

APG-III 2009

18S rDNA

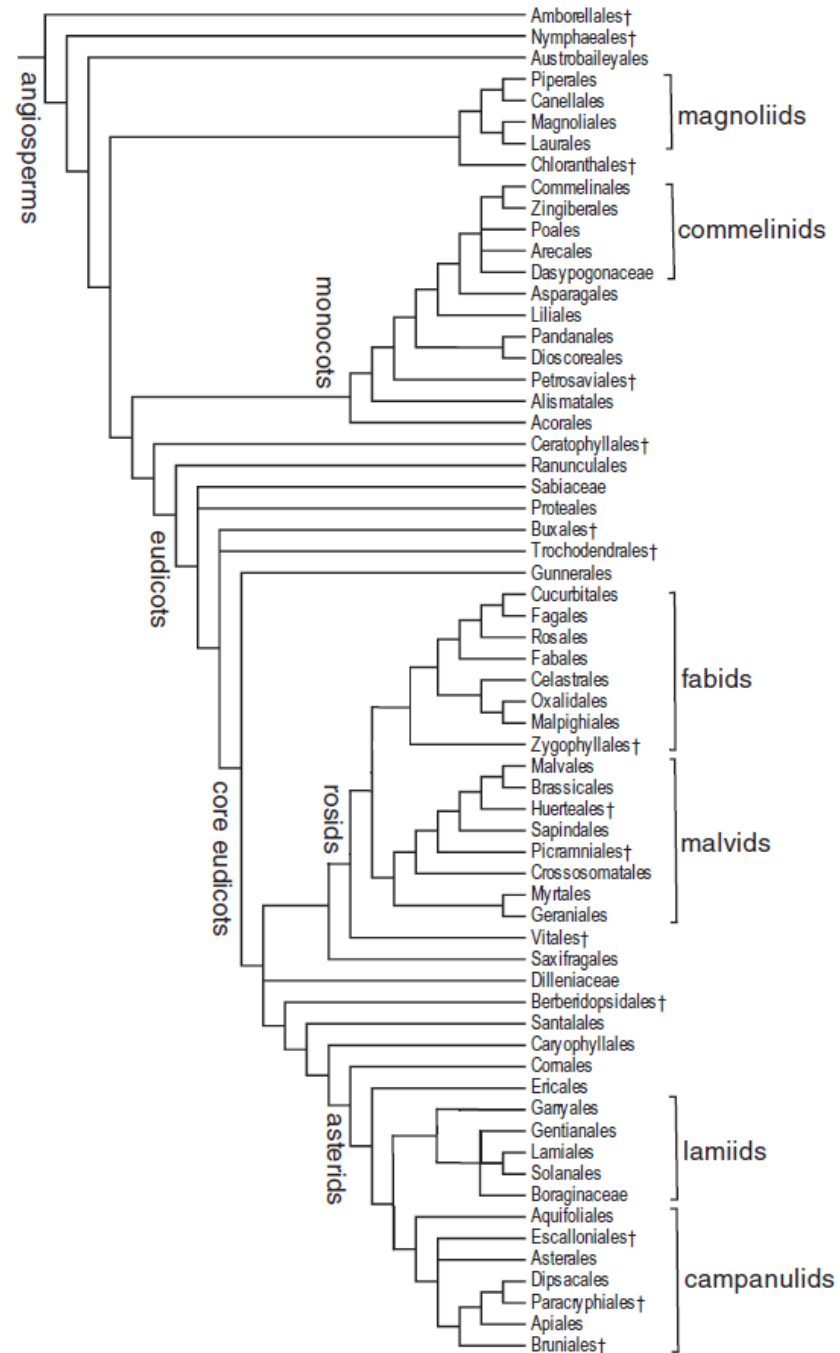
rbcL

atpB

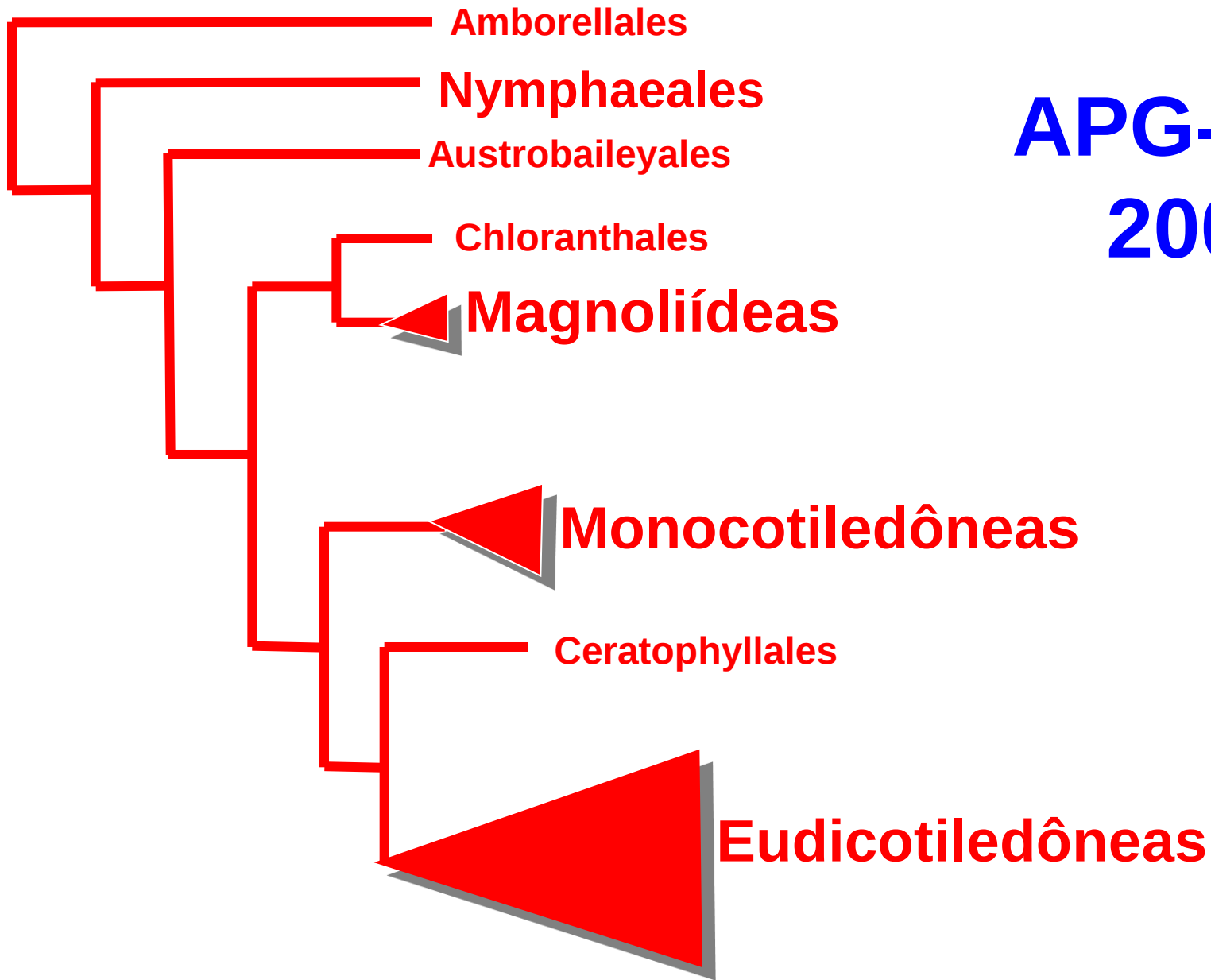
atp1

matR

