain SEM  $\times 1500$ . Drummond 357



*Areca caliso*: oblate monoporate pollen grain,  
distal polar face SEM  $\times 1500$ . Elmer 11898.

## Floral diversity in palms



## Calamoideae:

**a**, *Mauritiella armata* (Lepidocaryeae), pistillate flower, gynoecium, note reflexed scales.

## Nypoideae:

**b–c**, *Nypa fruticans*, **b**, staminate flower, perianth partially removed to reveal three connate stamens; **c**, one carpel isolated from pistillate flower.

## Coryphoideae:

**d**, *Leucothrinax morrisii* (Cryosophileae), hermaphroditic flower, stamens and perianth partially removed to show unicarpellate gynoecium.

**e**, *Cryosophila warscewiczii* (Cryosophileae), hermaphroditic flower, perianth removed to show staminal tube and exserted stigmas.

**f–g**, *Chelyocarpus ulei* (Cryosophileae), hermaphroditic flower, **f**, androecium and **g** apocarpos gynoecium;

**h**, *Rhapis subtilis* (Trachycarpeae), staminate flower, androecium.

**i**, *Rhapis excelsa* (Trachycarpeae), pistillate flower apocarpos gynoecium surrounded by conspicuous staminodes.

**j**, *Licuala petita* (Trachycarpeae), hermaphroditic flower, corolla removed to show stamens and exserted style.

**k–l**, *Copernicia t. burreiana* (Trachycarpeae), hermaphroditic flower, **k**, perianth and androecium partially removed to reveal gynoecium comprising three carpels free at the base, united distally, **l**, gynoecium with one carpel dislodged to reveal darker distal area of carpel connection and united style.

**m**, *Hyphaene coriacea* (Borasseae), pistillate flower, perianth removed, syncarpous gynoecium with conspicuous staminodes.

## Ceroxyloideae:

**n**, *Aphandra natalia* (Phytelepheae), staminate flower, note reduced, irregular perianth and multistamine androecium containing

400–650 stamens

**o**, *Phytelephas macrocarpa* (Phytelepheae), pistillate flower, perianth partially removed, note the large size of this flower, the numerous staminodes surrounding the **ovary**, the syncarpous pentamerous gynoecium (4–10 carpels in *Phytelephas*) comprising rounded **ovary**, and elongate style and stigmas.

## Arecoideae:

**p**, *Synechanthus warscewiczianus* (Chamaedoreeae), staminate flower sepal removed, androecium comprising three stamens only

**q**, *Chamaedorea hooperiana* (Chamaedoreeae), staminate flower, one petal removed

**r**, *Chamaedorea brachypoda* (Chamaedoreeae), staminate flower, one petal removed, note variation in stamen and pistillode morphology in **q** and **r**.

**s**, *Astrocaryum martinicense* (Geonamateae), staminate flower

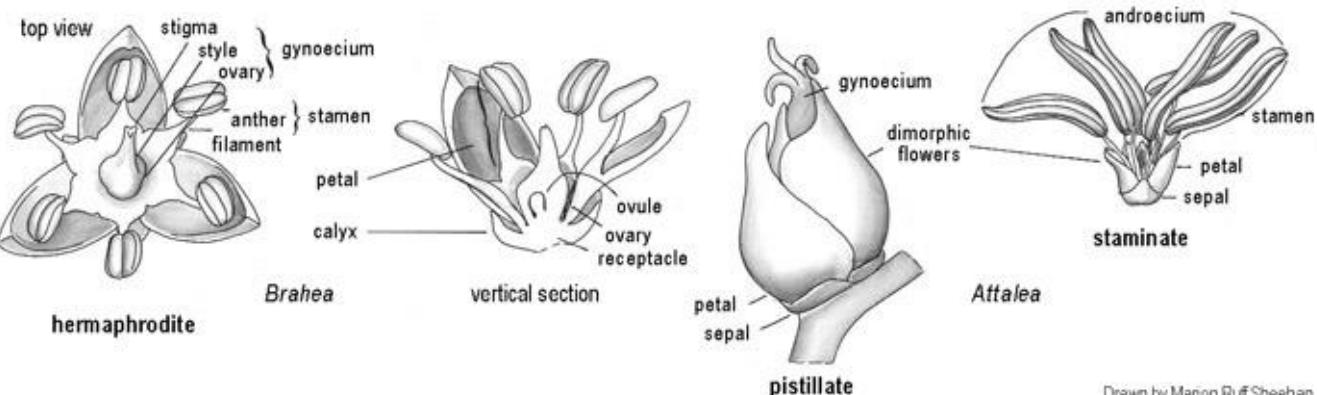
**t**, *Calyptrogyne ghiesbreghtiana* (Geonamateae), pistillate flower, trimerous gynoecium (see **u**)

**u**, *Geonoma simplicifrons* (Geonamateae), pistillate flower, pseudomonomerous gynoecium (see **t**, **w**)

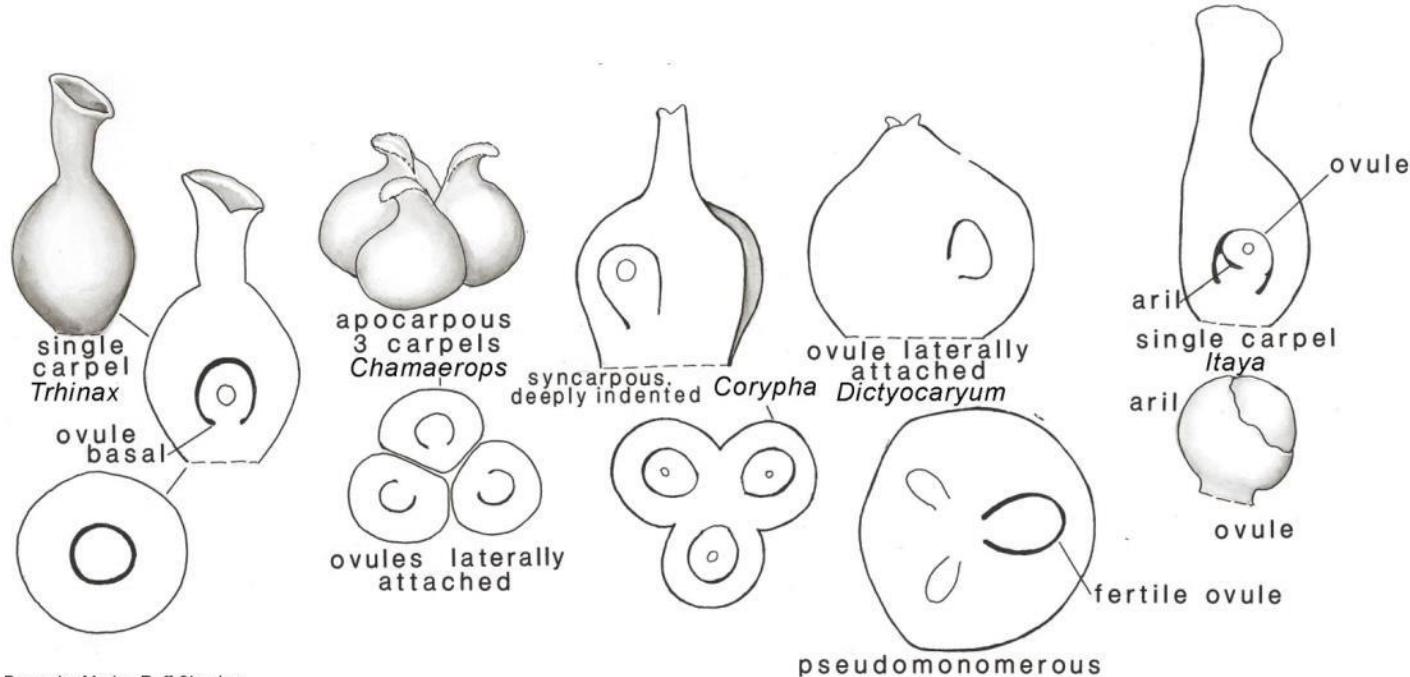
**v–w**, *Pelagodoxa henniana* (Pelagodoxeae), **v**, pistillate flower, perianth removed to show androecium and pistillode, **w**, pistillate flower, perianth and androecium removed to show pseudomonomerous gynoecium (see **u**) and staminodes.

Scale bars: a–c, j, q–s = 1 mm; d–i, k–m, p, t–w = 500 µm; n, o = 1 cm.

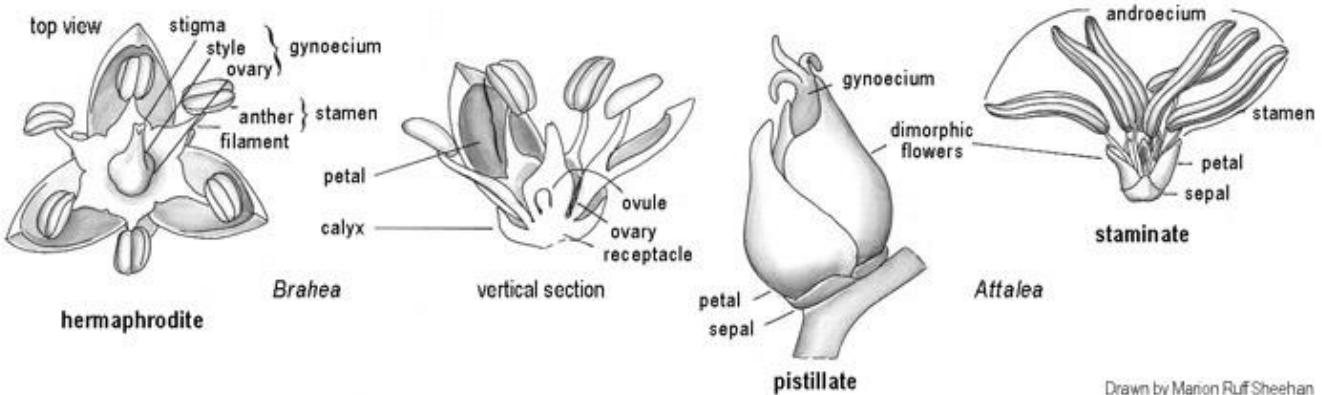
Photos: a, L. Guevara; b–c, J. A. S. Barfod & F. W. Stauffer; d, k–m, p, R. Ryder & P. Rudall; e–g, F. Castaño & F. W. Stauffer; h–i, A. Gidley & F. W. Stauffer; n–o, A. S. Barfod; q–r, A. Askgaard; s–w, F. W. Stauffer.



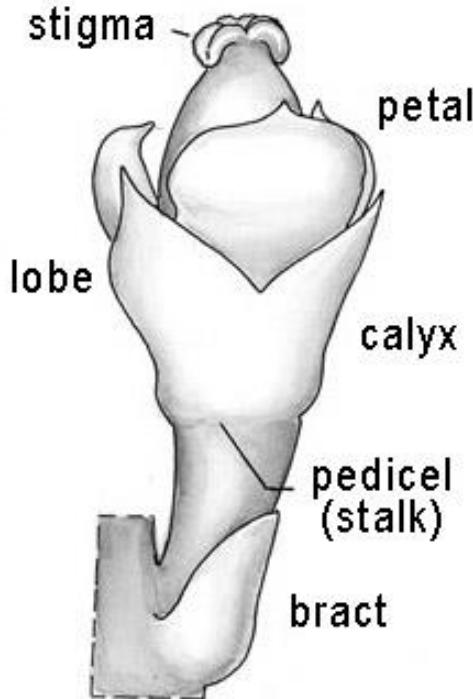
Drawn by Manon Ruff Sheehan



Drawn by Marion Ruff Sheehan

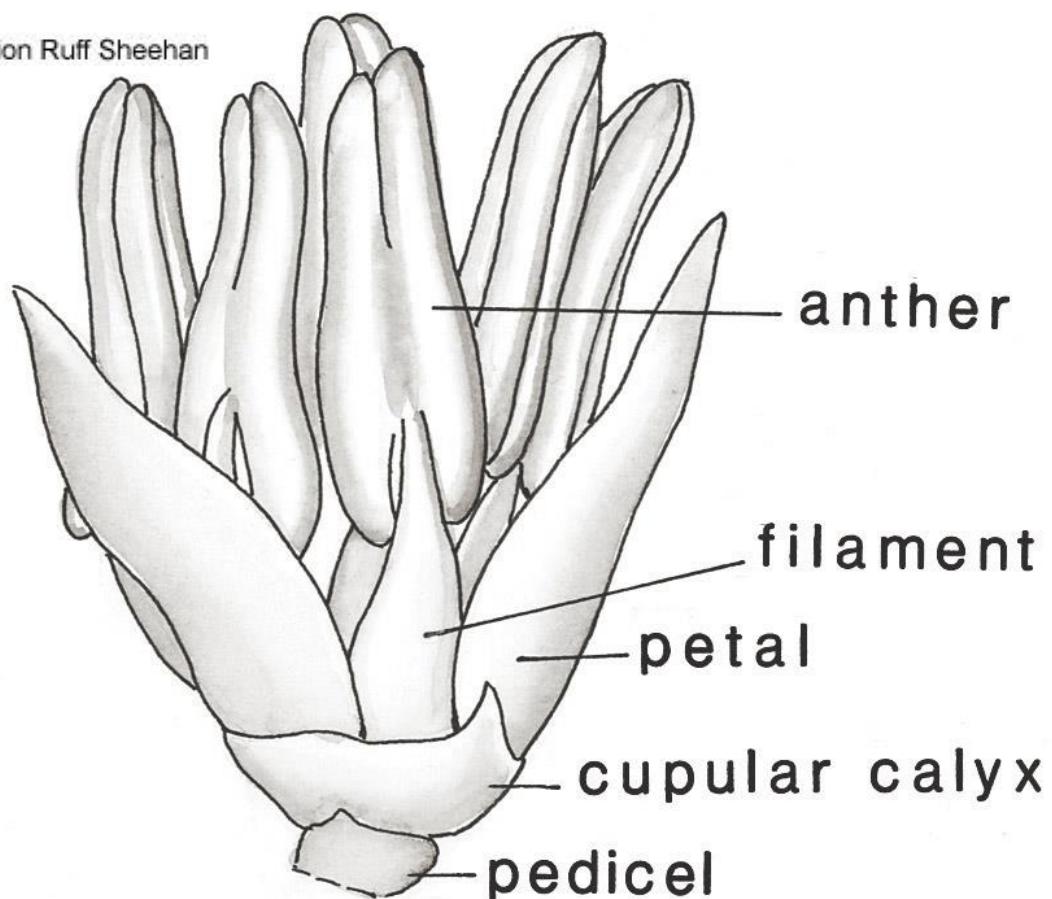


Drawn by Marion Ruff Sheehan



*Ravenea*

Drawn by Marion Ruff Sheehan



*Orianopsis*



### Floral diversity in palms

#### Calamoideae:

**a.** *Mauritiella armata* (Lepidocaryeae), pistillate flower, gynoecium, note reflexed scales.

#### Nypoideae:

**b–c.** *Nypa fruticans*, **b**, staminate flower, perianth partially removed to reveal three connate stamens; **c**, one carpel isolated from pistillate flower.

#### Coryphoideae:

**d.** *Leucothrinax morrisii* (Cryosophileae), hermaphroditic flower, stamens and perianth partially removed to show unicarpellate gynoecium.

**e.** *Cryosophila warscewiczii* (Cryosophileae), hermaphroditic flower, perianth removed to show staminal tube and exerted stigmas.

**f–g.** *Chelyocarpus ulmoides* (Cryosophileae), hermaphroditic flower, **f**, androecium and **g** apocarpous gynoecium;

**h.** *Rhapis subtilis* (Trachycarpeae), staminate flower, androecium

**i.** *Rhapis excelsa* (Trachycarpeae), pistillate flower, apocarpous gynoecium surrounded by conspicuous staminodes

**j.** *Licuala petala* (Trachycarpeae), hermaphroditic flower, corolla removed to show stamens and exerted style

**k–l.** *Copernicia ? burritoana* (Trachycarpeae), hermaphroditic flower, **k**, perianth and androecium partially removed to reveal gynoecium comprising three carpels free at the base, united distally, **l**, gynoecium with one a carpel dislodged to reveal darker distal area of carpel connection and united style

**m.** *Hypaaene coriacea* (Borasseae), pistillate flower, perianth removed, syncarpous gynoecium with conspicuous staminodes

**n.** *Aphandra natalia* (Phytelepheae), staminate flower, note reduced, irregular perianth and multistamine androecium containing 400–650 stamens

**o.** *Phytelephas macrocarpa* (Phytelepheae), pistillate flower, perianth partially removed, note the large size of this flower, the numerous staminodes surrounding the ovary, the syncarpous pentamerous gynoecium (4–10 carpels in *Phytelephas*) comprising rounded ovary, and elongate style and stigmas

**p.** *Synechanthus warscewiczianus* (Chamaedoreeae), staminate flower, sepal removed, androecium comprising three stamens only

**q.** *Chamaedorea hooperiana* (Chamaedoreeae), staminate flower, one petal removed

**r.** *Chamaedorea brachypoda* (Chamaedoreeae), staminate flower, one petal removed, note variation in stamen and pistilode morphology in **q** and **r**

**s.** *Asterogyne maritima* (Geonomeatae), staminate flower

**t.** *Calyptragnea ghiesbreghtiana* (Geonomeatae), pistillate flower, trimerous gynoecium (see **u**)

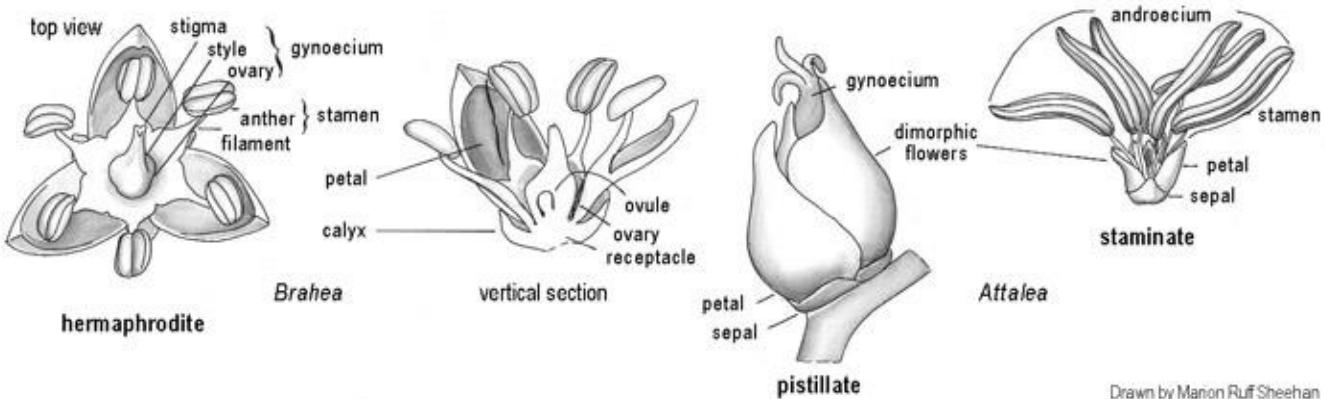
**u.** *Geonoma simplicifrons* (Geonomeatae), pistillate flower, pseudomonomerous gynoecium (see **t**, **w**)

**v–w.** *Pelagodoxa henyana* (Pelagodoxeae), **v**, staminate flower, perianth removed to show androecium and pistilode, **w**, pistillate flower, perianth and androecium removed to show pseudomonomerous gynoecium (see **u**) and staminodes

Scale bars: a–c, i, q–s = 1 mm; d–i, k–m, p, t–w = 500 µm; n, o = 1 cm.

Photos: a, L. Guevara, b–c, J. A. S. Barfod & F. W. Stauffer; d–k, p, R. Rydger & P. Rudall; e–g, F. Castaño & F. W. Stauffer; h–i, A. Glidley & F. W. Stauffer; n–o, A. S. Barfod; q–r, A. Asgaard; s–w, F. W. Stauffer.

# Petal Sepal Receptacle



Drawn by Marion Ruff Sheehan

## Floral diversity in palms



### Calamoideae:

a, *Mauritiella armata* (Lepidocaryeae), **pistillate** flower, gynoecium, note reflexed scales.

Nypoideae:

b–c, *Nypha fruticans*, b, staminate flower, perianth partially removed to reveal three connate stamens; c, one carpel isolated from pistillate flower.