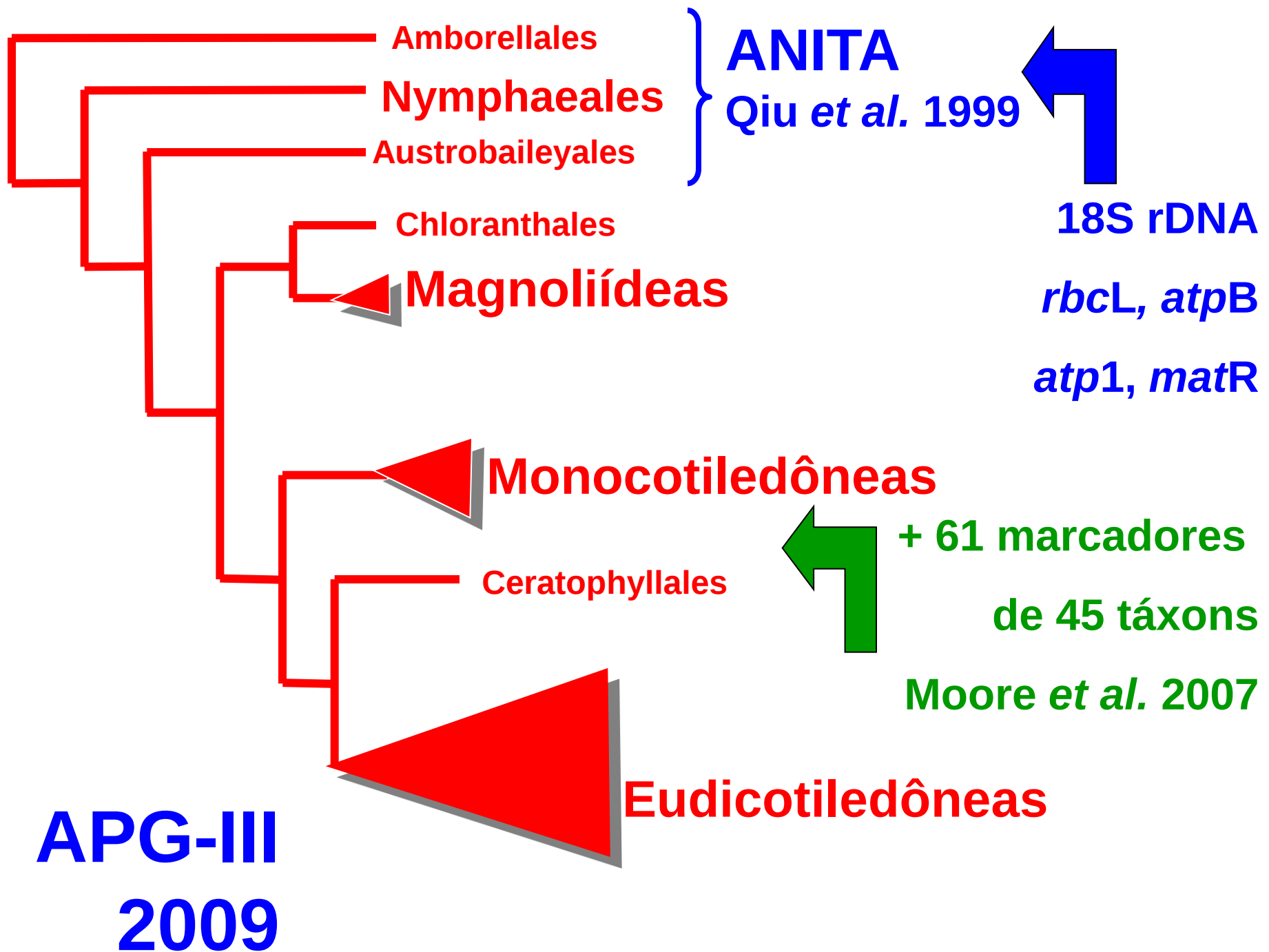
+ 61 genes de 45
táxons



APG-III 2009



www.mobot.org/MOBOT/research/APweb
(Stevens 2010)