Cynophioideae:

d, *Leucothrinax morrisii* (Cryosophileae), hermaphroditic flower, stamens and perianth partially removed to show unicarpellate gynoecium

e, *Cryosophila warscewiczii* (Cryosophileae), hermaphroditic flower, perianth removed to show staminal tube and exerted stigmas

f–g, *Chelyocarpus ulei* (Cryosophileae), hermaphroditic flower, f, androecium and g apocarous gynoecium;

h, *Rhapis subtilla* (Trachycarpeae), staminate flower, androecium

i, *Rhapis excelsa* (Trachycarpeae), **pistillate** flower, apocarous gynoecium surrounded by conspicuous staminodes

j, *Licuala petiota* (Trachycarpeae), hermaphroditic flower, corolla removed to show stamens and exerted style

k–l, *Copernicia t. burritoana* (Trachycarpeae), hermaphroditic flower, k, perianth and androecium partially removed to reveal gynoecium comprising three carpels free at the base, united distally, l, gynoecium with one carpel dislodged to reveal darker distal area of carpel connation and united style

m, *Hypaaene coriacea* (Borasseae), **pistillate** flower, perianth removed, syncarpous gynoecium with conspicuous staminodes

Cercozygoideae:

n, *Aphandra natalia* (Phytellepheae), staminate flower, note reduced, irregular perianth and multistamine androecium containing 400–650 stamens

o, *Phytelephas macrocarpa* (Phytellepheae), **pistillate** flower, perianth partially removed, note the large size of this flower, the numerous staminodes surrounding the ovary, the syncarpous pentamerous gynoecium (4–10 carpels in Phytellephas) comprising rounded ovary, and elongate style and stigmas

Arecoideae:

p, *Synechanthus warscewiczianus* (Chamaedoreeae), staminate flower sepal removed, androecium comprising three stamens only

q, *Chamaedorea hooperiana* (Chamaedoreeae), staminate flower, one petal removed

r, *Chamaedorea brachypoda* (Chamaedoreeae), staminate flower, one petal removed, note variation in stamen and pistillode morphology in q and r

s, *Asteroxyne martiana* (Geonomeatae), staminate flower

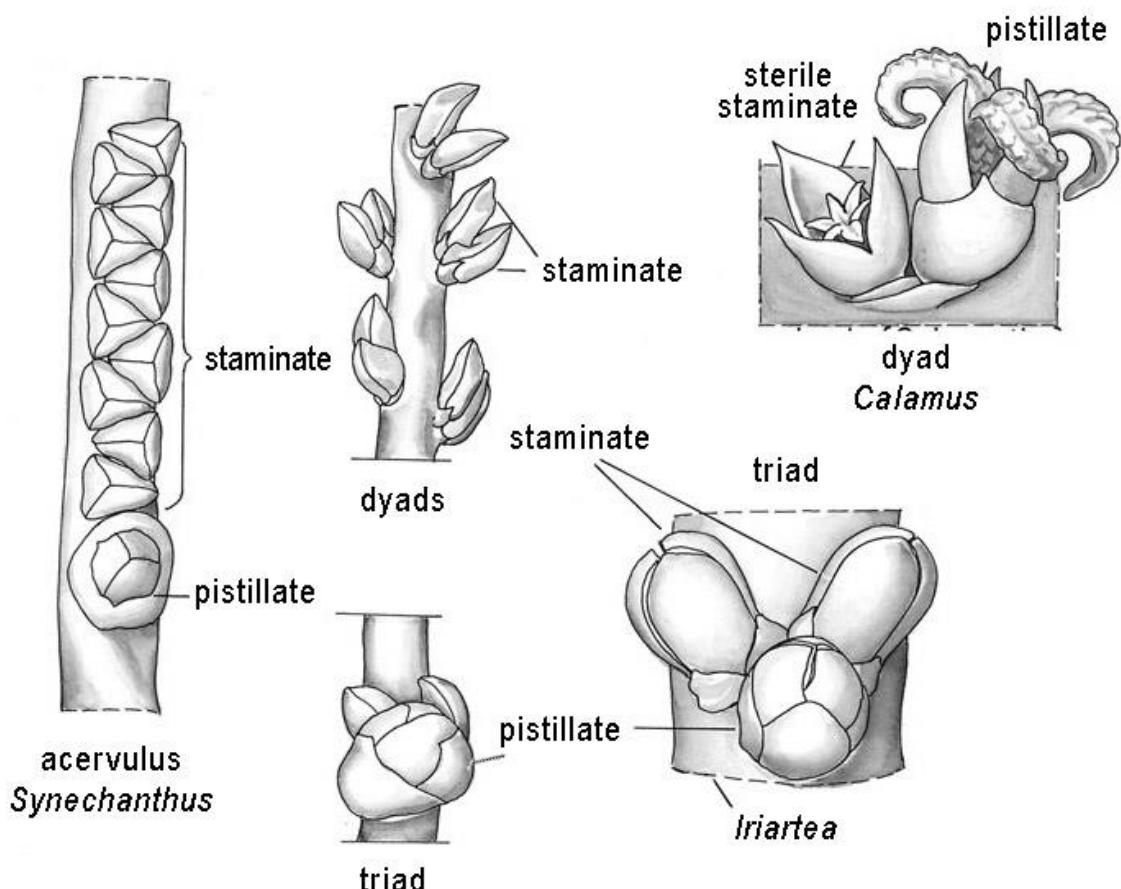
t, *Calyptrogyne ghiesbreghtiana* (Geonomeatae), **pistillate** flower, trimerous gynoecium (see u)

u, *Geonoma simpliciflora* (Geonomeatae), **pistillate** flower, pseudomonomerous gynoecium (see t, w)

v–w, *Pelagodoxa henryana* (Pelagodoxeae), v, staminate flower, perianth removed to show androecium and pistillode, w, **pistillate** flower, perianth and androecium removed to show pseudomonomerous gynoecium (see u) and staminodes

Scale bars: a–c, i, q–s = 1 mm; d–l, k–m, p, t–w = 500 µm; n, o = 1 cm.

Photos: a, L. Guevara; b–c, j, A. S. Barfod & F. W. Stauffer; d, k–m, p, R. Ryder & P. Rudall; e–g, F. Castaño & F. W. Stauffer; h–i, A. Gidley & F. W. Stauffer; n–o, A. S. Barfod; q–r, A. Askgaard; s–w, F. W. Stauffer.



## Floral diversity in palms



### Calamoideae:

a, *Mauritiella armata* (Lepidocaryeae), pistillate flower, gynoecium, note reflexed scales.

### Nypoideae

b–c, *Myrsia fruticans*, b, staminate flower, perianth partially removed to reveal three connate stamens; c, one carpel isolated from pistillate flower.

### Coryphoideae:

d, *Leucothrinax morrisii* (Cryosophileae), hermaphroditic flower, stamens and perianth partially removed to show unicarpellate gynoecium

e, *Cryosophila warscewiczii* (Cryosophileae), hermaphroditic flower, perianth removed to show staminal tube and exerted stigmas

f–g, *Chelyocarpus ulei* (Cryophyphileae), hermaphroditic flower, f, androecium and g apocarpous gynoecium;

h, *Rhapis subtilla* (Trachycarpeae), staminate flower, androecium

i, *Rhapis excelsa* (Trachycarpeae), pistillate flower, apocarpous gynoecium surrounded by conspicuous staminodes

j, *Licuala petiata* (Trachycarpeae), hermaphroditic flower, corolla removed to show stamens and exerted style

k–l, *Copernicia ? burelana* (Trachycarpeae), hermaphroditic flower, k, perianth and androecium partially removed to reveal gynoecium comprising three carpels free at the base, united distally, l, gynoecium with one carpel dislodged to reveal darker distal area of carpel connation and united style

m, *Hypaaene coriacea* (Borasseae), pistillate flower, perianth removed, syncarpous gynoecium with conspicuous staminodes

### Ceroxyloideae:

n, *Aphandra natalia* (Phytelepheae), staminate flower, note reduced, irregular perianth and multistamine androecium containing

400–650 stamens

o, *Phytelephas macrocarpa* (Phytelepheae), pistillate flower, perianth partially removed, note the large size of this flower,

the numerous staminodes surrounding the ovary, the syncarpous pentamerous gynoecium (4–10 carpels in *Phytelephas*) comprising rounded ovary, and elongate style and stigmas

### Arecoidae:

p, *Synechanthus warscewiczianus* (Chamaedoreeae), staminate flower sepal removed, androecium comprising three stamens only

q, *Chamaedorea hooperiana* (Chamaedoreeae), staminate flower, one petal removed

r, *Chamaedorea brachypoda* (Chamaedoreeae), staminate flower, one petal removed, note variation in stamen and **pistillode**

morphology in q and r

s, *Asteroxyne martiana* (Geonomeatae), staminate flower

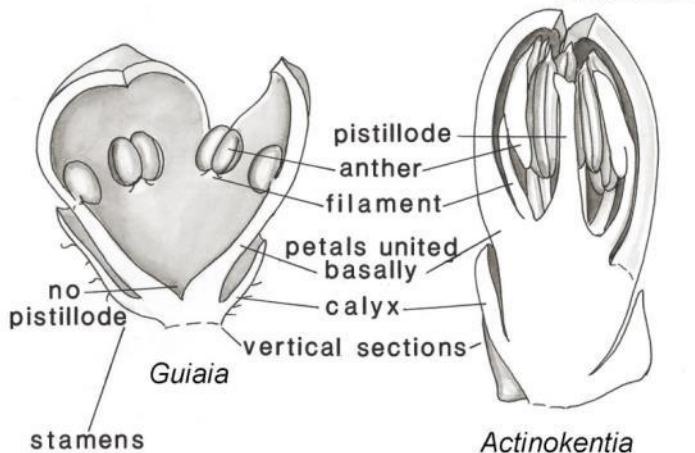
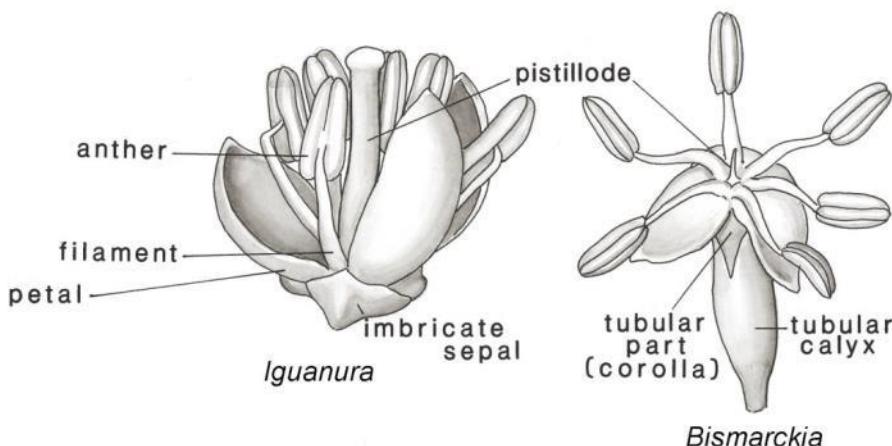
t, *Calyptogyne ghiesbreghtiana* (Geonomeatae), pistillate flower, trimerous gynoecium (see u)

u, *Geonoma simplicifolia* (Geonomeatae), pistillate flower, pseudomonomerous gynoecium (see t, w)

v–w, *Pelagodoxa henryana* (Pelagodoxeae), v, staminate flower, perianth removed to show androecium and **pistillode**, w, pistillate flower, perianth and androecium removed to show pseudomonomerous gynoecium (see u) and staminodes

Scale bars: a–c, j, q–s = 1 mm; d–i, k–m, p, t–w = 500 µm; n, o = 1 cm.

Photos: a, L. Guevara; b–c, J. A. S. Barfod & F. W. Stauffer; d, k–m, p, R. Ryder & P. Rudall; e–g, F. Castaño & F. W. Stauffer; h–l, A. Gidley & F. W. Stauffer; n–o, A. S. Barfod; q–r, A. Askgaard; s–w, F. W. Stauffer).



## Floral diversity in palms



### Calamoideae:

a, *Mauritiella armata* (Lepidocaryeae), pistillate flower, gynoecium, note reflexed scales.

### Nypoideae:

b–c, *Nypa fruticans*, b, staminate flower, perianth partially removed to reveal three connate stamens, c, one carpel isolated from pistillate flower.

### Coryphoidae:

d, *Leucothrinax morrisii* (Cryosophileae), hermaphroditic flower, stamens and perianth partially removed to show unicarpellate gynoecium

e, *Cryosophila warscewiczii* (Cryosophileae), hermaphroditic flower, perianth removed to show staminal tube and exerted stigmas

f–g, *Cheilocarpus ulei* (Cryosophileae), hermaphroditic flower, f, androecium and g apocarpos gynoecium;

h, *Rhapis subtilis* (Trachycarpeae), staminate flower, androecium

i, *Rhapis excelsa* (Trachycarpeae), pistillate flower, apocarpos gynoecium surrounded by conspicuous staminodes

j, *Licuala pettata* (Trachycarpeae), hermaphroditic flower, corolla removed to show stamens and exerted style

k–l, *Copernicia ? burretiana* (Trachycarpeae), hermaphroditic flower, k, perianth and androecium partially removed to reveal gynoecium comprising three carpels free at the base, united distally, l, gynoecium with one carpel dislodged to reveal darker distal area of carpel connation and united style

m, *Hyphaene coriacea* (Borasseae), pistillate flower, perianth removed, syncarpous gynoecium with conspicuous staminodes

Ceroxyloideae:

n, *Aphandra natalis* (Phytelephaeae), staminate flower, note reduced, irregular perianth and multistamine androecium containing 400–650 stamens

o, *Phytelephas macrocarpa* (Phytelephaeae), pistillate flower, perianth partially removed, note the large size of this flower, the numerous staminodes surrounding the ovary, the syncarpous pentamerous gynoecium (4–10 carpels in Phytelephas) comprising rounded ovary, and elongate style and stigmas

### Arecoideae:

p, *Synechanthus warscewiczianus* (Chamaedoreeae), staminate flower, sepal removed, androecium comprising three stamens only

q, *Chamaedorea hooperiana* (Chamaedoreeae), staminate flower, one petal removed

r, *Chamaedorea brachypoda* (Chamaedoreeae), staminate flower, one petal removed, note variation in stamen and pistillode morphology in q and r

s, *Asterogyne martiana* (Geonomeatae), staminate flower

t, *Calyptragne ghiesbreghtiana* (Geonomeatae), pistillate flower, trimorous gynoecium (see u)

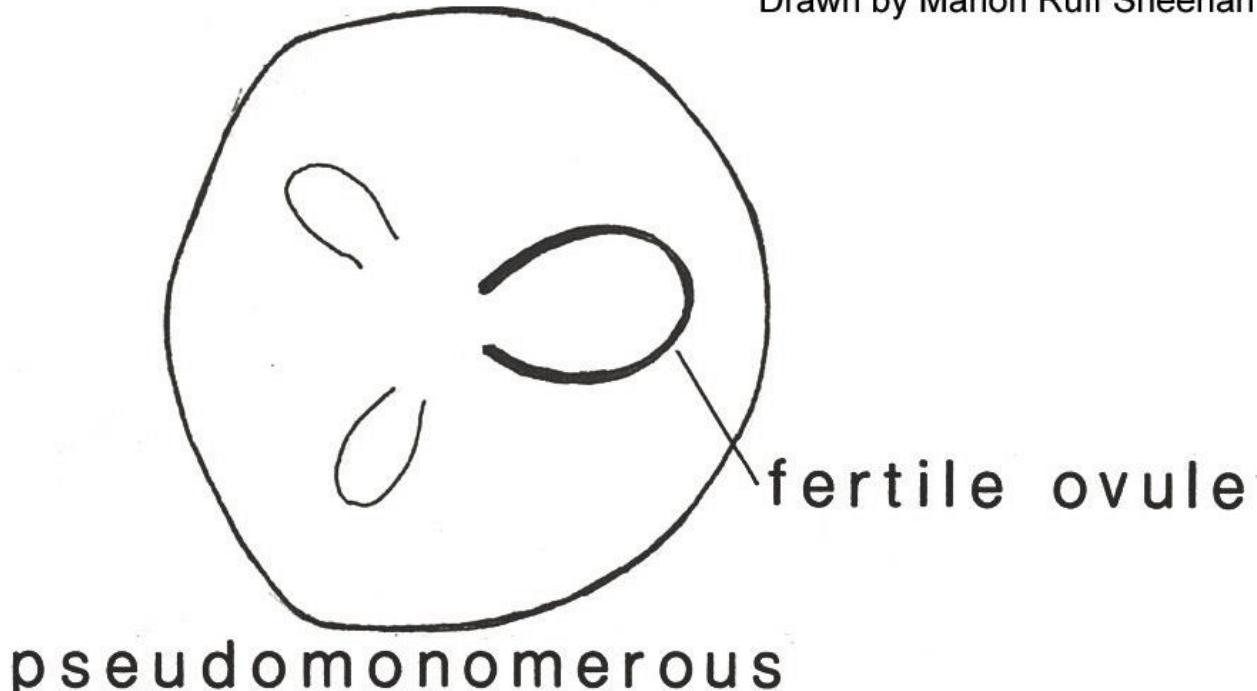
u, *Geonoma simplicifrons* (Geonomeatae), pistillate flower, **pseudomonomerous** gynoecium (see t, w)

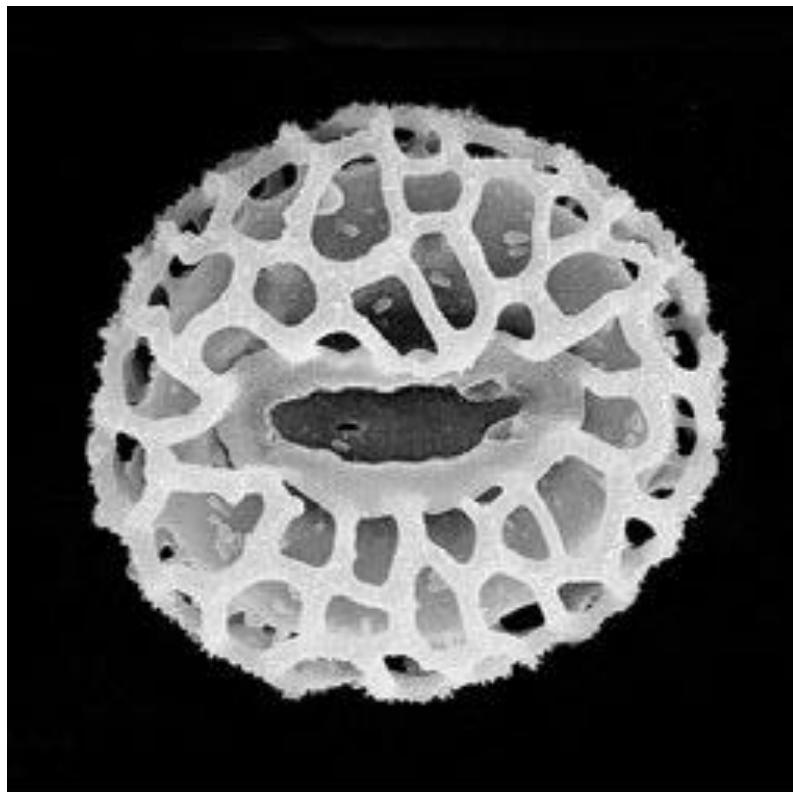
v–w, *Pelagodoxa henryana* (Pelagodoxeae), v, staminate flower, perianth removed to show androecium and pistillode, w, pistillate flower, perianth and androecium removed to show **pseudomonomerous** gynoecium (see u) and staminodes

Scale bars: a–c, j, q–s = 1 mm; d–l, k–m, p, t–w = 500 µm; n, o = 1 cm.

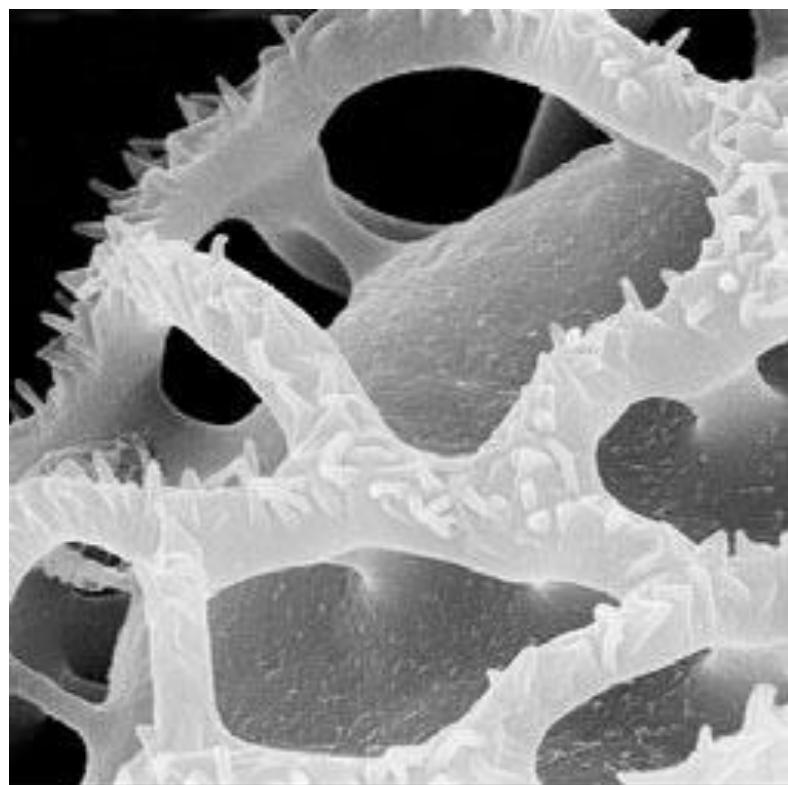
Photos: a, L. Guevara; b–c, J. A. S. Barfod & F. W. Staufer; d, k–m, p, R. Ryder & P. Rudall; e–g, F. Castaño & F. W. Staufer; h–l, A. Gilgley & F. W. Staufer; n–o, A. S. Barfod; q–r, A. Askgaard; s–w, F. W. Staufer.

Drawn by Marion Ruff Sheehan

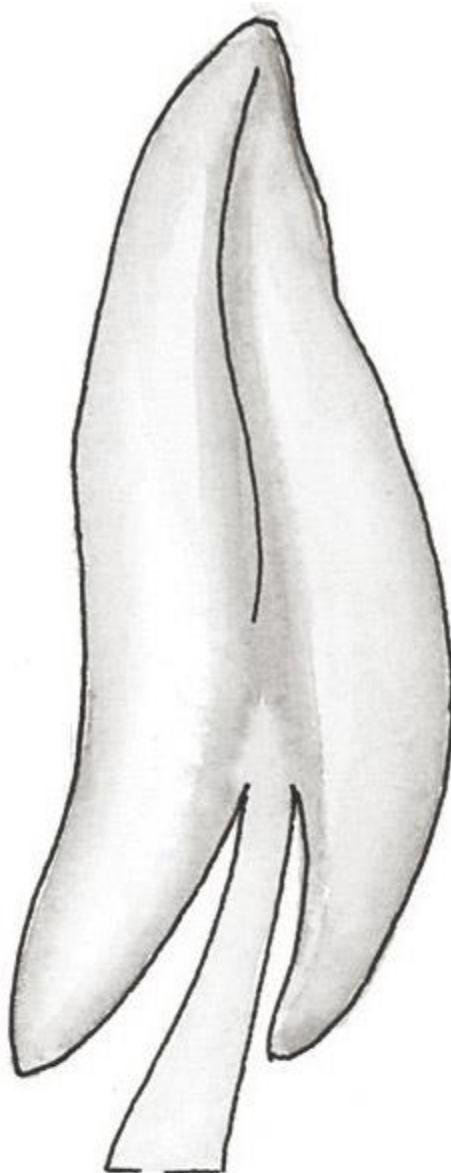




*Nenga gajah*: monosulcate coarsely reticulate  
pollen grain, distal face SEM  $\times 1000$ .  
Gundersen et al. LVG29.

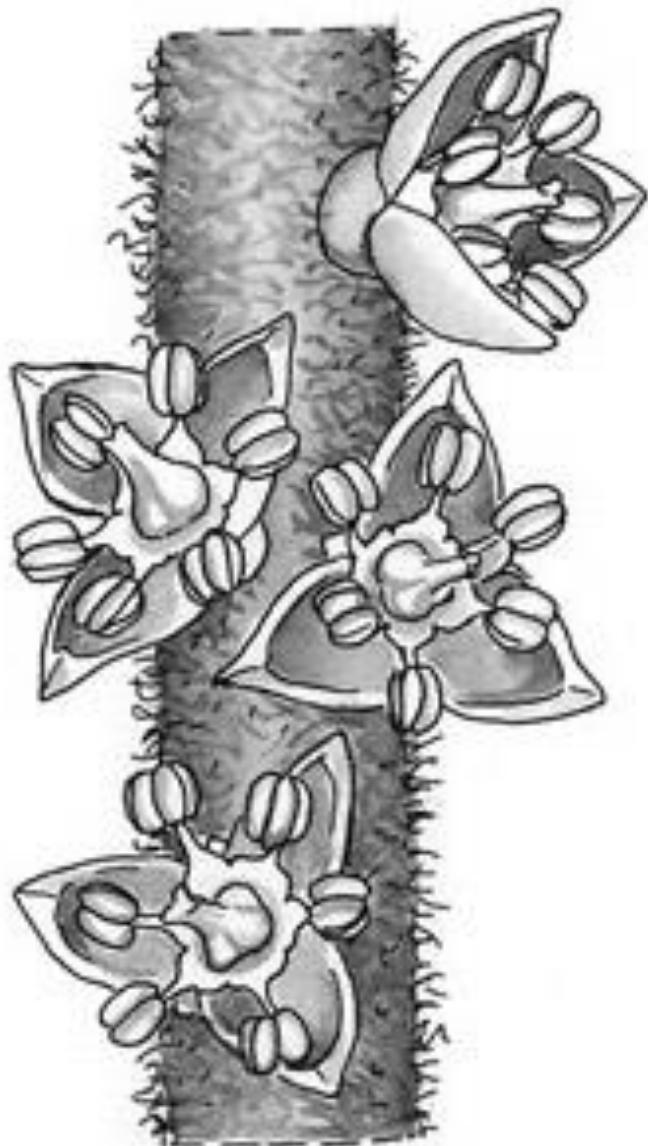


*Nenga gajah*: close-up, reticulum with spinulose  
muri SEM  $\times 5750$ . Gundersen et al. LVG29.



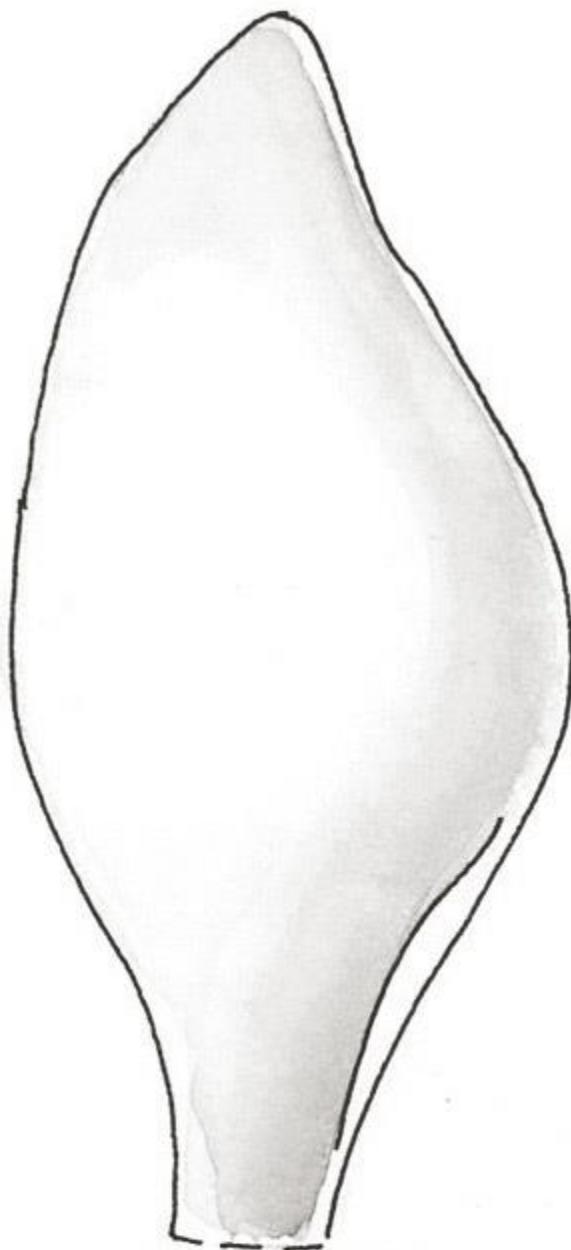
sagittate basally  
*Beccariphoenix*

Drawn by Marion Ruff Sheehan



**sessile flowers**  
*Brahea*

Drawn by Marion Ruff Sheehan

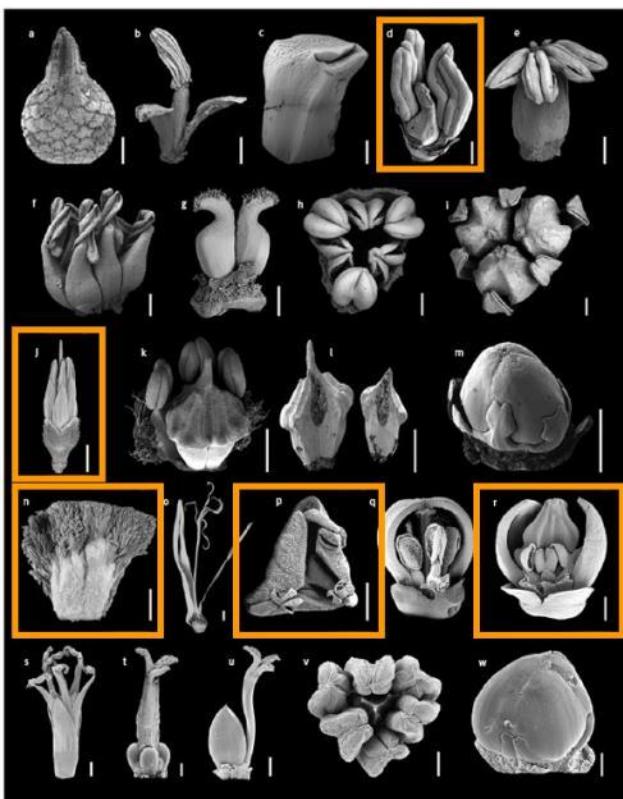


spatulate  
petal

*Attalea*

Drawn by Marion Ruff Sheehan

## Floral diversity in palms



## Calamoideae:

**a.** *Mauritiella armata* (Lepidocaryeae), pistillate flower, gynoecium, note reflexed scales.

## Nypoideae:

**b–c.** *Nypa fruticans*, **b**, staminate flower, perianth partially removed to reveal three connate **stamens**; **c**, one carpel isolated from pistillate flower.

## Coryphoideae:

**d.** *Leucothrinax morrisii* (Cryosophileae), hermaphroditic flower, **stamens** and perianth partially removed to show unicarpellate gynoecium**e.** *Cryosophila warscewiczii* (Cryosophileae), hermaphroditic flower, perianth removed to show staminal tube and exerted stigmas**f–g.** *Chelyocarpus ulei* (Cryosophileae), hermaphroditic flower; **f**, androecium and **g** apocarpous gynoecium;**h.** *Rhapis subtilis* (Trachycarpeae), staminate flower, androecium**i.** *Rhapis excelsa* (Trachycarpeae), pistillate flower, apocarpous gynoecium surrounded by conspicuous staminodes**j.** *Licuala peitata* (Trachycarpeae), hermaphroditic flower, corolla removed to show **stamens** and exerted style**k–l.** *Copernicia ? burretiana* (Trachycarpeae), hermaphroditic flower, **k**, perianth and androecium partially removed to reveal gynoecium comprising three carpels free at the base, united distally, **l**, gynoecium with one carpel dislodged to reveal darker distal area of carpel connection and united style**m.** *Hypaaene coriacea* (Borasseae), pistillate flower, perianth removed, syncarpous gynoecium with conspicuous staminodes

## Ceroxyloideae:

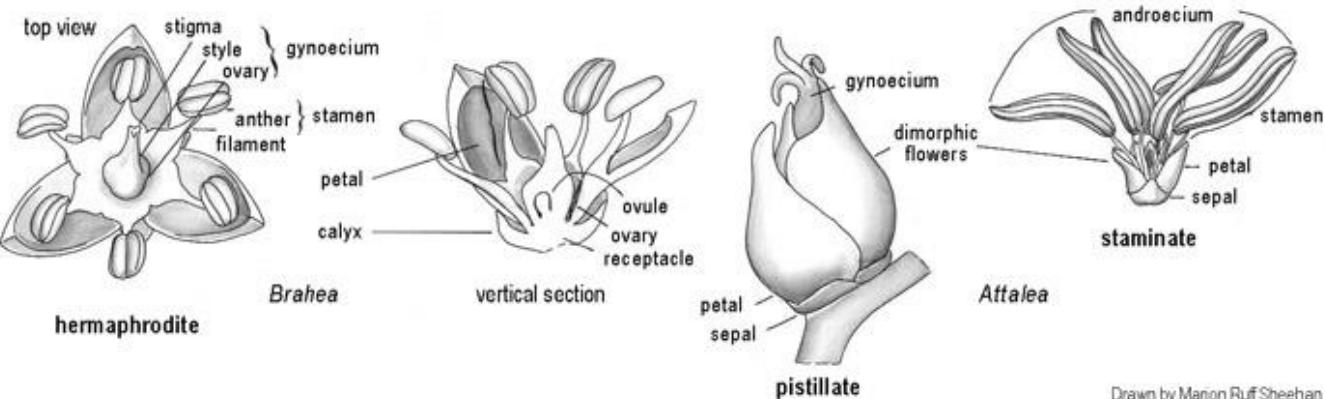
**n.** *Aphandra natalia* (Phytelephae), staminate flower, note reduced, irregular perianth and multistamine androecium containing 400–650 **stamens****o.** *Phytelephas macrocarpa* (Phytelephae), pistillate flower, perianth partially removed, note the large size of this flower, the numerous staminodes surrounding the ovary, the syncarpous pentamerous gynoecium (4–10 carpels in Phytelephas) comprising rounded ovary, and elongate style and stigmas

## Arecoideae:

**p.** *Synechanthus warscewiczianus* (Chamaedoreeae), staminate flower sepal removed, androecium comprising three **stamens** only**q.** *Chamaedorea hooperiana* (Chamaedoreeae), staminate flower, one petal removed**r.** *Chamaedorea brachypoda* (Chamaedoreeae), staminate flower, one petal removed, note variation in **stamen** and pistilode morphology in **q** and **r****s.** *Asterogyne martiana* (Geonamateae), staminate flower**t.** *Calyptrogyne ghiesbreghtiana* (Geonamateae), pistillate flower, trimerous gynoecium (see **u**)**u.** *Geonoma simplicifrons* (Geonamateae), pistillate flower, pseudomonomerous gynoecium (see **t**, **w**)**v–w.** *Pelagodoxa henryana* (Pelagodoxeae), **v**, staminate flower, perianth removed to show androecium and pistillode, **w**, pistillate flower, perianth and androecium removed to show pseudomonomerous gynoecium (see **u**) and staminodes

Scale bars: a–c, i, q–s = 1 mm; d–l, k–m, p, t–w = 500 µm; n, o = 1 cm.

Photos: a, L. Guevara; b–c, J.A. S. Barfod &amp; F. W. Stauffer; d, k–m, p, R. Ryder &amp; P. Rudall; e–g, F. Castaño &amp; F. W. Stauffer; h–l, A. Gidley &amp; F. W. Stauffer; n–q, A. S. Barfod; q–r, A. Askgaard; s–w, F. W. Stauffer.



Drawn by Marion Ruff Sheehan

## Floral diversity in palms



Calamoideae:

a, *Mauritiella armata* (Lepidocaryeae), pistillate flower, gynoecium, note reflexed scales.

Nypoideae:

b–c, *Nypa fruticans*, b, staminate flower, perianth partially removed to reveal three connate stamens; c, one carpel isolated from pistillate flower.

Cyphoidae:

d, *Leucothrinax morrisii* (Cryosophileae), hermaphroditic flower, stamens and perianth partially removed to show unicarpellate gynoecium

e, *Cryosophila warscewiczii* (Cryosophileae), hermaphroditic flower, perianth removed to show staminal tube and exerted stigmas

f–g, *Chelyocarpus ulei* (Cryosophileae), hermaphroditic flower, f, androecium and g apocarous gynoecium;

h, *Rhapis subtilla* (Trachycarpeae), staminate flower, androecium

i, *Rhapis excelsa* (Trachycarpeae), pistillate flower, apocarous gynoecium surrounded by conspicuous staminodes

j, *Licuala petala* (Trachycarpeae), hermaphroditic flower, corolla removed to show stamens and exerted style

k–l, *Copernicia ? burruiana* (Trachycarpeae), hermaphroditic flower, k, perianth and androecium partially removed to reveal gynoecium comprising three carpels free at the base, united distally, l, gynoecium with one carpel dislodged to reveal darker distal area of carpel connection and united style

m, *Hypahene coriacea* (Borasseae), pistillate flower, perianth removed, syncarpous gynoecium with conspicuous staminodes

Ceratozoidae:

n, *Aphandra natalia* (Phytelpleae), staminate flower, note reduced, irregular perianth and multistamine androecium containing

400–650 stamens

o, *Phytelephas macrocarpa* (Phytelpleae), pistillate flower, perianth partially removed, note the large size of this flower, the

numerous staminodes surrounding the ovary, the syncarpous pentamerous gynoecium (4–10 carpels in *Phytelephas*) comprising

rounded ovaries and elongate style and stigmas

Arecoideae:

p, *Synechanthus warscewiczianus* (Chamaedoreeae), staminate flower sepal removed, androecium comprising three stamens only

q, *Chamaedorea hooperiana* (Chamaedoreeae), staminate flower, one petal removed

r, *Chamaedorea brachypoda* (Chamaedoreeae), staminate flower, one petal removed, note variation in stamen and pistillode

morphology in q and r

s, *Astergyne martiana* (Geonomeatae), staminate flower

t, *Calyptogyne ghiesbreghtiana* (Geonomeatae), pistillate flower, trimerous gynoecium (see u)

u, *Geonoma simplicifrons* (Geonomeatae), pistillate flower, pseudomonomerous gynoecium (see t, w)

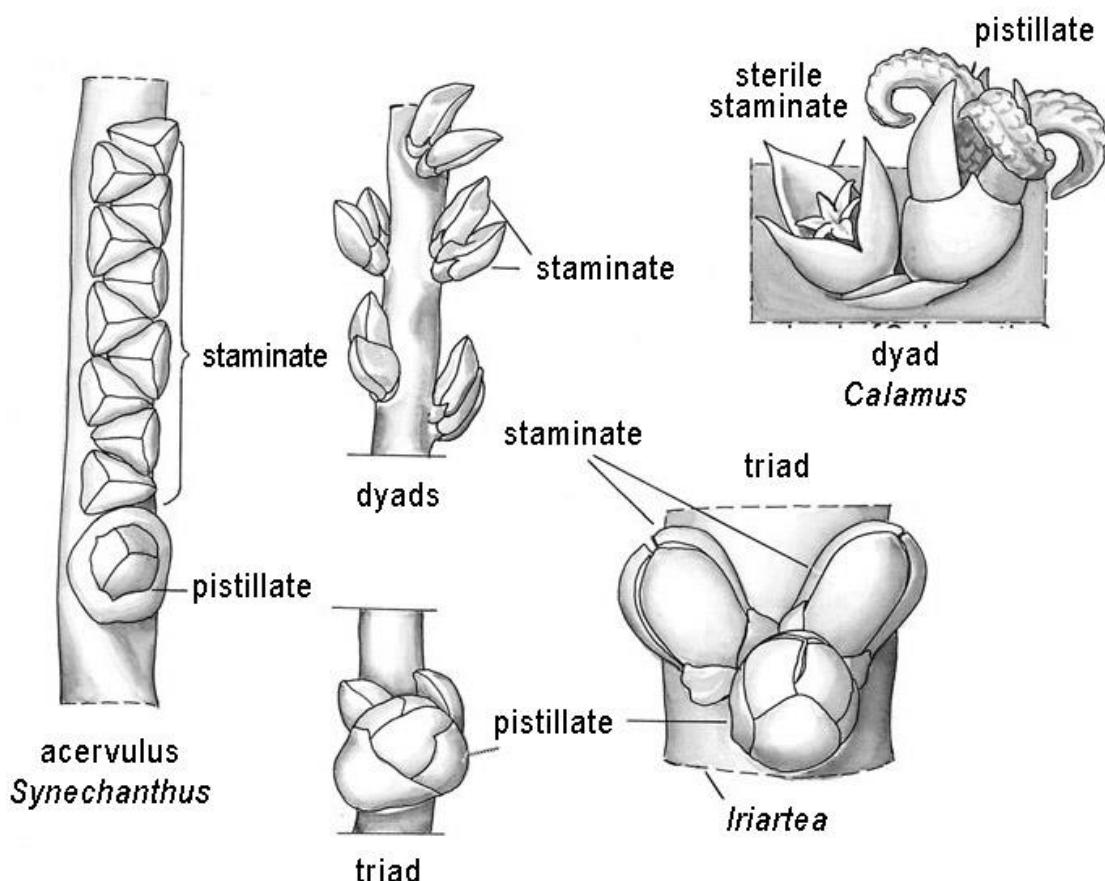
v–w, *Pelagodoxa henryana* (Pelagodoxeae), v, staminate flower, perianth removed to show androecium and pistillode, w, pistillate

flower, perianth and androecium removed to show pseudomonomerous gynoecium (see u) and staminodes

Scale bars: a–c, i, j–s = 1 mm; d–l, k–m, p, t–w = 500 µm; n, o = 1 cm.