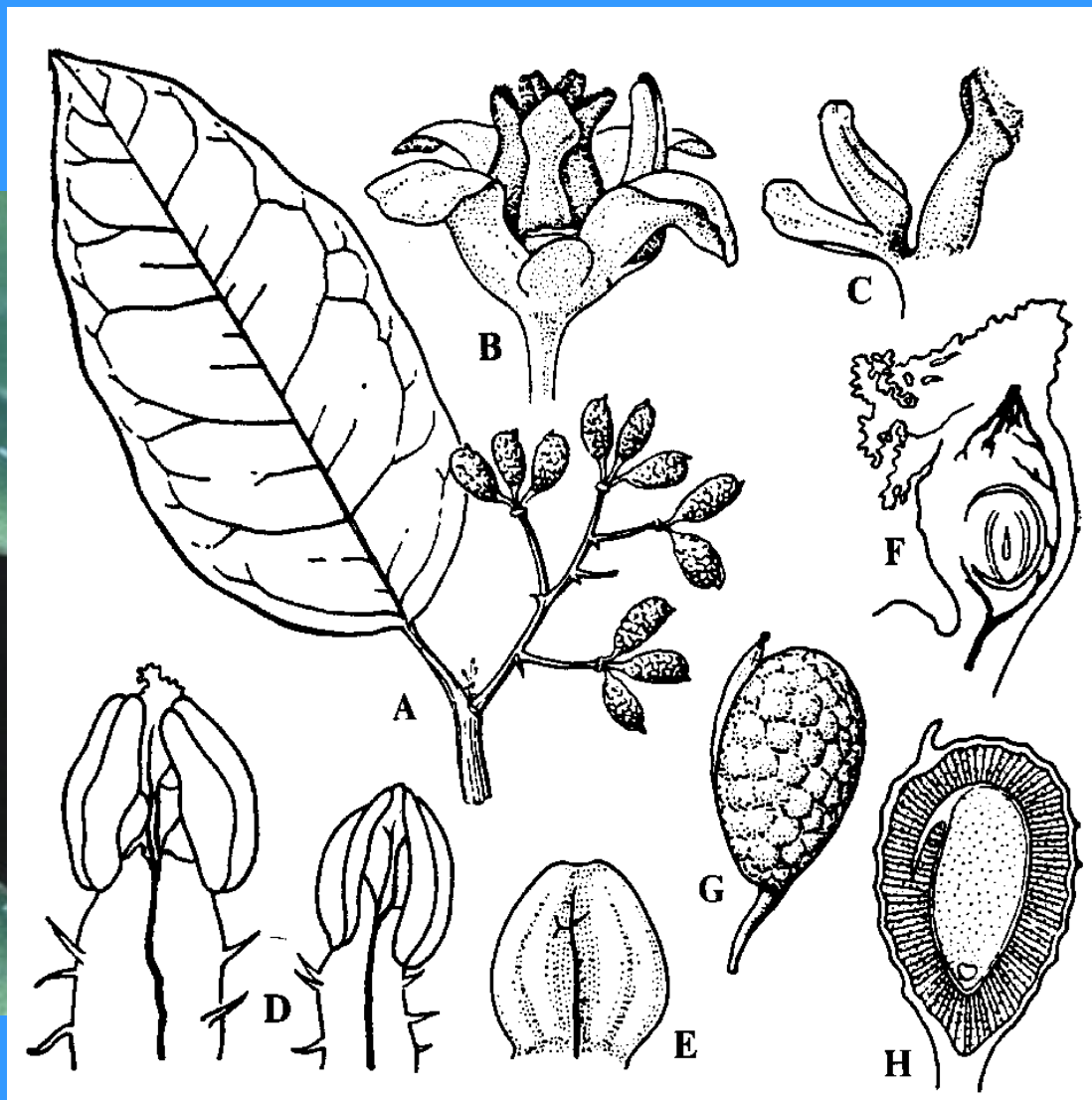


GIMNO

Qiu et al. 1999

INDEL *matR* mitochondrial





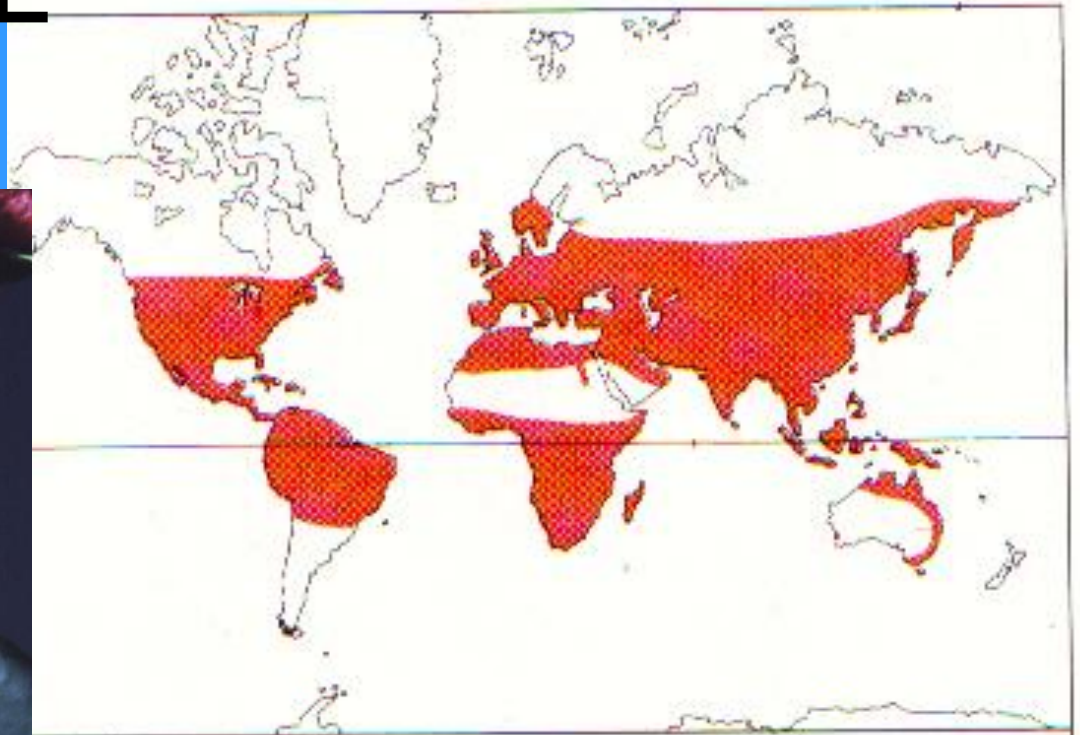
Philipson 1993

Amborella trichopoda
AMBORELLACEAE

NYMPHAEACEAE



Water Lilies



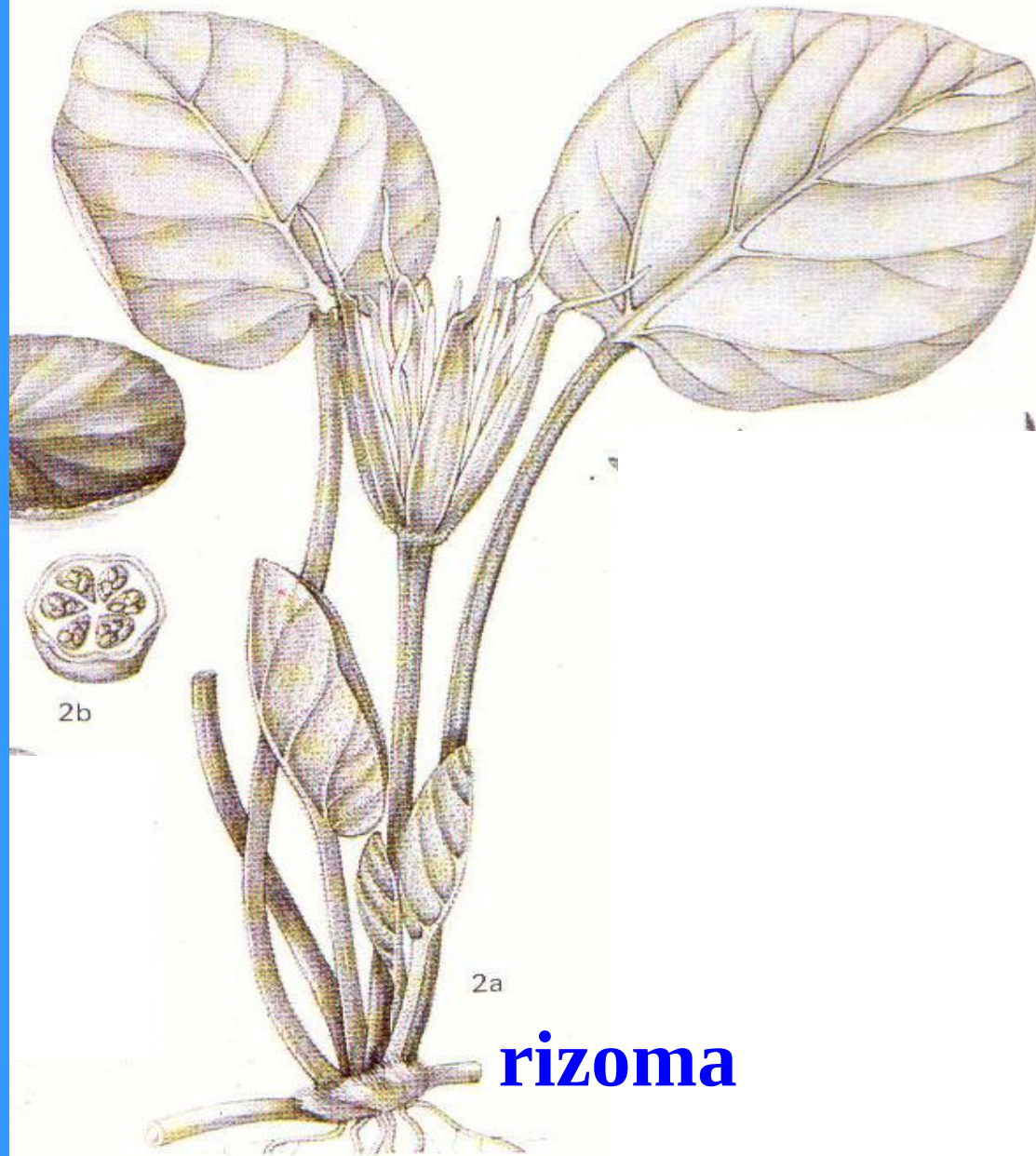
Number of genera: 9

Number of species: over 90

Distribution: cosmopolitan, in fresh-water habitats.

Economic uses: ornamental aquatics, eg water lilies, lotus, Queen Victoria waterlily; some yield edible seeds and rhizomes.

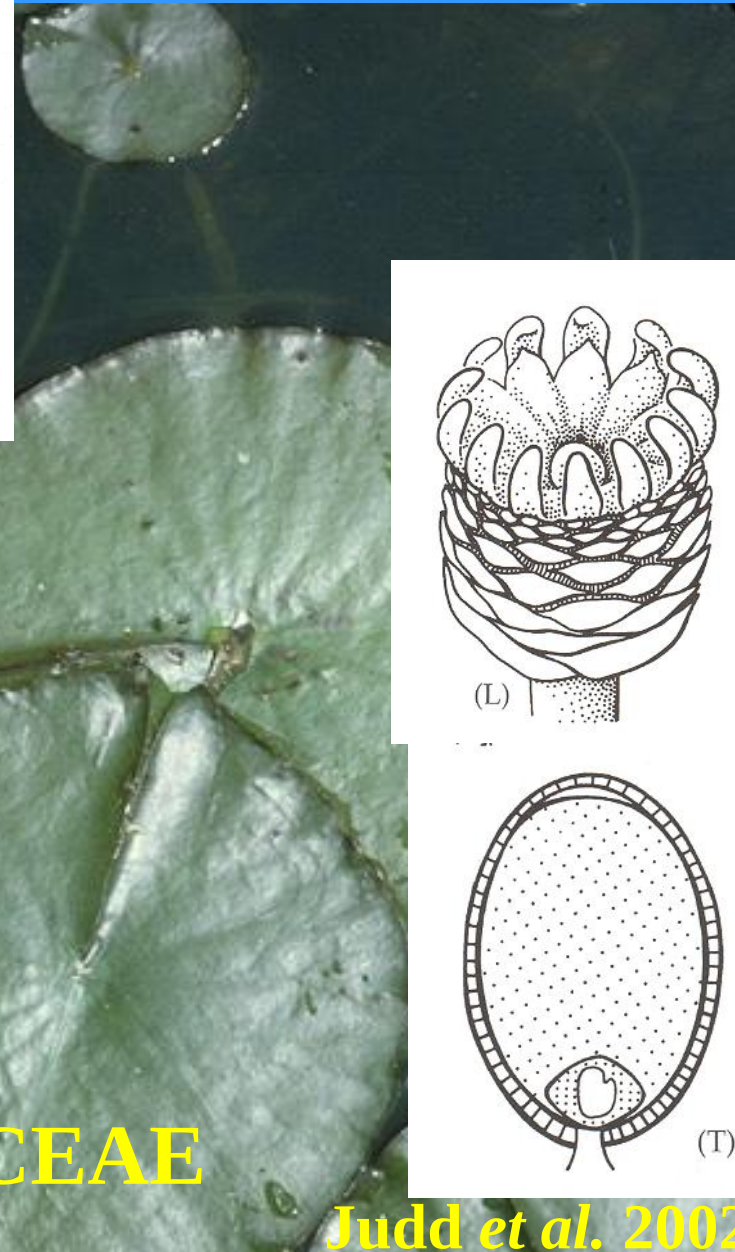
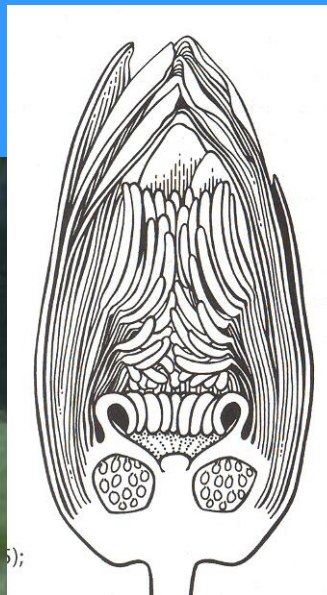
Heywood 1974