Photos: a, L. Guevara; b–c, j, A. S. Barfod & F. W. Staufer; d, k–m, p, R. Ryder & P. Rudall; e–g, F. Castaño & F. W. Staufer;

h–i, A. Gidley & F. W. Staufer; n–o, A. S. Barfod; q–r, A. Askgaard; s–w, F. W. Staufer.





## Floral diversity in palms

### Calamoideae:

a, *Mauritiella armata* (Lepidocaryeae), pistillate flower, gynoecium, note reflexed scales.

### Nypoideae:

b–c, *Nypa fruticans*, b, staminate flower, perianth partially removed to reveal three connate stamens; c, one carpel isolated from pistillate flower.

### Coryphoideae:

d, *Leucothrinax morrisii* (Cryosophileae), hermaphroditic flower, stamens and perianth partially removed to show unicarpellate gynoecium.

e, *Cyosopha warscewiczii* (Cryosophileae), hermaphroditic flower, perianth removed to show staminal tube and exerted stigmas.

f–g, *Chelyocarpus ulei* (Cryosophileae), hermaphroditic flower, f, androecium and g apocarpos gynoecium;

h, *Rhapis subtilis* (Trachycarpeae), staminate flower, androecium

i, *Rhapis excelsa* (Trachycarpeae), pistillate flower, apocarpos gynoecium surrounded by conspicuous staminodes.

j, *Licuala petiata* (Trachycarpeae), hermaphroditic flower, corolla removed to show stamens and exerted style.

k–l, *Copestylum ? buretiense* (Trachycarpeae), hermaphroditic flower, k, perianth and androecium partially removed to reveal gynoecium comprising three carpels free at the base, united distally, l, gynoecium with one carpel dislodged to reveal darker distal area of carpel connation and united style.

m, *Hypnarrhine conacea* (Borasseae), pistillate flower, perianth removed, syncarpous gynoecium with conspicuous staminodes.

### Ceroxyloideae:

n, *Aphandra natalia* (Phytolaepeae), staminate flower, note reduced, irregular perianth and multistamine androecium containing

400–650 stamens

o, *Phytelephas macrocarpa* (Phytolaepeae), pistillate flower, perianth partially removed, note the large size of this flower, the numerous staminodes surrounding the ovary, the syncarpous pentamerous gynoecium (4–10 carpels in Phytolaepeas) comprising rounded ovary, and elongate style and stigmas.

Arecoideae:

p, *Synechanthus warscewiczianus* (Chamaedoreeae), staminate flower sepal removed, androecium comprising three stamens only

q, *Chamaedorea hooperiana* (Chamaedoreeae), staminate flower, one petal removed

r, *Chamaedorea brachypoda* (Chamaedoreeae), staminate flower, one petal removed, note variation in stamen and pistillode morphology in q and r

s, *Asterogyne maritima* (Geonamateae), staminate flower

t, *Calyptrogyne ghiesbreghtiana* (Geonamateae), pistillate flower, trimerous gynoecium (see u)

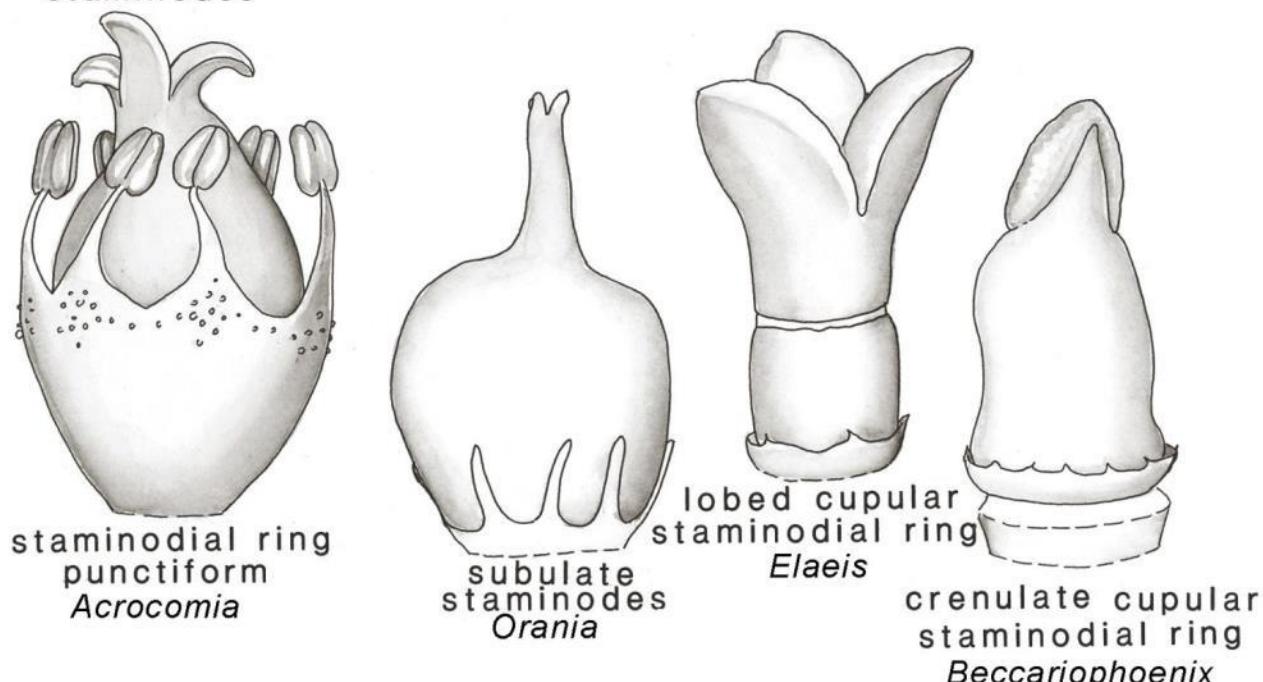
u, *Geonoma simplicifrons* (Geonamateae), pistillate flower, pseudomonomerous gynoecium (see t, w)

v–w, *Pelagodoxa henyana* (Pelagodoxeae), v, staminate flower, perianth removed to show androecium and pistillode, w, pistillate flower, perianth and androecium removed to show pseudomonomerous gynoecium (see u) and staminodes

Scale bars: a–c, j, o–s = 1 mm; d–i, k–m, p, t–w = 500 µm; n, o = 1 cm.

Photos: a, L. Guevara; b–c, J. A. S. Barfod & F. W. Stauffer; d, k–m, p, R. Ryder & P. Rudall; e–g, F. Castaño & F. W. Stauffer; h–i, A. Gidley & F. W. Stauffer; n–o, A. S. Barfod; q–r, A. Askgaard; s–w, F. W. Stauffer.

## staminodes



Drawn by Marion Ruff Sheehan

## Floral diversity in palms



## Calamoideae:

**a.** *Mauritiella armata* (Lepidocaryeae), pistillate flower, gynoecium, note reflexed scales.

## Nypoideae:

**b–c.** *Nypha fruticans*, **b**, staminate flower, perianth partially removed to reveal three connate stamens; **c**, one carpel isolated from pistillate flower.

## Coryphoidae:

**d.** *Leucothrinax morrisii* (Cryosophileae), hermaphroditic flower, stamens and perianth partially removed to show unicarpellate gynoecium

**e.** *Cryosophila warscewiczii* (Cryosophileae), hermaphroditic flower, perianth removed to show staminal tube and exerted **stigmas**

**f–g.** *Chelyocarpus ulicis* (Cryosophileae), hermaphroditic flower, **f**, androecium and **g** apocarous gynoecium;

**h.** *Rhapis subtiles* (Trachycarpeae), staminate flower, androecium

**i.** *Rhapis excelsa* (Trachycarpeae), pistillate flower, apocarous gynoecium surrounded by conspicuous staminodes

**j.** *Licuala petiata* (Trachycarpeae), hermaphroditic flower, corolla removed to show stamens and exerted style

**k–l.** *Copernicia ? burritoana* (Trachycarpeae), hermaphroditic flower, **k**, perianth and androecium partially removed to reveal gynoecium comprising three carpels free at the base, united distally; **l**, gynoecium with one carpel dislodged to reveal darker distal area of carpel connation and united style

**m.** *Hypaaea ne coriacea* (Borasseae), pistillate flower, perianth removed, syncarpous gynoecium with conspicuous staminodes

## Ceroxyloideae:

**n.** *Aphandra natalia* (Phytelephaeae), staminate flower, note reduced, irregular perianth and multistamine androecium containing 400–650 stamens

**o.** *Phytelephas macrocarpa* (Phytelephaeae), pistillate flower, perianth partially removed, note the large size of this flower, the numerous staminodes surrounding the ovary, the syncarpous pentamerous gynoecium (4–10 carpels in *Phytelephas*) comprising rounded ovary, and elongate style and **stigmas**

## Arecoideae:

**p.** *Synechanthus warscewiczianus* (Chamaedoreeae), staminate flower, sepal removed, androecium comprising three stamens only

**q.** *Chamaedorea hooperiana* (Chamaedoreeae), staminate flower, one petal removed

**r.** *Chamaedorea brachypoda* (Chamaedoreeae), staminate flower, one petal removed, note variation in stamen and pistillode morphology in **q** and **r**

**s.** *Astergome martiana* (Geonomeatae), staminate flower

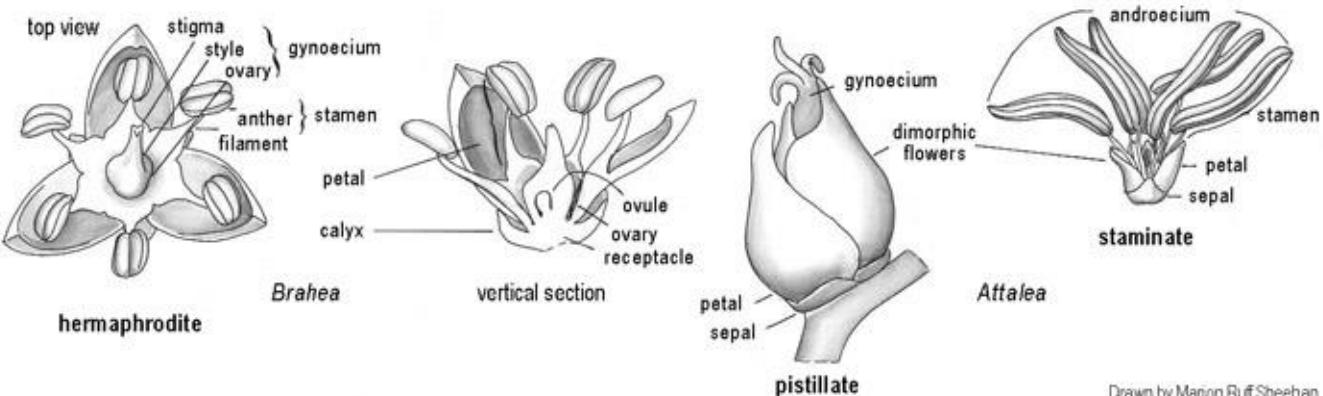
**t.** *Calycotryna ghiesbreghtiana* (Geonomeatae), pistillate flower, trimerous gynoecium (see **u**)

**u.** *Geonoma simpliciflora* (Geonomeatae), pistillate flower, pseudomonomerous gynoecium (see **t**, **w**)

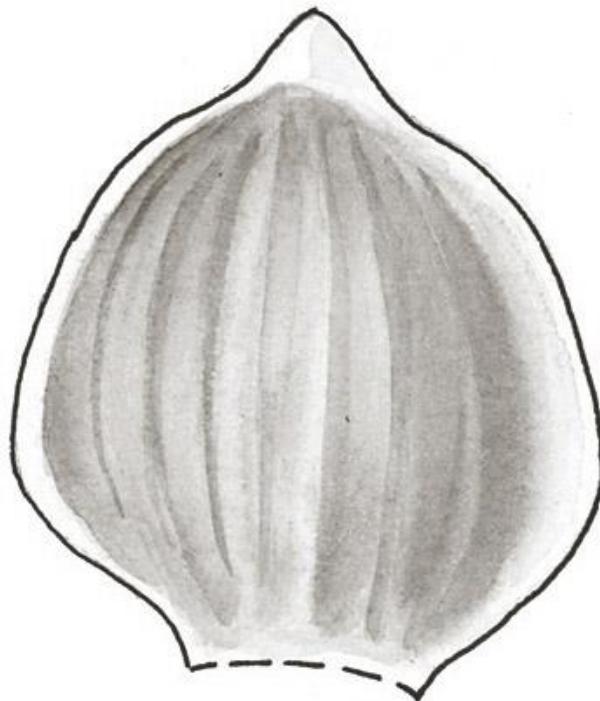
**v–w.** *Pelagodoxa henryana* (Pelagodoxeae), **v**, staminate flower, perianth removed to show androecium and pistillode, **w**, pistillate flower, perianth and androecium removed to show pseudomonomerous gynoecium (see **u**) and staminodes

Scale bars: a–c, j, q–s = 1 mm; d–i, k–m, p, t–w = 500 µm; n, o = 1 cm.

Photos: a, L. Guevara; b–c, J.A. S. Barfod & F.W. Stauffer; d, k–m, p, R. Ryder & P. Rudall; e–g, F. Castaño & F.W. Stauffer; h–i, A. Gildey & F.W. Stauffer; n–o, A. S. Barfod; q–r, A. Askgaard; s–w, F.W. Stauffer.

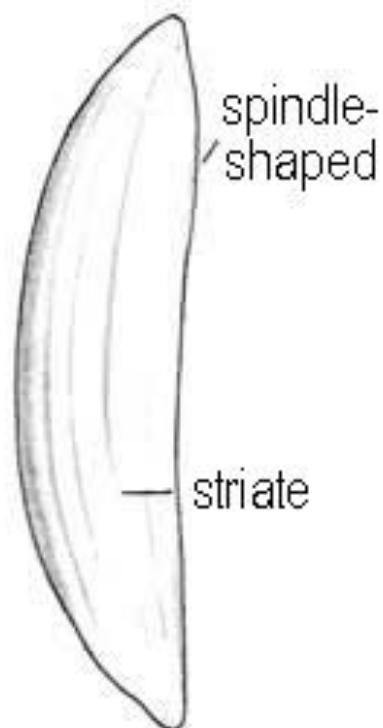


Drawn by Marion Ruff Sheehan



petal  
striate  
*Hyospathe*

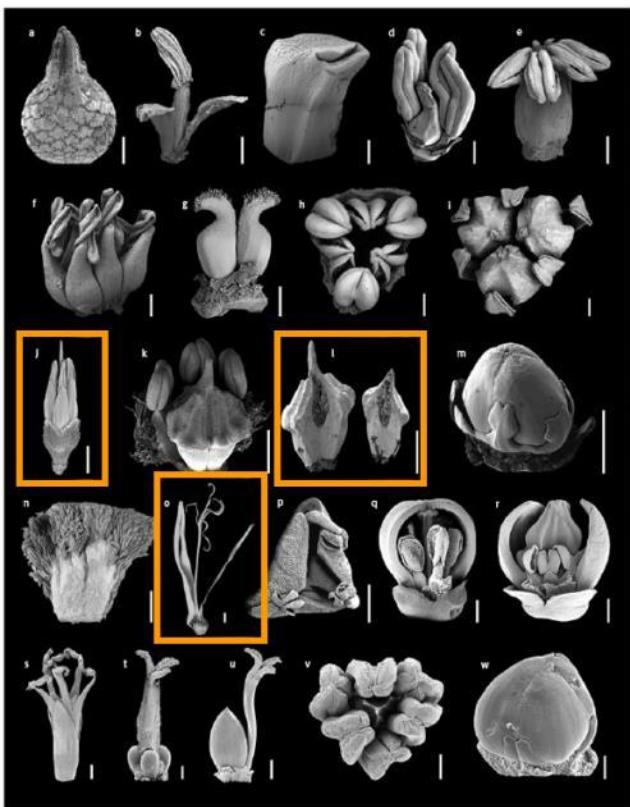
Drawn by Marion Ruff Sheehan



*Podococcus*

Drawn by Marion Ruff Sheehan

## Floral diversity in palms



### Calamoideae:

**a.** *Mauritiella armata* (Lepidocaryeae), pistillate flower, gynoecium, note reflexed scales.

### Nypoideae:

**b–c.** *Nypa fruticans*, **b.** staminate flower, perianth partially removed to reveal three connate stamens; **c.** one carpel isolated from pistillate flower.

### Coryphoideae:

**d.** *Leucothrinax morrisii* (Cryosophileae), hermaphroditic flower, stamens and perianth partially removed to show unicarpellate gynoecium

**e.** *Cryosophila warscewiczii* (Cryosophileae), hermaphroditic flower, perianth removed to show staminal tube and exerted stigmas

**f–g.** *Chelyocarpus ulei* (Cryosophileae), hermaphroditic flower, **f.** androecium and **g.** apocarpous gynoecium;

**h.** *Rhapis subtilis* (Trachycarpeae), staminate flower, androecium

**i.** *Licuala excelsa* (Trachycarpeae), pistillate flower, apocarpous gynoecium surrounded by conspicuous staminodes

**j.** *Licuala pettata* (Trachycarpeae), hermaphroditic flower, corolla removed to show stamens and exerted style

**k–l.** *Copernicia ? burribana* (Trachycarpeae), hermaphroditic flower, **k.** perianth and androecium partially removed to reveal gynoecium comprising three carpels free at the base, united distally; **l.** gynoecium with one carpel dislodged to reveal darker distal area of carpel connation and united style

**m.** *Hypochaene coriacea* (Borasseae), pistillate flower, perianth removed, syncarpous gynoecium with conspicuous staminodes

**n.** *Aphandra natalia* (Phytelepheae), staminate flower, note reduced, irregular perianth and multistamine androecium containing 400–650 stamens

**o.** *Phytelephas macrocarpa* (Phytelepheae), pistillate flower, perianth partially removed, note the large size of this flower, the numerous staminodes surrounding the ovary, the syncarpous pentamerous gynoecium (4–10 carpels in *Phytelephas*) comprising rounded ovary, and elongate style and stigmas

### Arecoideae:

**p.** *Synechanthus warscewiczianus* (Chamaedoreeae), staminate flower sepal removed, androecium comprising three stamens only

**q.** *Chamaedorea hooperiana* (Chamaedoreeae), staminate flower, one petal removed

**r.** *Chamaedorea brachypoda* (Chamaedoreeae), staminate flower, one petal removed, note variation in stamen and pistillode morphology in **q** and **r.**