rizoma

Barclaya
NYMPHAEACEAE

Heywood 1974



NYMPHAEACEAE

Judd et al. 2002

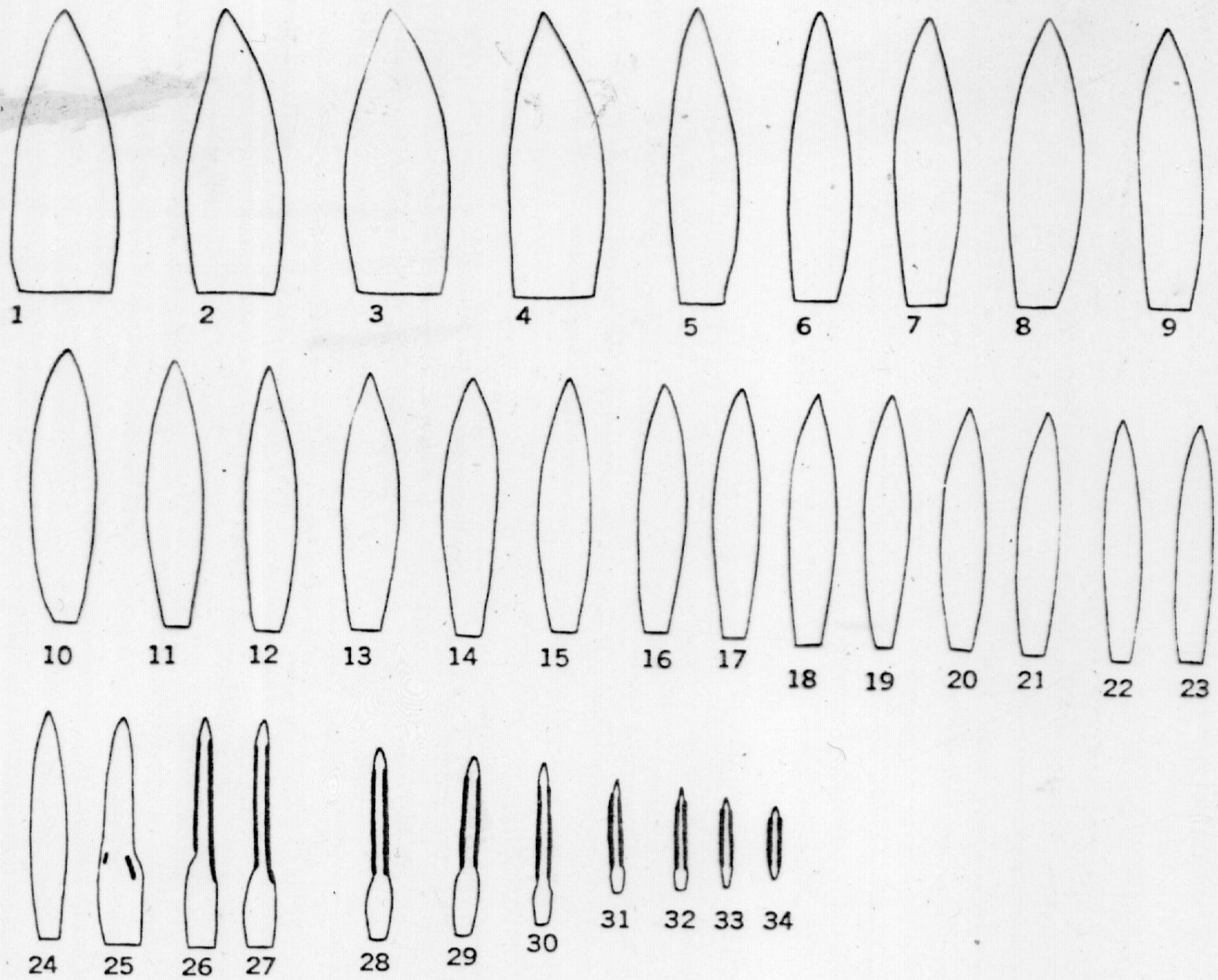
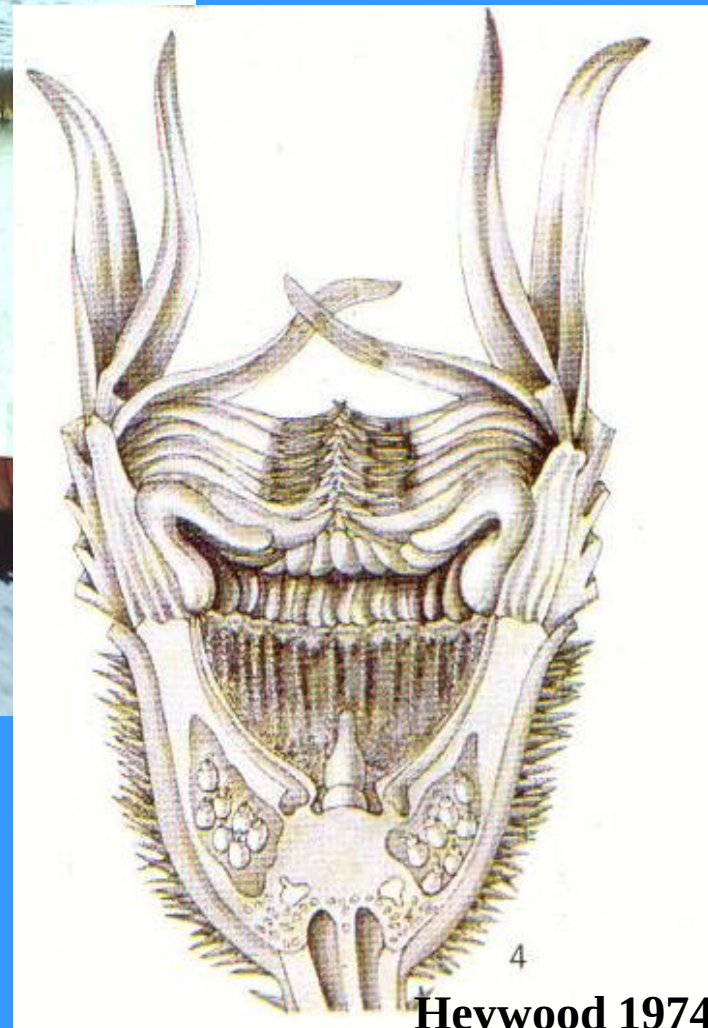