**s.** *Astergyne martiana* (Geonomeatae), staminate flower

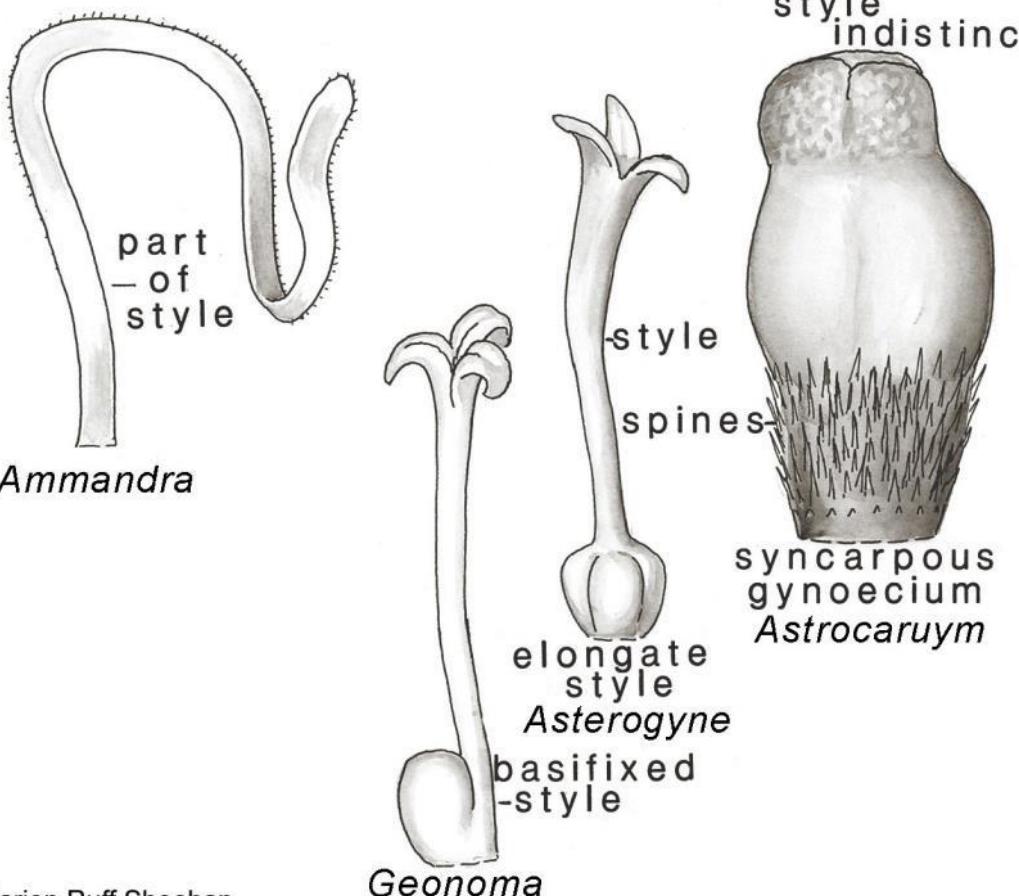
**t.** *Calycostygne ghiesbreghtiana* (Geonomeatae), pistillate flower, trimerous gynoecium (see **u**)

**u.** *Geonoma simplicifrons* (Geonomeatae), pistillate flower, pseudomonomerous gynoecium (see **t**, **w**)

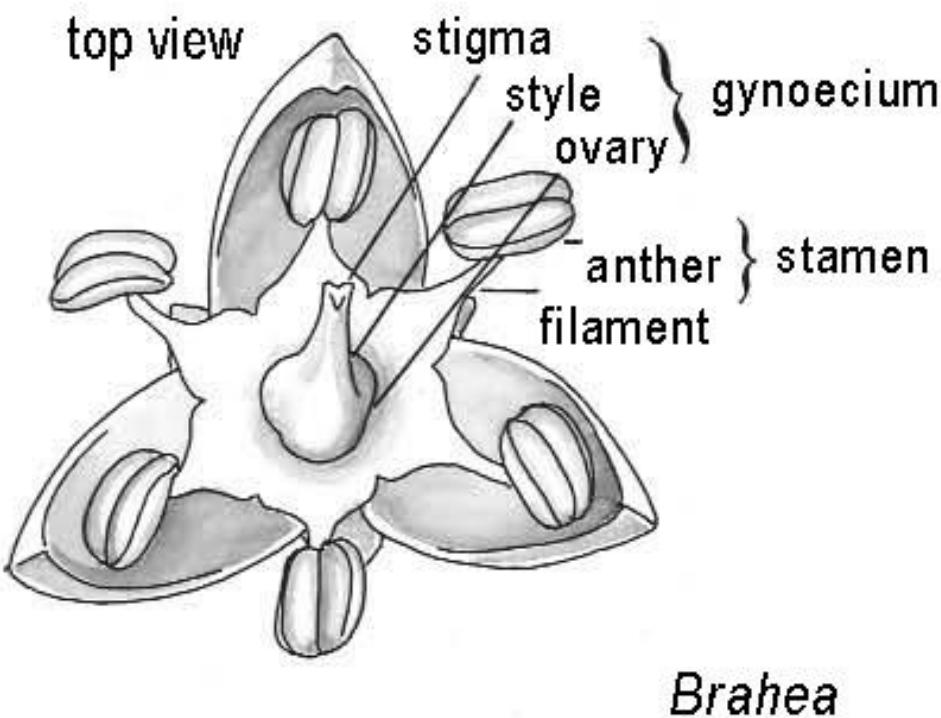
**v–w.** *Pelagodoxa henryana* (Pelagodoxeae), **v.** staminate flower, perianth removed to show androecium and pistillode, **w.** pistillate flower, perianth and androecium removed to show pseudomonomerous gynoecium (see **u**) and staminodes

Scale bars: a–c, j, q–s = 1 mm; d–l, k–m, p, t–w = 500 µm; n, o = 1 cm.

Photos: a, L. Guevara; b–c, j, A. S. Barfod & F. W. Staufer; d, k–m, p, R. Ryder & P. Rudall; e–g, F. Castaño & F. W. Staufer; h–l, A. Gidley & F. W. Staufer; n–o, A. S. Barfod; q–r, A. Askgaard; s–w, F. W. Staufer.



Drawn by Marion Ruff Sheehan



Drawn by Marion Ruff Sheehan

## Floral diversity in palms



### Calamoideae:

a, *Mauritiella armata* (Lepidocaryeae), pistillate flower, gynoecium, note reflexed scales.

### Nypoideae:

b–c, *Nypa fruticans*, b, staminate flower, perianth partially removed to reveal three connate stamens; c, one carpel isolated from pistillate flower.

### Coryphoideae:

d, *Leucothrinax morrisii* (Cryosophileae), hermaphroditic flower, stamens and perianth partially removed to show unicarpellate gynoecium

e, *Cryosophila warscewiczii* (Cryosophileae), hermaphroditic flower, perianth removed to show staminal tube and exerted stigmas

f–g, *Chelyocarpus ulei* (Cryosophileae), hermaphroditic flower, f, androecium and g apocarpous gynoecium;

h, *Rhapis subtilla* (Trachycarpeae), staminate flower, androecium

i, *Rhapis excelsa* (Trachycarpeae), pistillate flower, apocarpous gynoecium surrounded by conspicuous staminodes

j, *Licuala petiata* (Trachycarpeae), hermaphroditic flower, corolla removed to show stamens and exerted style

k–l, *Copernicia ? burleana* (Trachycarpeae), hermaphroditic flower, k, perianth and androecium partially removed to reveal gynoecium comprising three carpels free at the base, united distally, l, gynoecium with one carpel dislodged to reveal darker distal area of carpel connation and united style

m, *Hyphaene coriacea* (Borasseae), pistillate flower, perianth removed, syncarpous gynoecium with conspicuous staminodes

### Ceroxyloideae:

n, *Aphandra natalia* (Phytelepheae), staminate flower, note reduced, irregular perianth and multistamine androecium containing 400–650 stamens

o, *Phytelephas macrocarpa* (Phytelepheae), pistillate flower, perianth partially removed, note the large size of this flower, the numerous staminodes surrounding the ovary, the syncarpous pentamerous gynoecium (4–10 carpels in Phytelephas) comprising rounded ovary, and elongate style and stigmas

### Arecoidae:

p, *Synechanthus warscewiczianus* (Chamaedoreeae), staminate flower sepal removed, androecium comprising three stamens only

q, *Chamaedorea hooperiana* (Chamaedoreeae), staminate flower, one petal removed

r, *Chamaedorea brachypoda* (Chamaedoreeae), staminate flower, one petal removed, note variation in stamen and pistilode morphology in q and r

s, *Asteroxyne martiana* (Geonomeatae), staminate flower

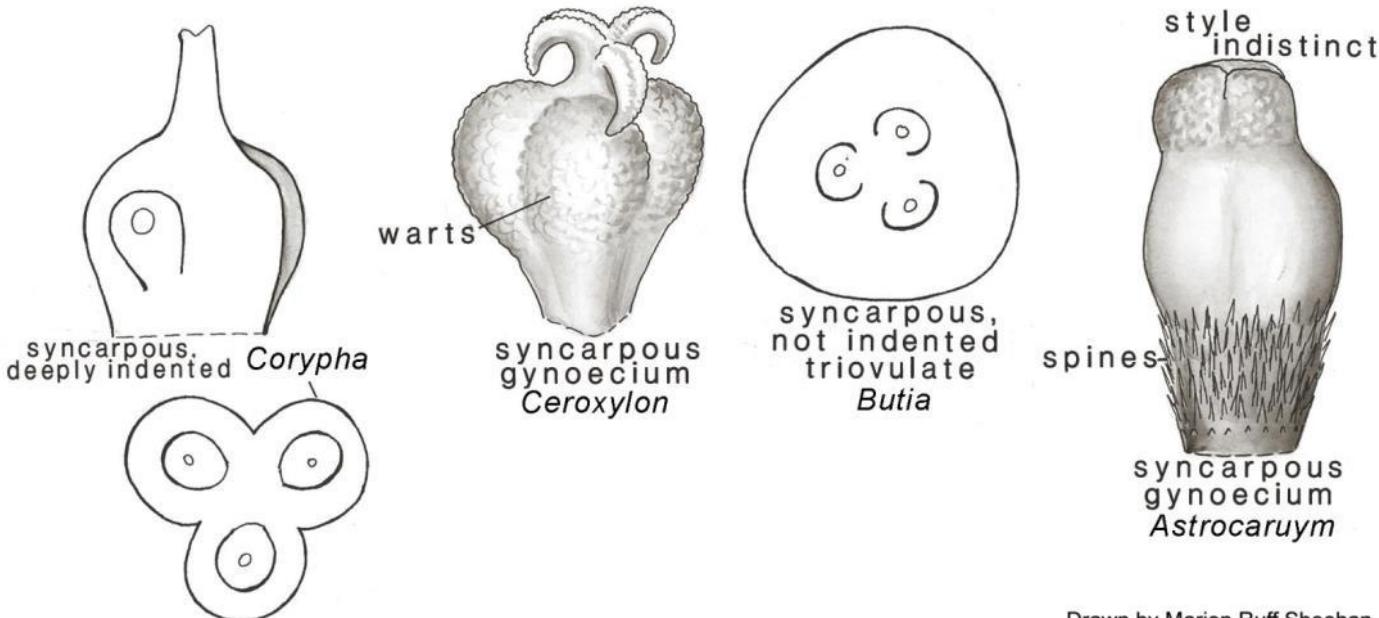
t, *Calycotryne ghiesbreghtiana* (Geonomeatae), pistillate flower, trimerous gynoecium (see u)

u, *Geonoma simplicifrons* (Geonomeatae), pistillate flower, pseudomonomerous gynoecium (see t, w)

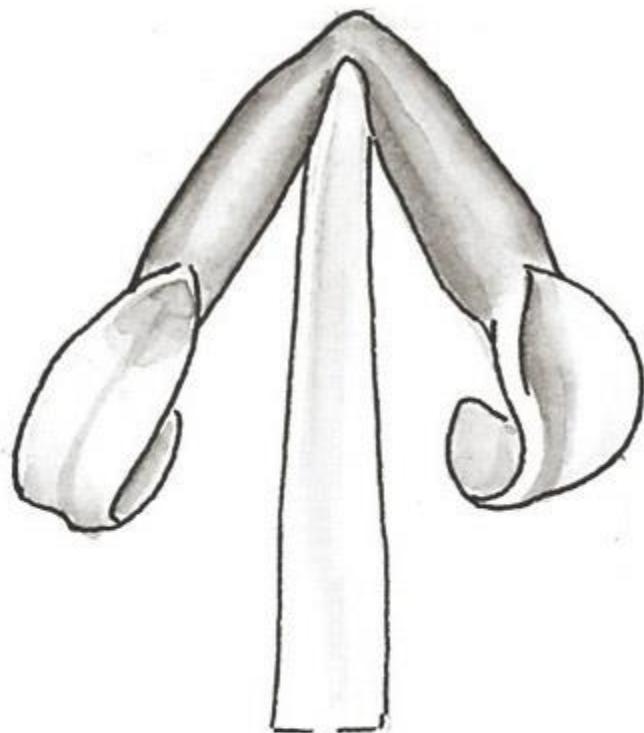
v–w, *Pelagodoxa hentyana* (Pelagodoxeae), v, staminate flower, perianth removed to show androecium and pistillode, w, pistillate flower, perianth and androecium removed to show pseudomonomerous gynoecium (see u) and staminodes

Scale bars: a–c, j, q–s = 1 mm; d–i, k–m, p, t–w = 500 µm; n, o = 1 cm.

Photos: a, L. Guevara; b–c, J. A. S. Barfod & F. W. Stauffer; d, k–m, p, R. Ryder & P. Rudall; e–g, F. Castaño & F. W. Stauffer; h–i, A. Gidley & F. W. Stauffer; n–o, A. S. Barfod; q–r, A. Askgaard; s–w, F. W. Stauffer.

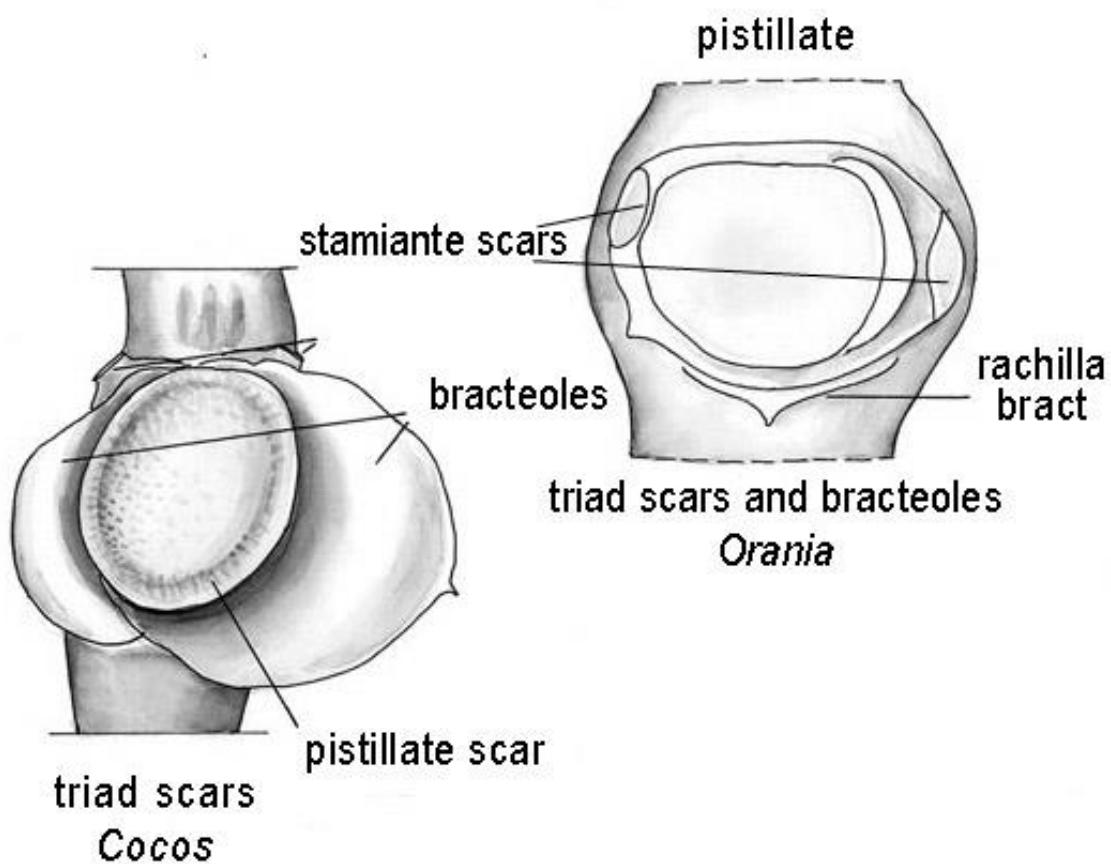
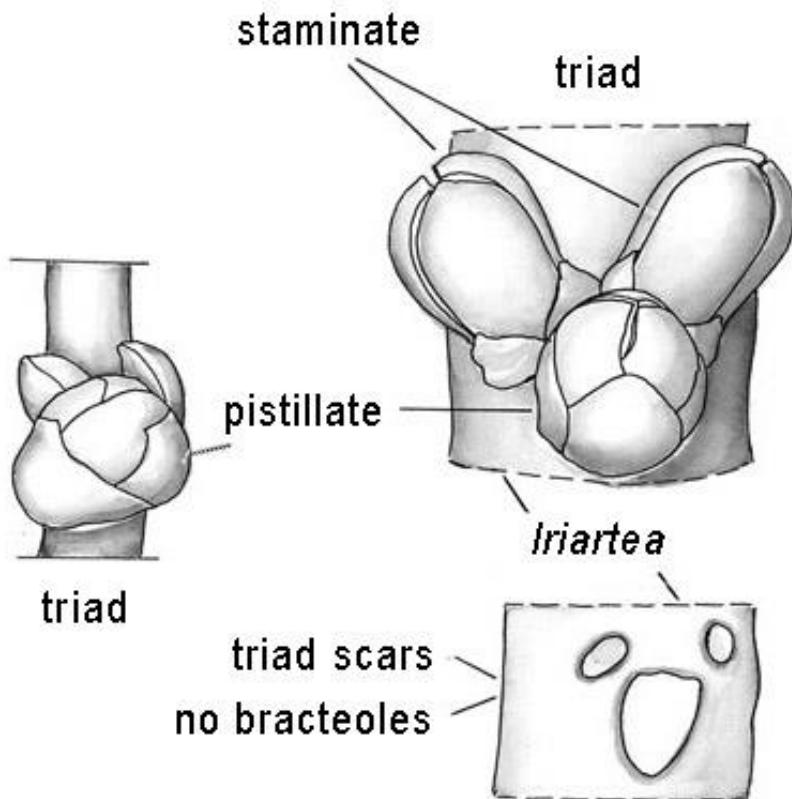


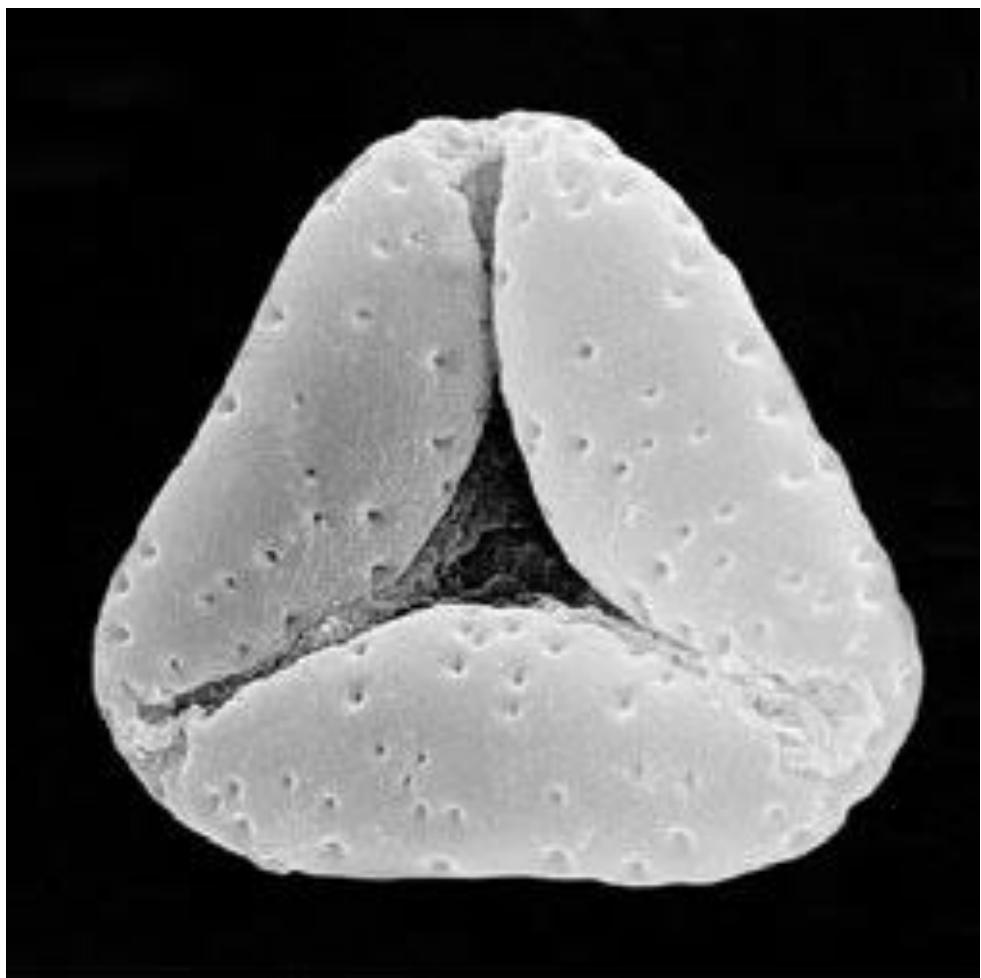
Drawn by Marion Ruff Sheehan



free thecae on  
a bifid connective  
*Asterogyne*

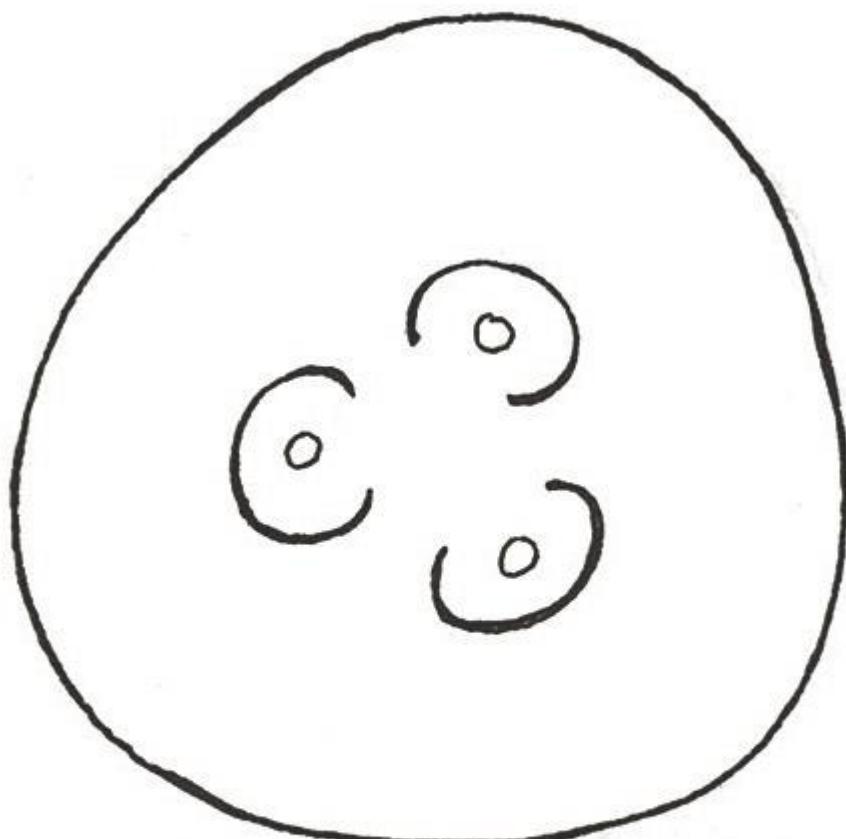
Drawn by Marion Ruff Sheehan



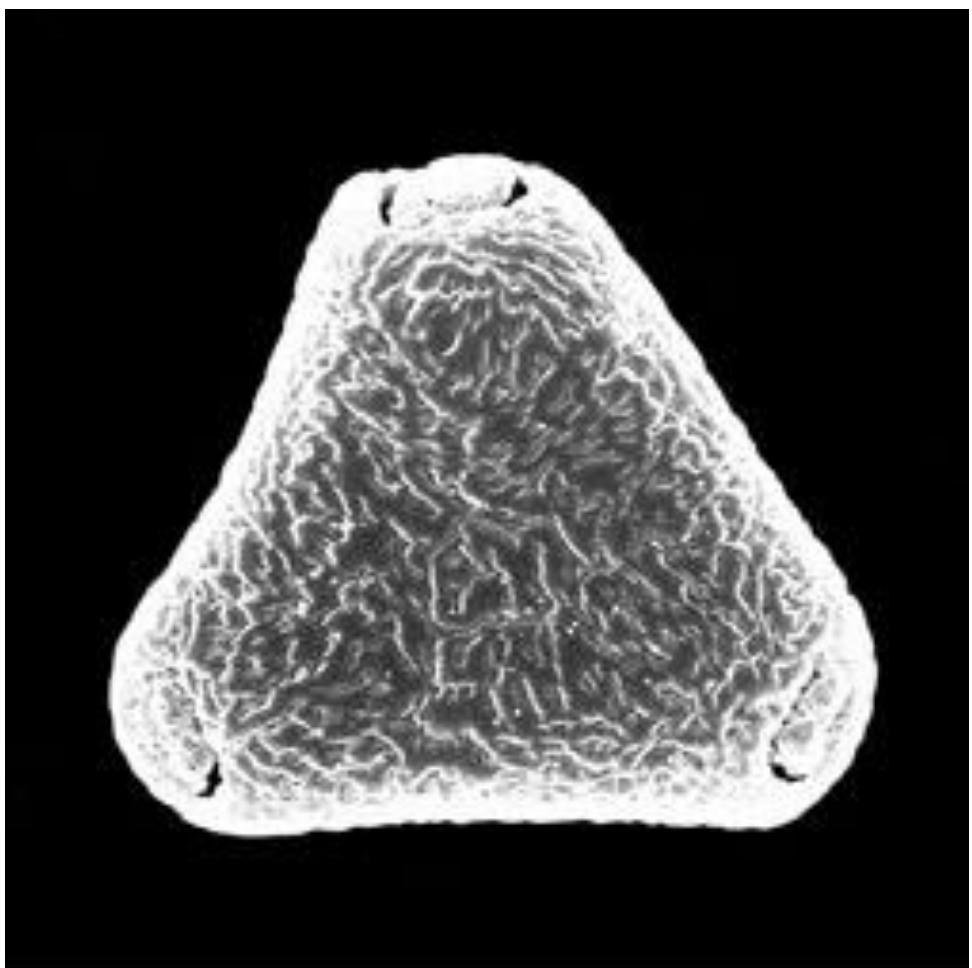


*Bactris concinna*  
trichotomosulcate pollen grain SEM ×  
1000. Krukoff 6497.

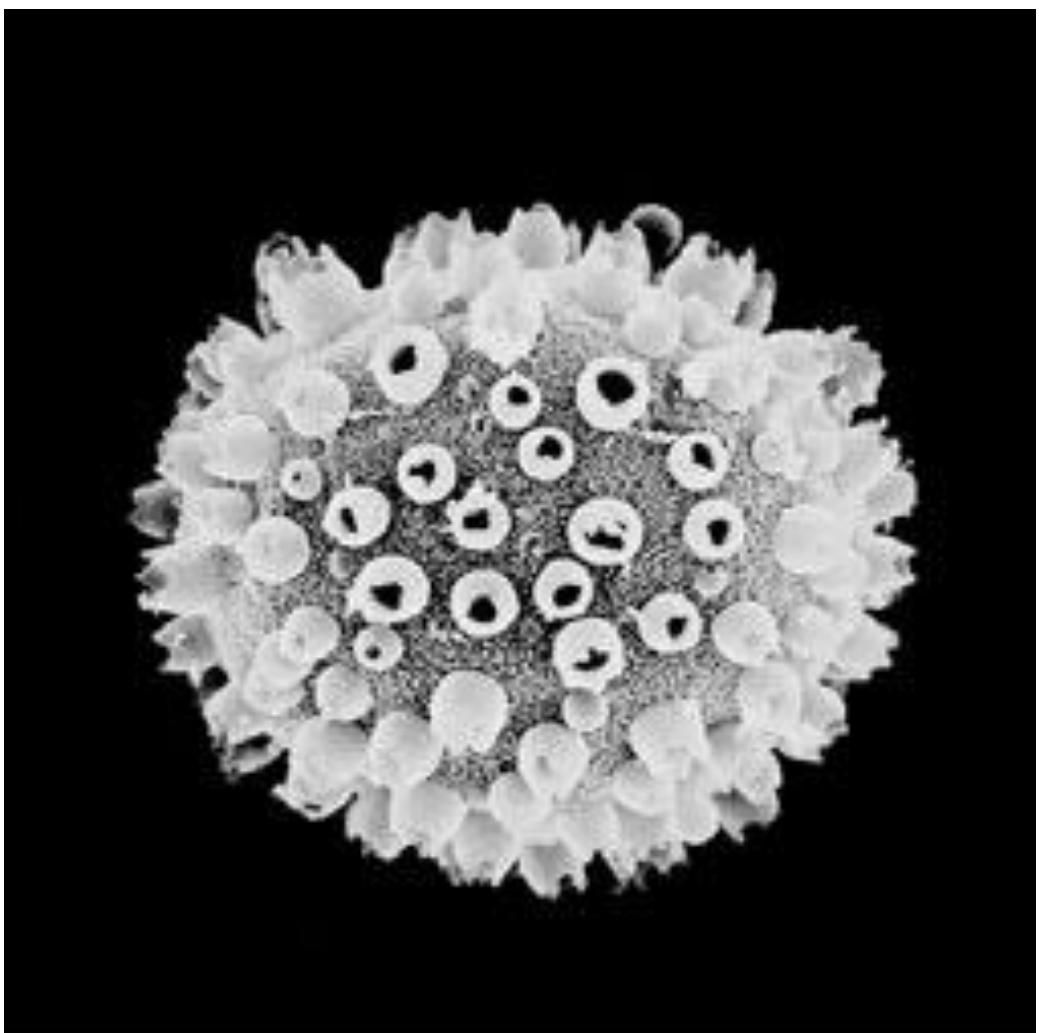
Drawn by Marion Ruff Sheehan



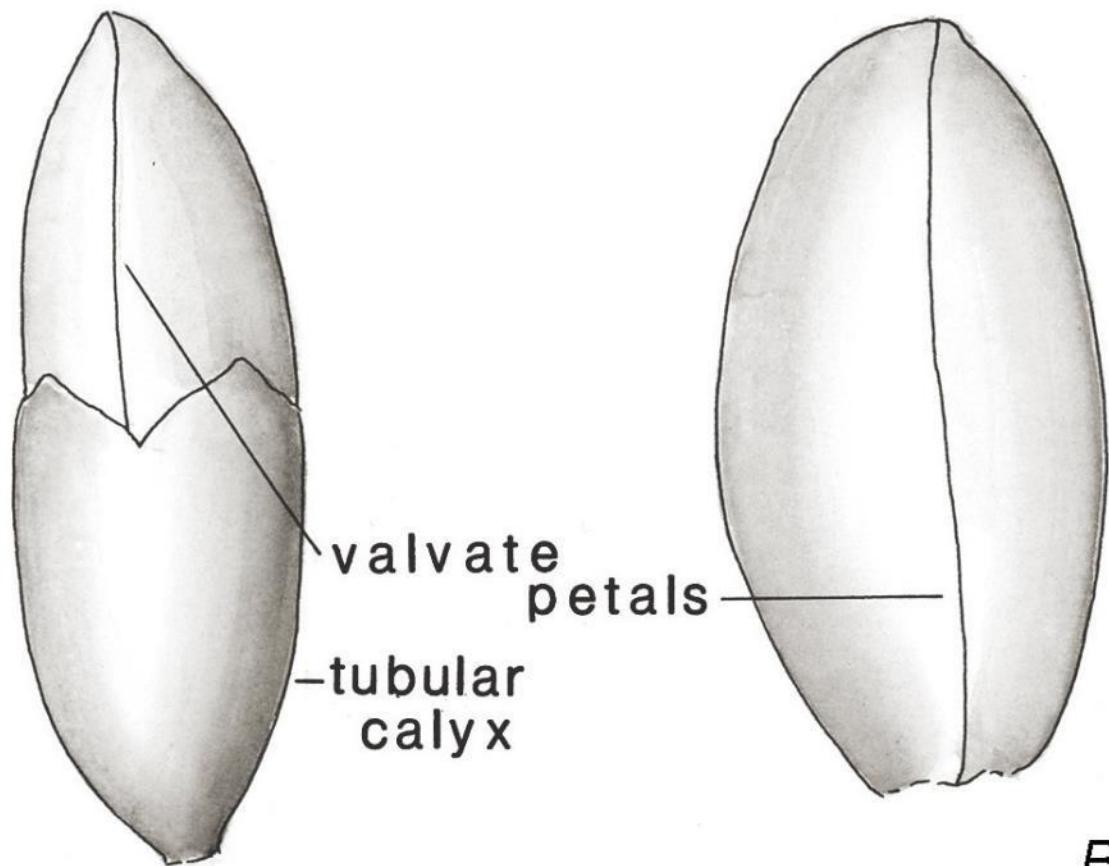
syncarpous,  
not indented  
triovulate  
*Butia*



*Sclerosperma profiziana*: subapical, operculate  
triporate pollen grain, distal face SEM  $\times 1000$ .  
Profizi 841.



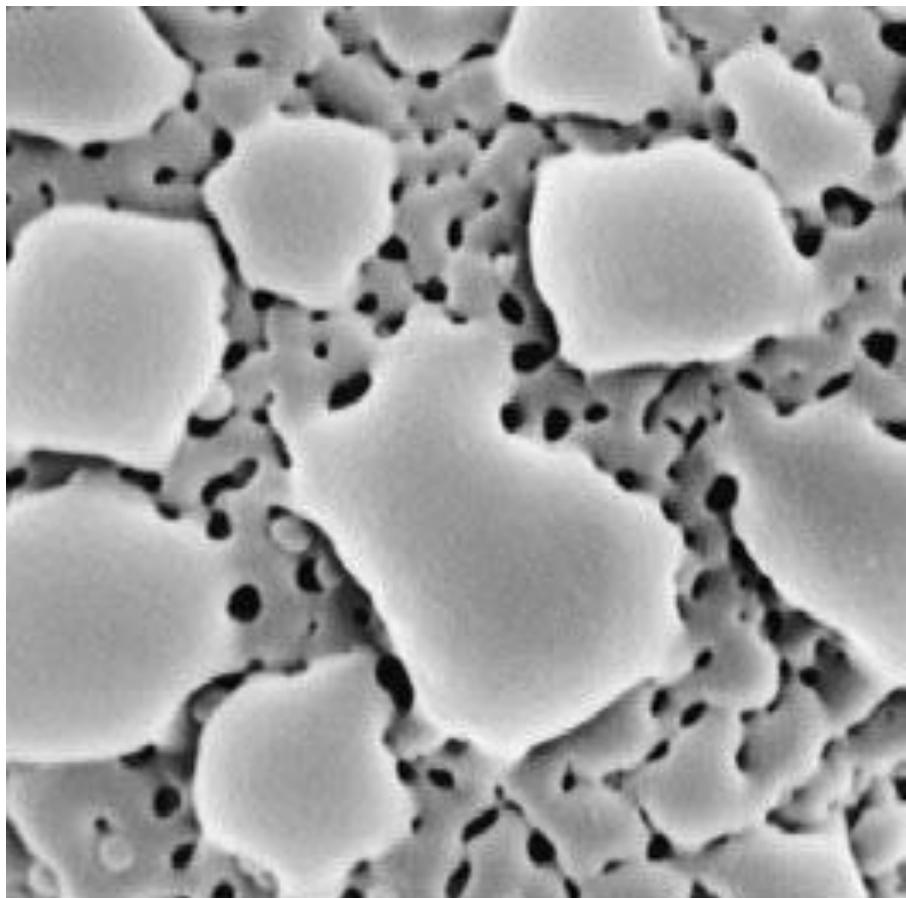
*Pinanga aristata*: monosulcate pollen grain,  
proximal face, urceolate pollen surface SEM  $\times 2000$ .  
Dransfield JD5341



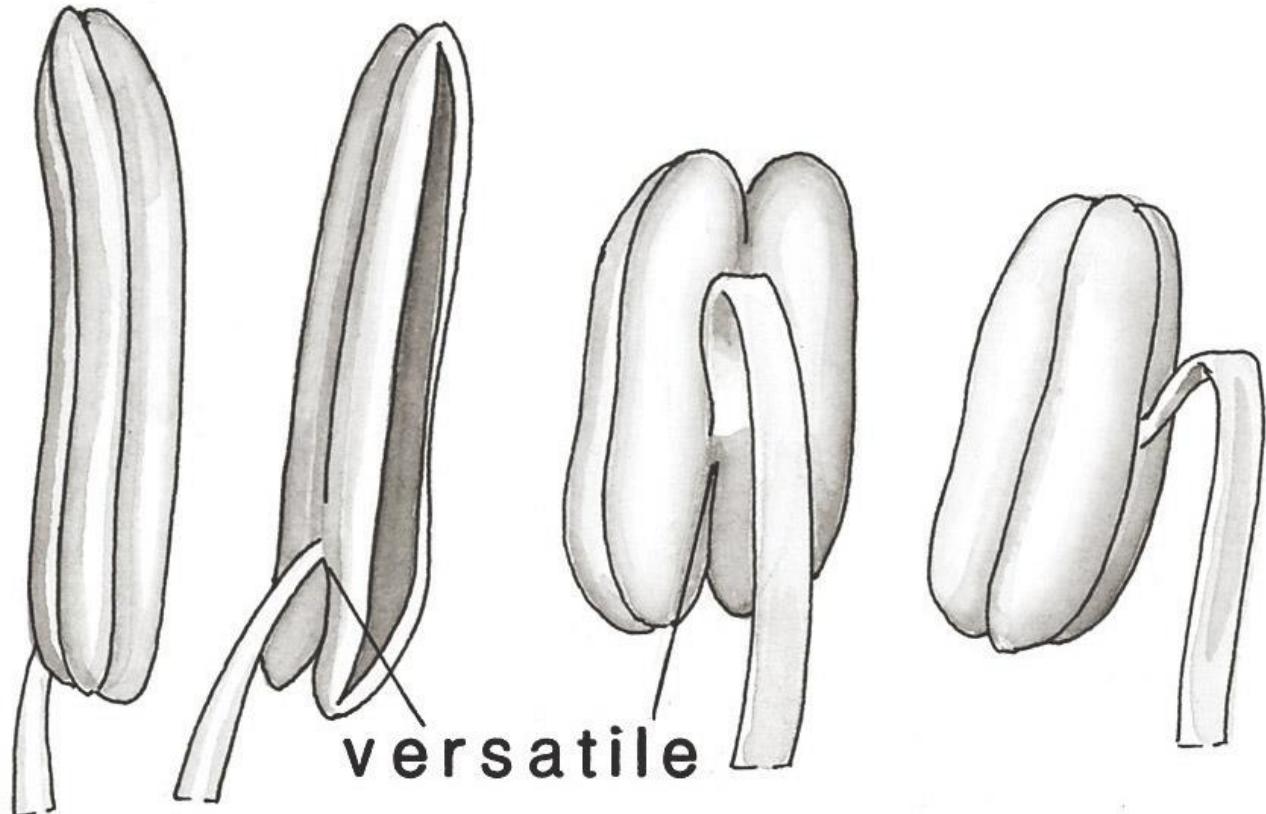
*Laccosperma*

*Balaka*

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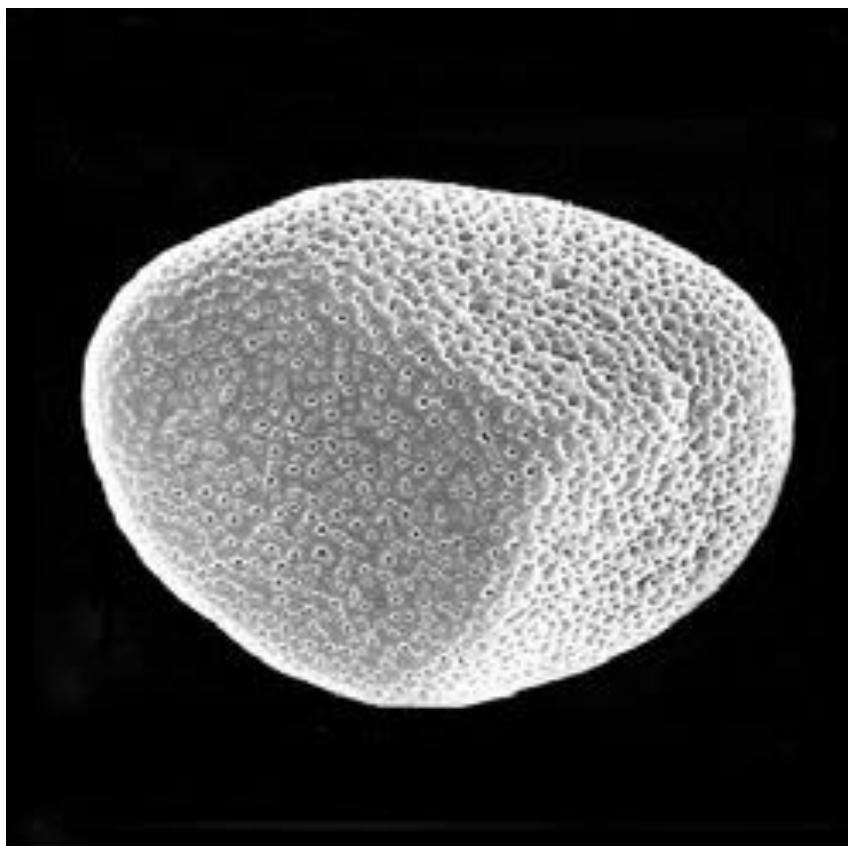
*Calamus viminalis*: close-up, reticulate/coarsely  
verrucate surface SEM  $\times$  8000. Lobb s.n.