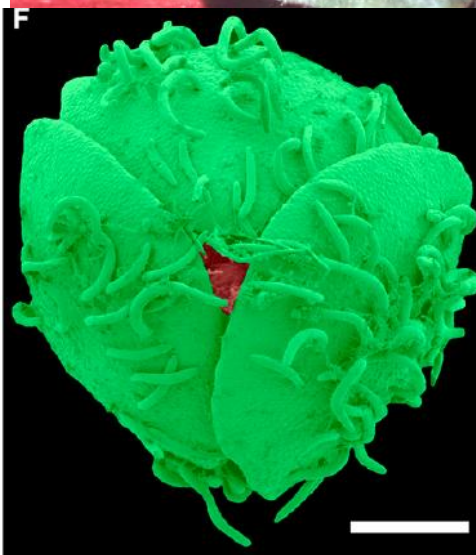
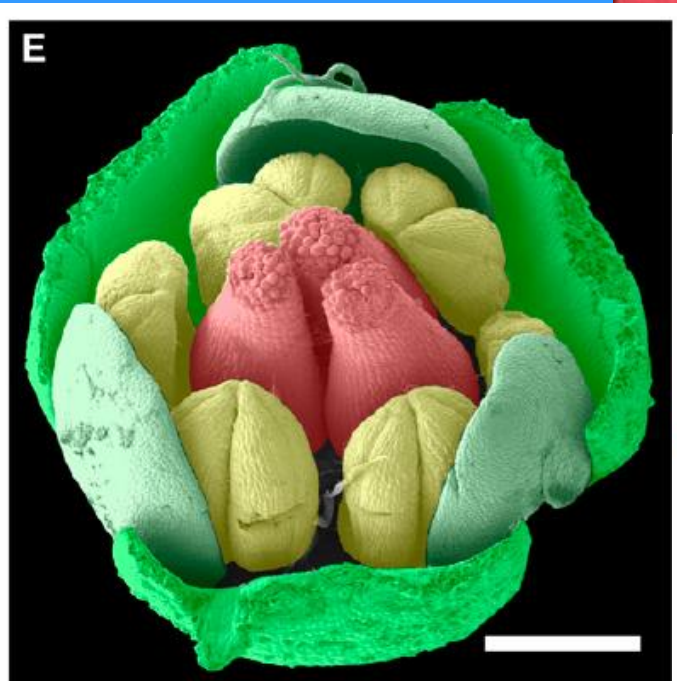
FIGURE 22-3 Floral parts of water lily showing transitions. 1-4, sepaloid; 5-24, petaloid; 25-34, stamens. (After Gibbs.)



NYMPHAEACEAE
Victoria amazonica



Heywood 1974



CABOMBACEAE
Cabomba aquatica

Rudall et al. 2009



NYMPHAEALES

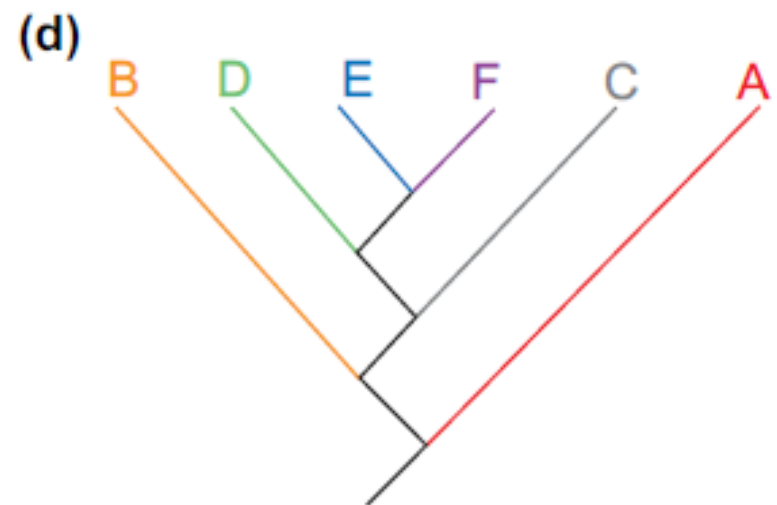
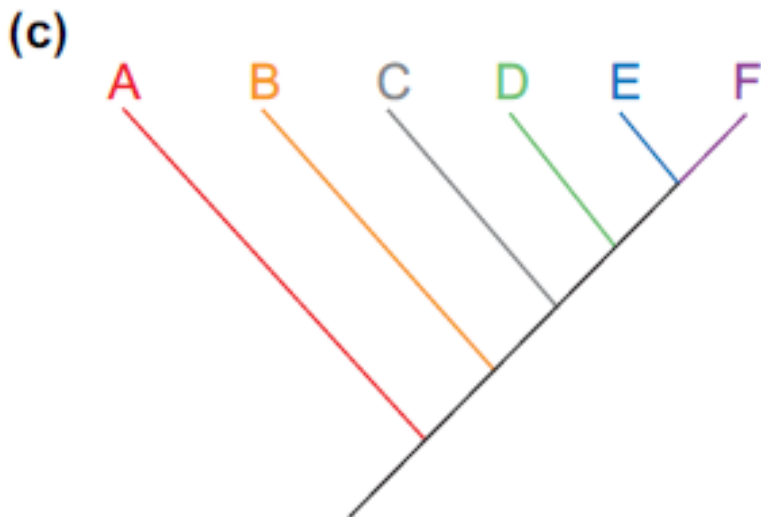
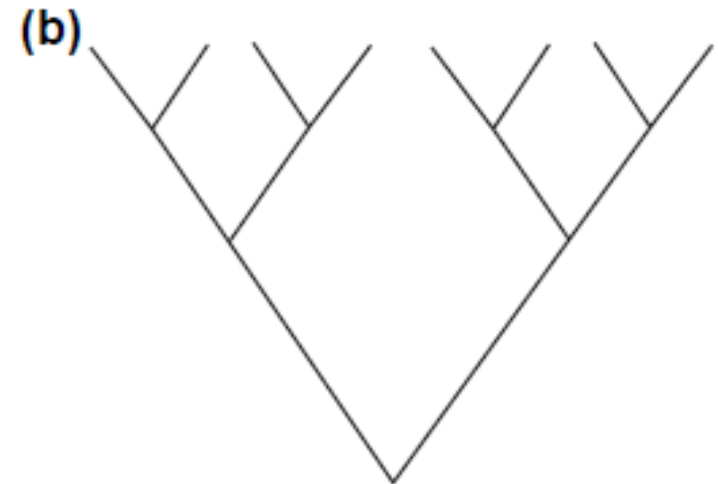
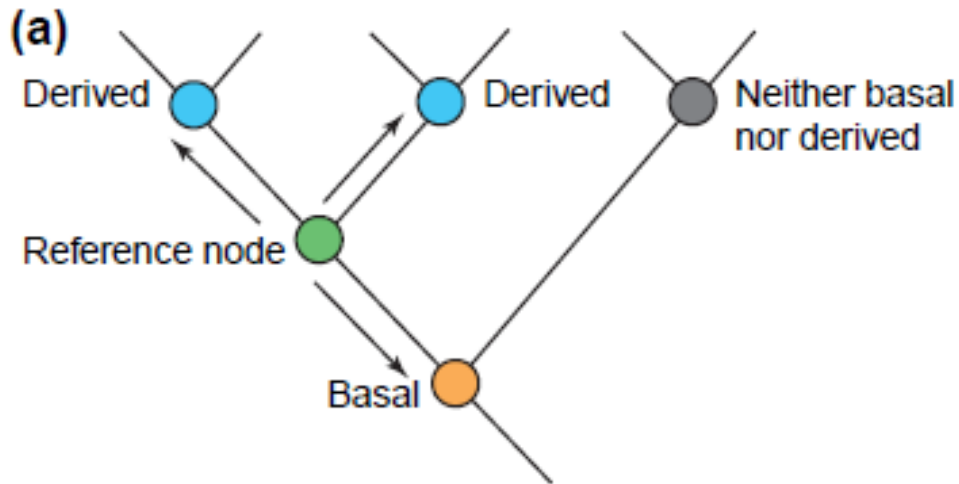
Trithuria submersa