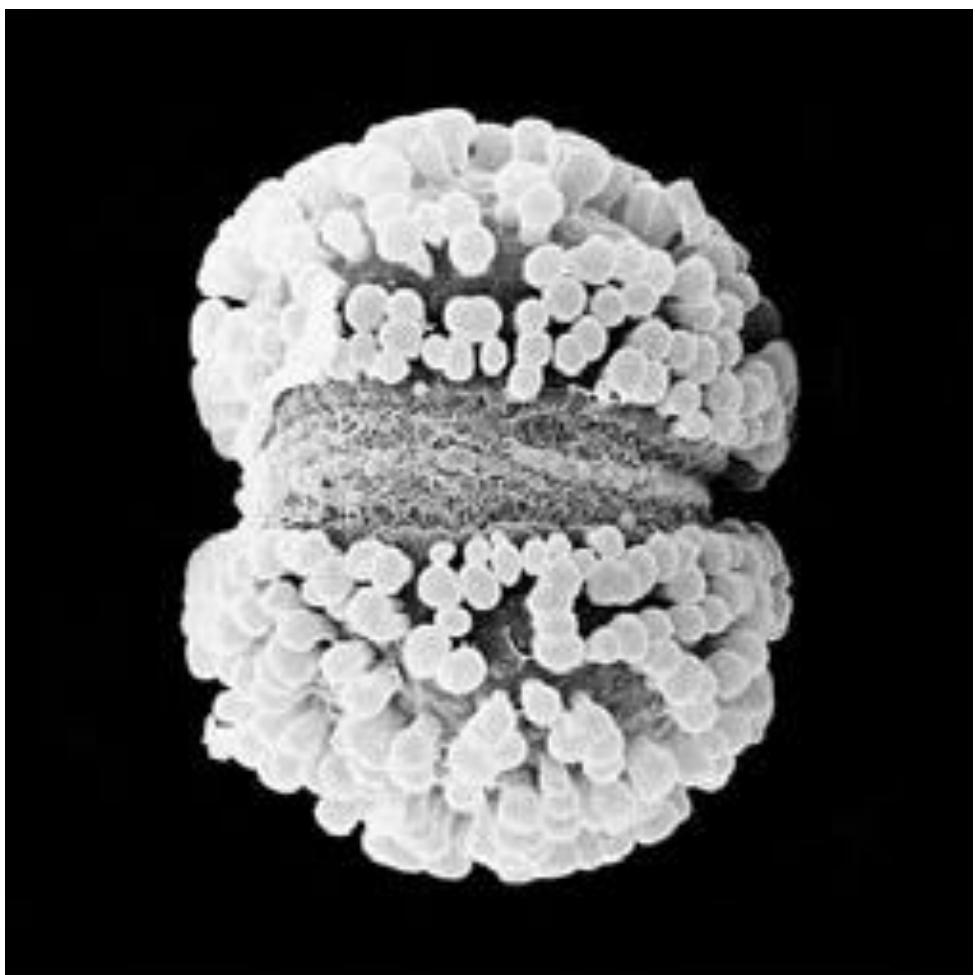
dorsifixed  
*Thrinax*

inflexed  
*Bactris*

Drawn by Marion Ruff Sheehan



*Geonoma macrostachys* proximal face of  
pollen grain to show Y-shaped impression  
mark remaining from tetrad stage SEM x  
1500. Prance et al. 2801.

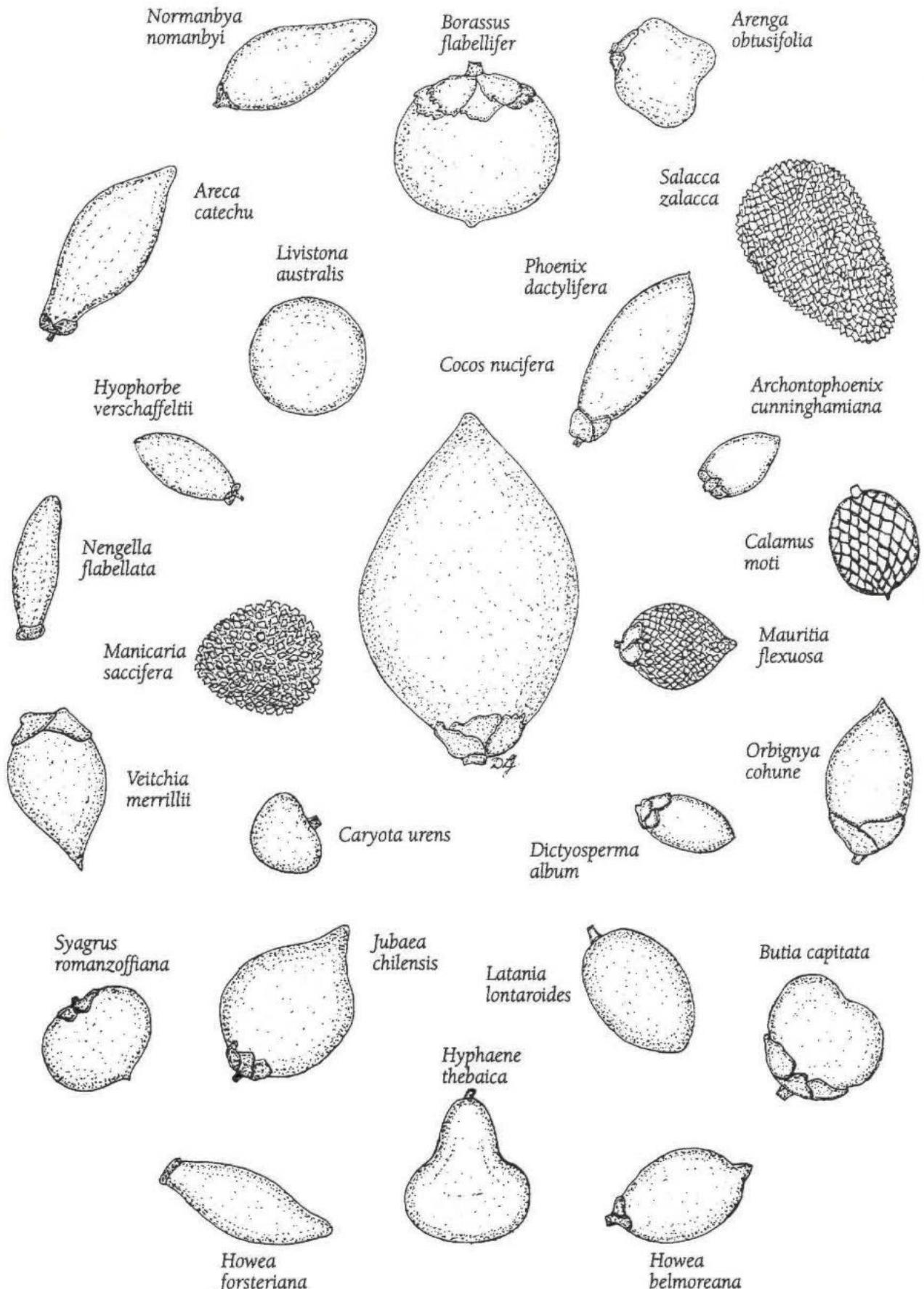


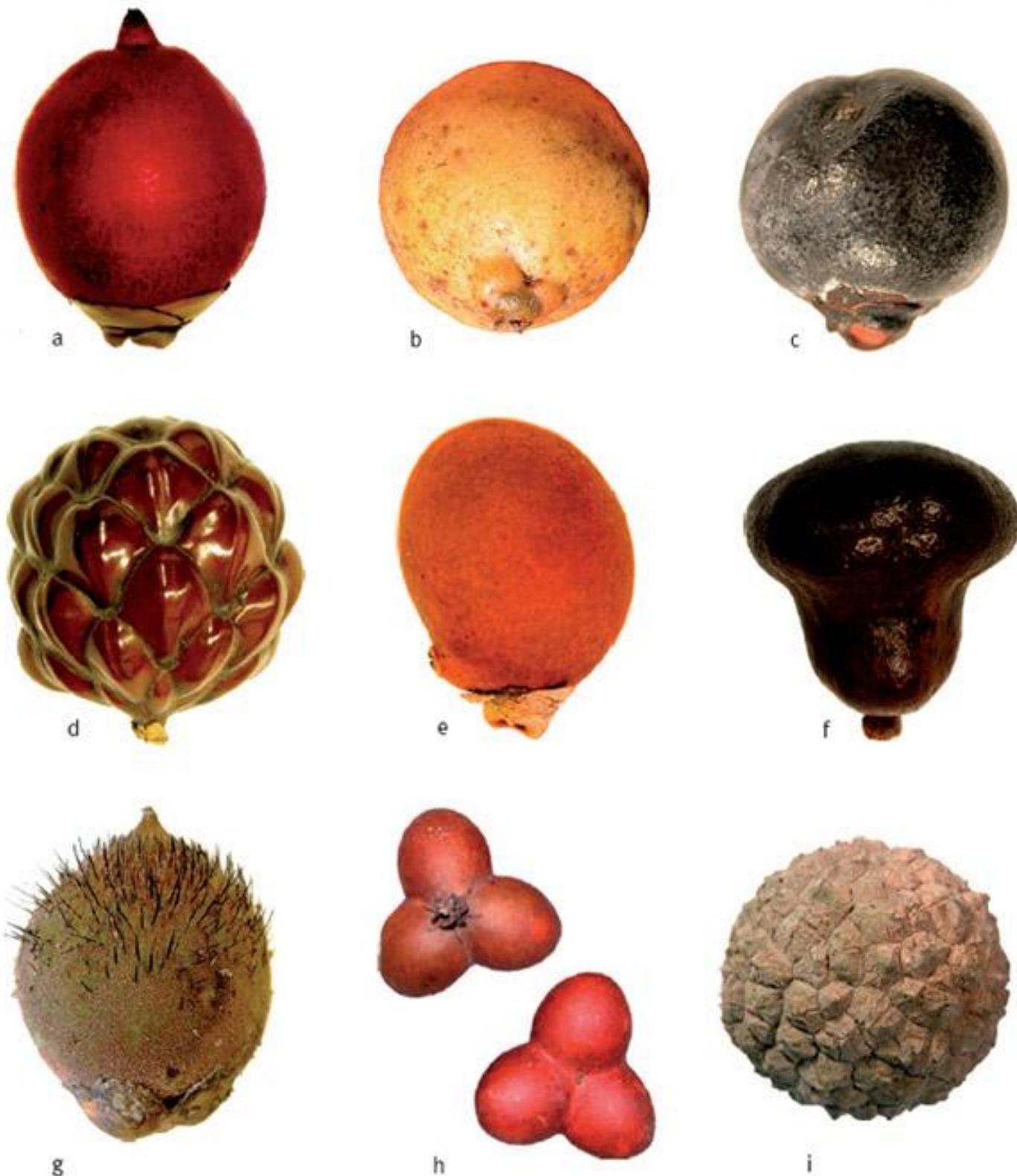
*Korthalsia furtadoana*: zonasulcate pollen grain  
SEM  $\times 1500$ , Matusop 7427.

# FRUITS

# Formes des fruits de palmiers (non à l'échelle)

Fruits



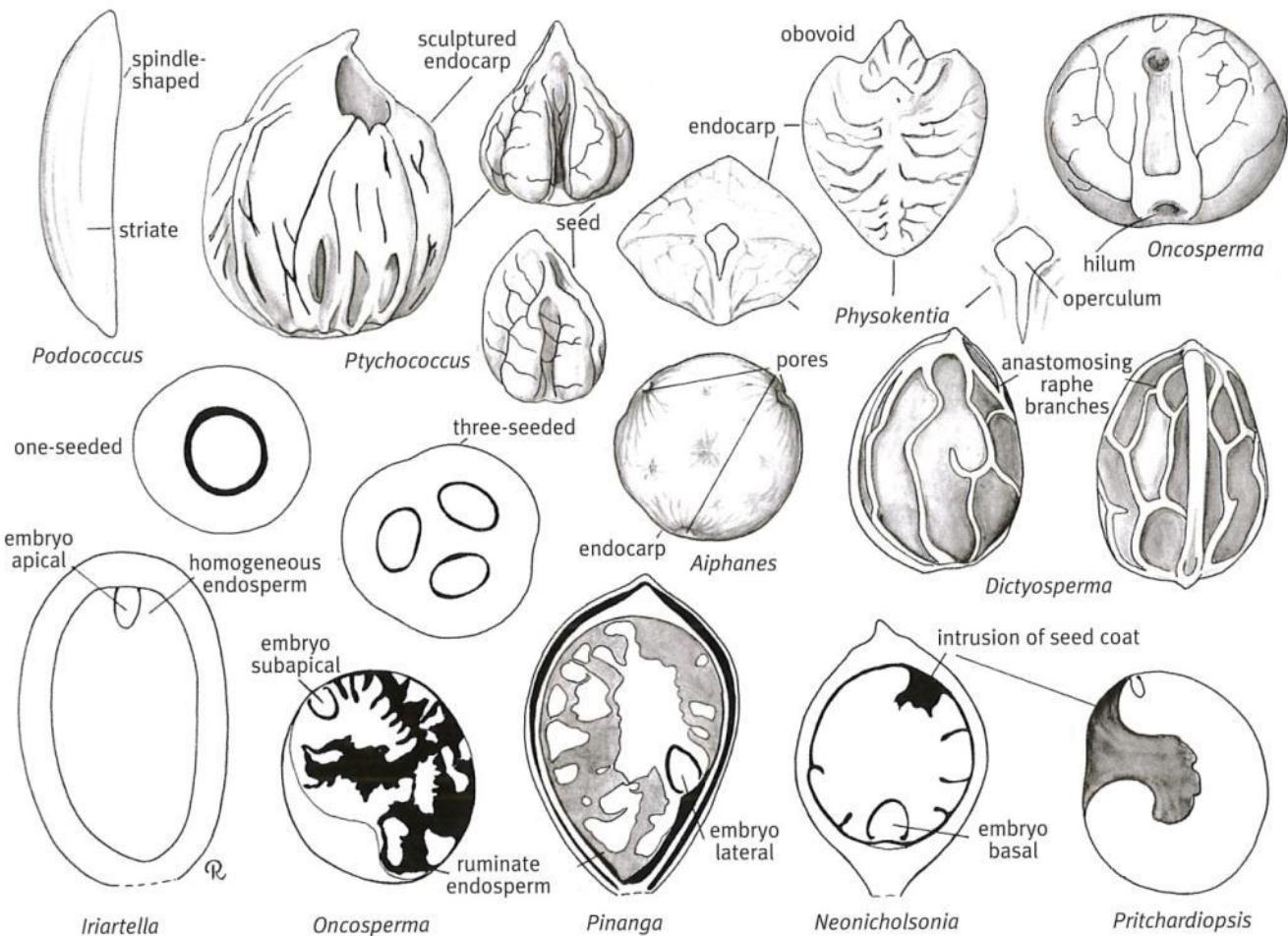


## Fruits

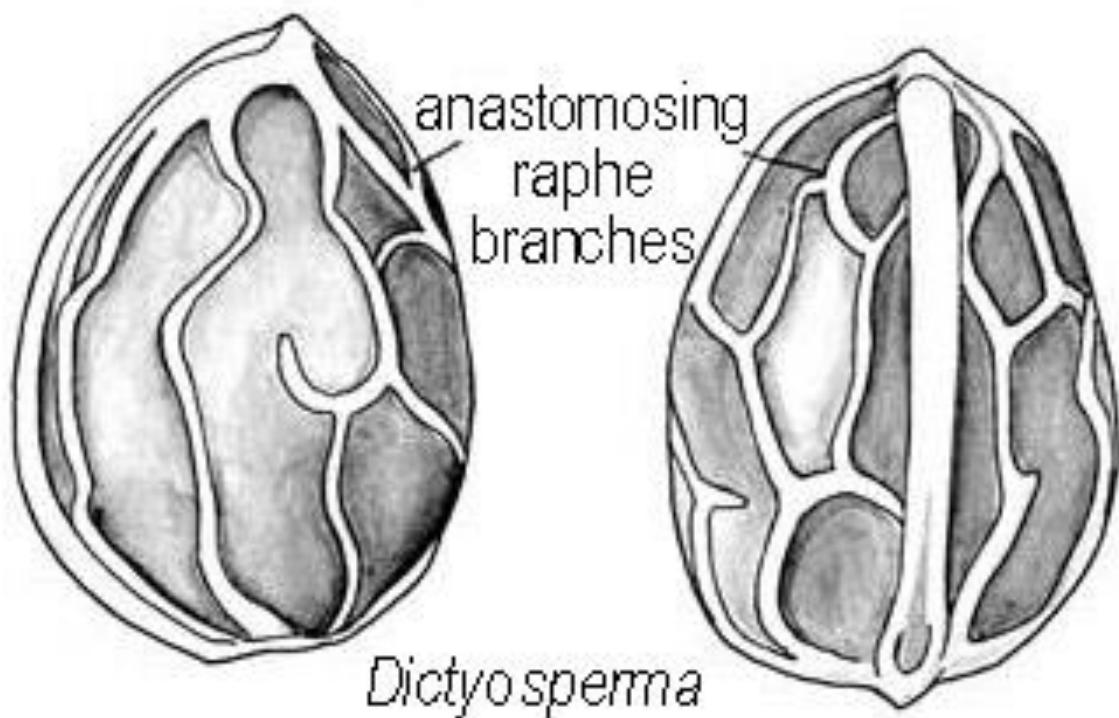
- a**, beaked, apical stigmatic remains (*Wodyetia bifurcata*)
- b**, basal stigmatic remains, vestigial carpels (*Orania palindra*)
- c**, subapical stigmatic remains, pebbled epicarp (*Oncosperma tigillarium*)
- d**, imbricate scales (*Raphia farinifera*)
- e**, subbasal stigmatic remains (*Roystonea regia*)

- f**, pyriform (*Hyphaene coriacea*)
- g**, spiny (*Astrocaryum alatum*)
- h**, three-seeded (*Pseudophoenix sargentii*)
- i**, corky-warted (*Pelagodoxa henryana*)

Photos C.E. Lewis

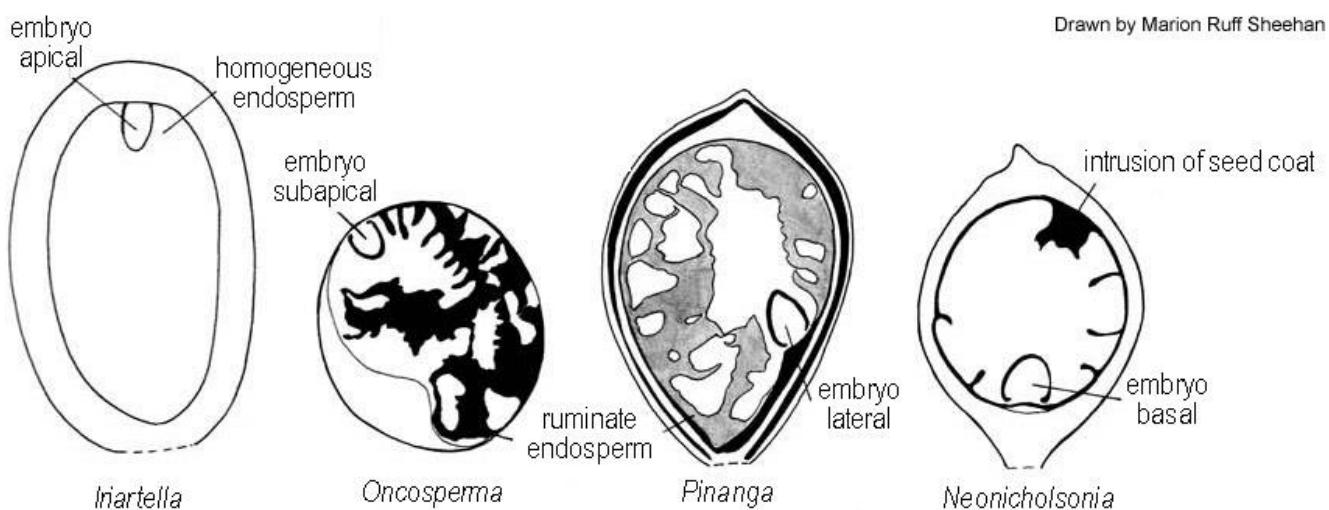
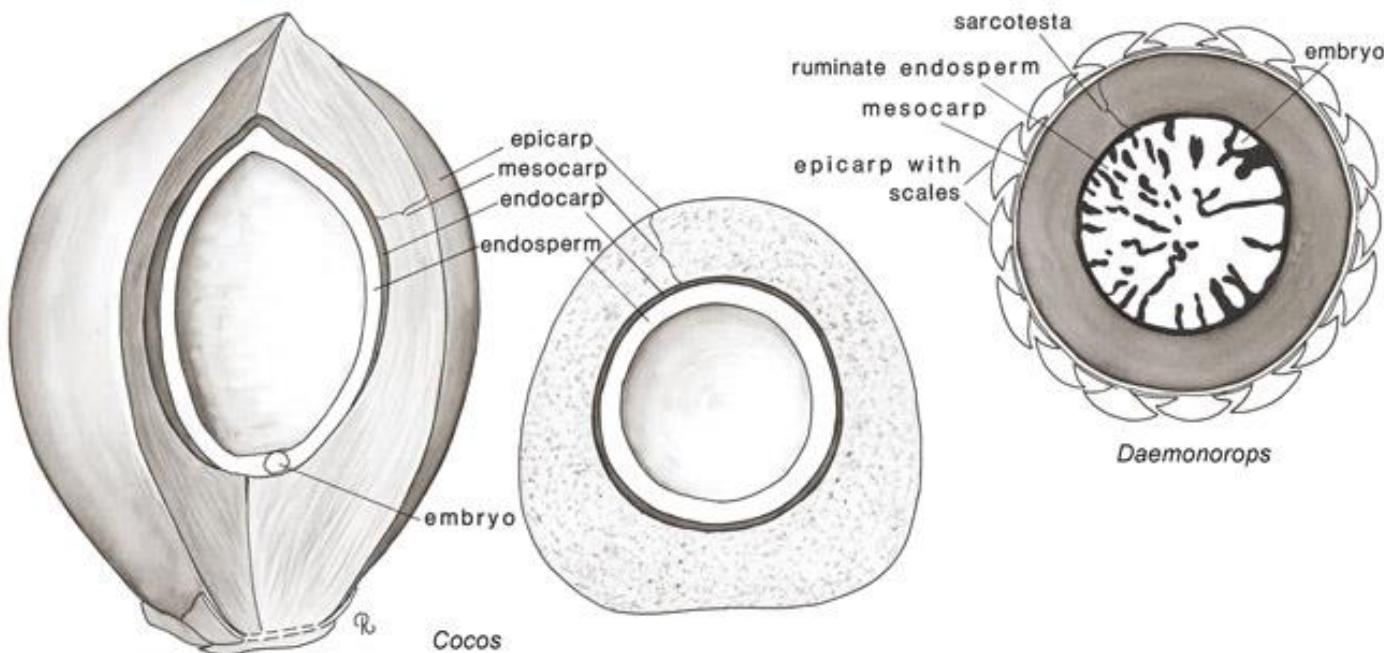


Anastomose  
Raphe (ridge)

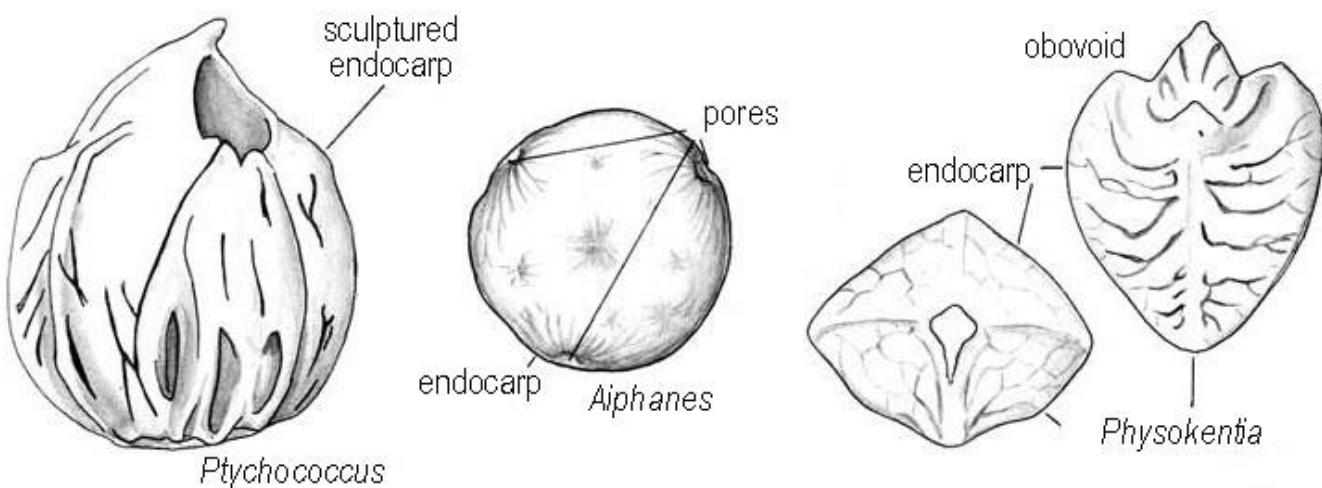
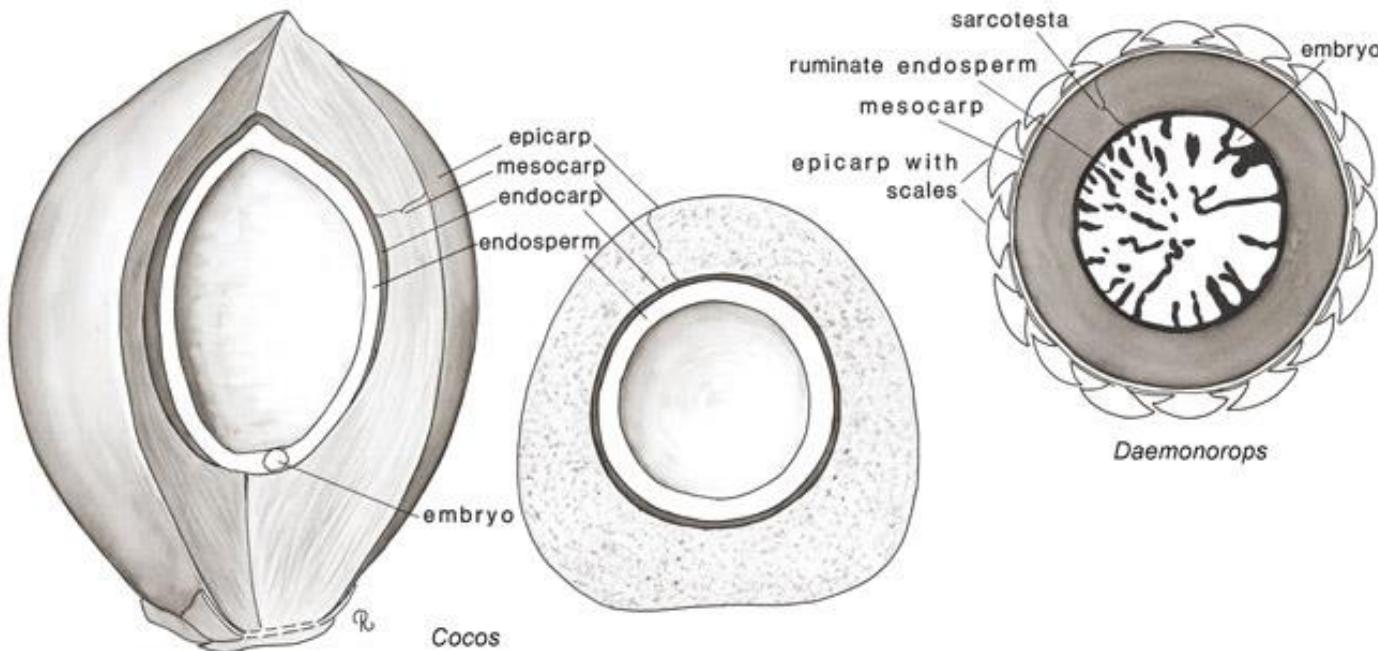


Drawn by Marion Ruff Sheehan

# Embryo Endosperm Epicarp



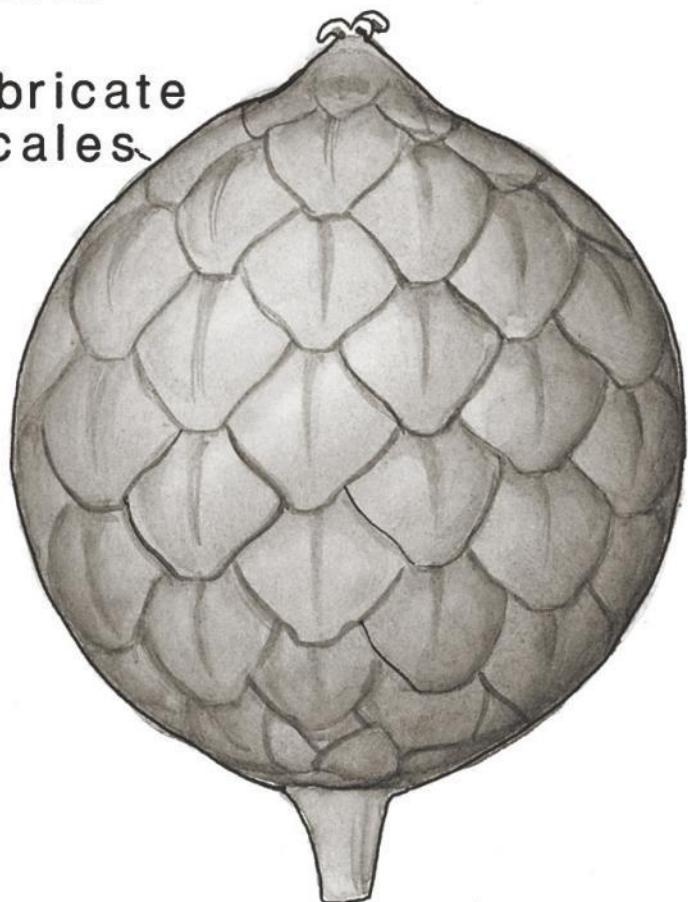
# Endocarp Mesocarp



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(*Metroxylon*)



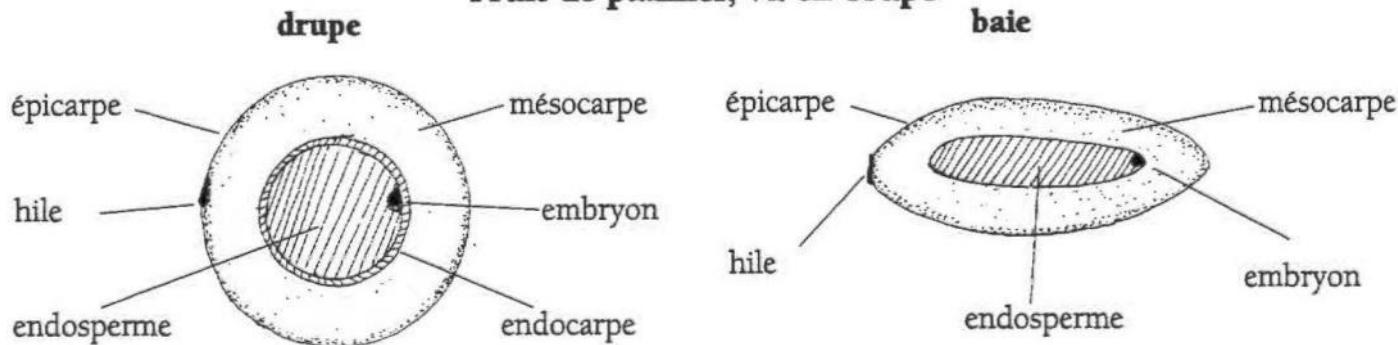
(*Daemonorops*)

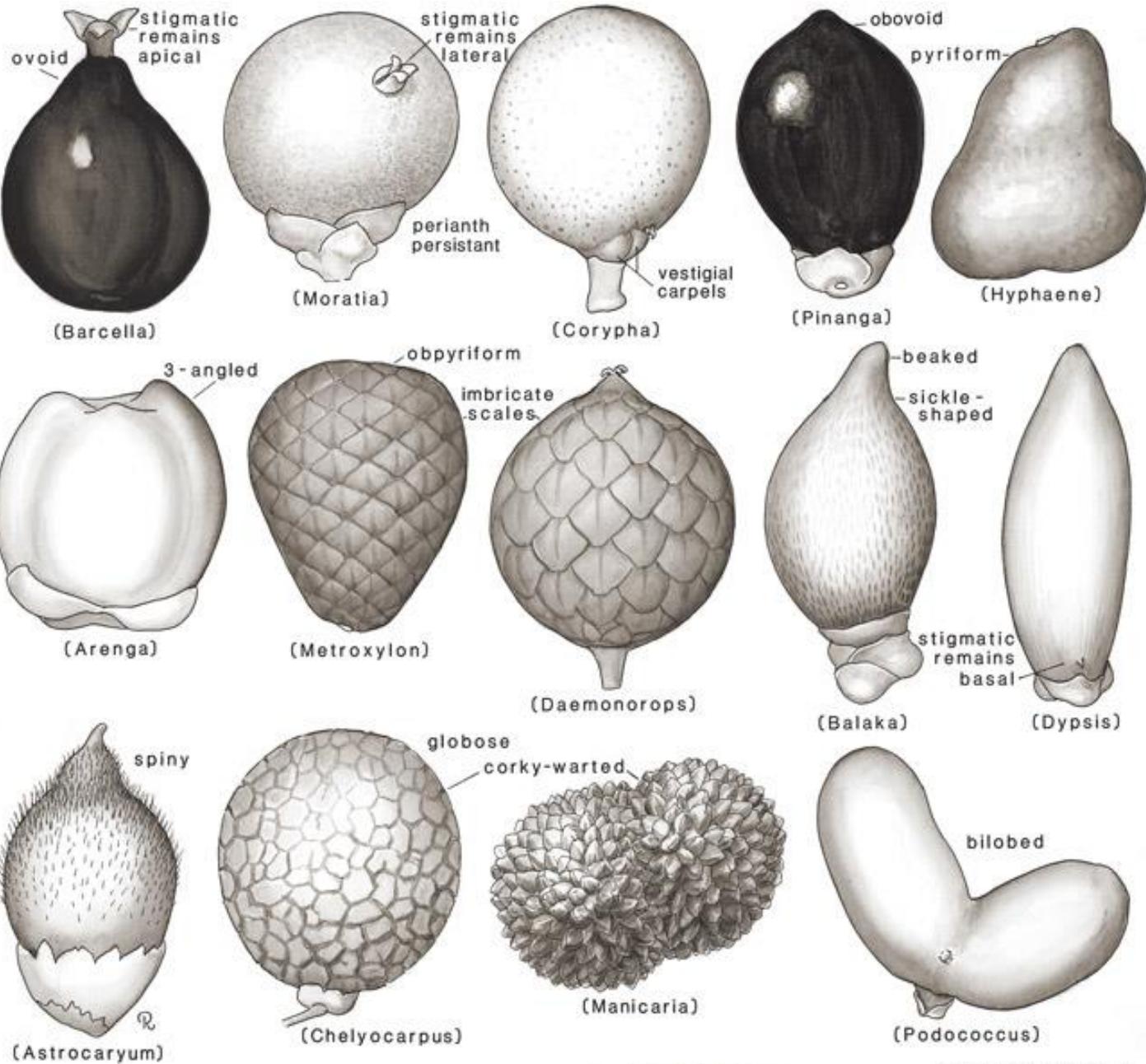
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*Raphia farinifera* (C.E. Lewis)

## Fruit de palmier, vu en coupe

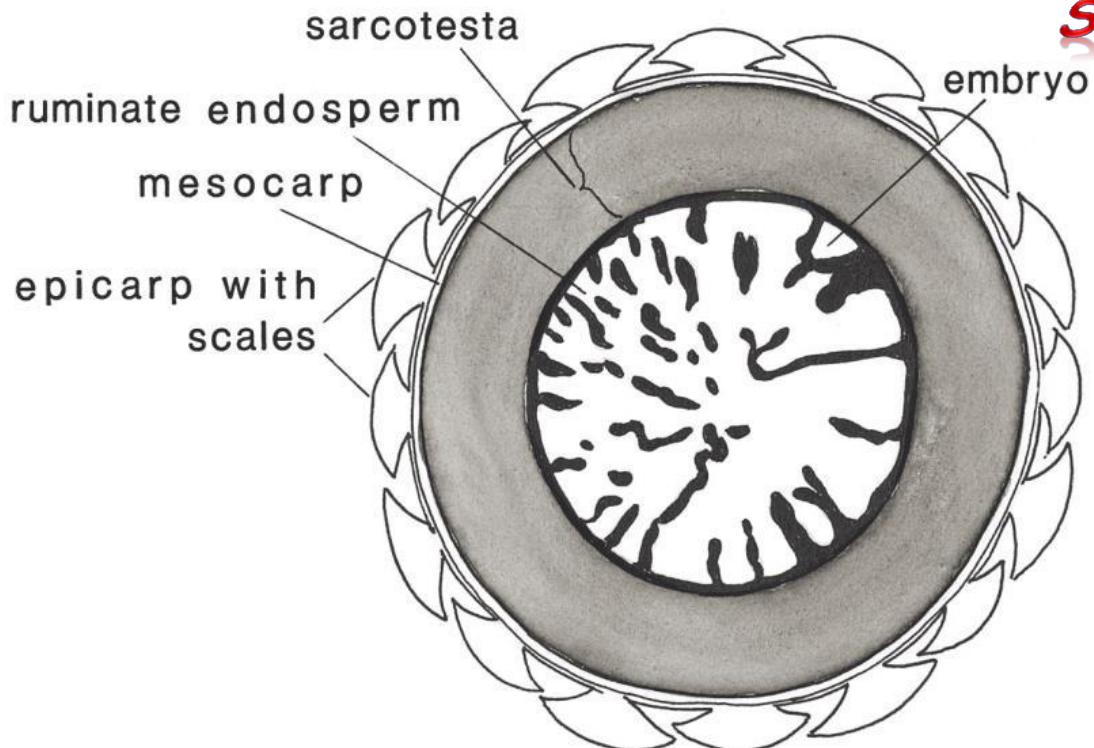




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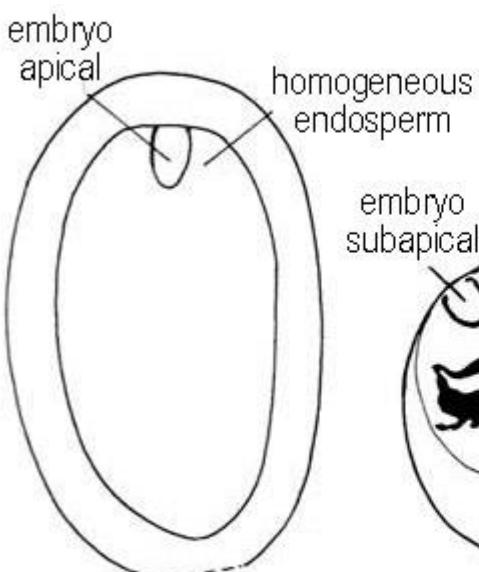


*Hyphaene coriacea* (C.E. Lewis)



*Daemonorops*

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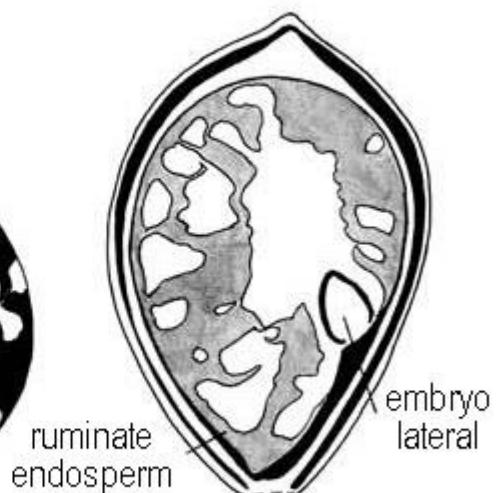


*Iriartella*



*Oncosperma*

Drawn by Marion Ruff Sheehan



*Pinanga*



Danke  
Gracias  
Grazie  
Hvala  
Mersi  
Obrigado  
Sheshe  
Shoukran  
Spassiba  
Terimah  
Kasih  
Thank you