Hydatellaceae

Rudall et al. 2009

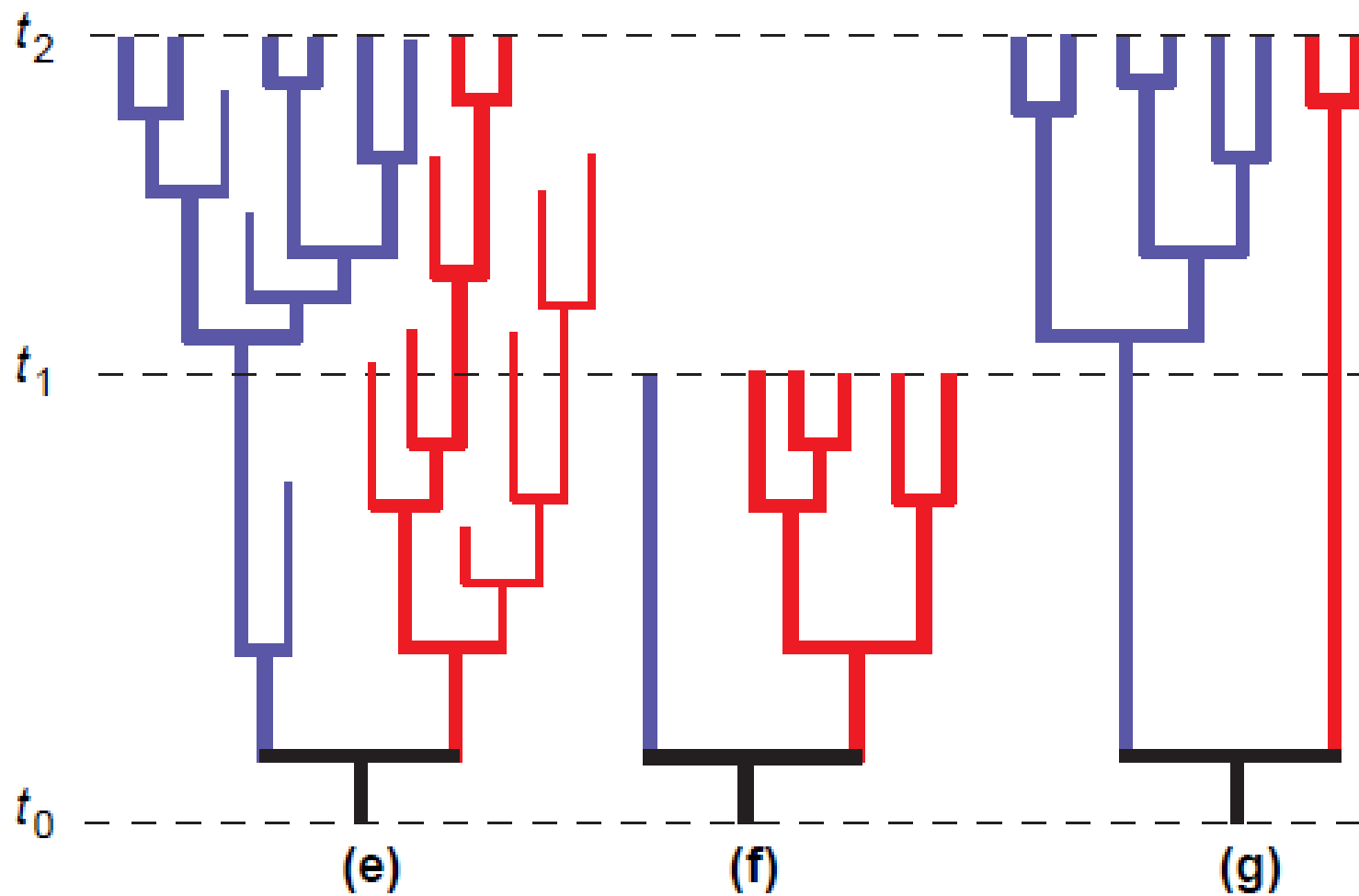


Stevens 2010



Interpretação de árvores de acordo com a topologia

Crisp & Cook 2005



Interpretação de árvores de acordo com a topologia

Crisp & Cook 2005

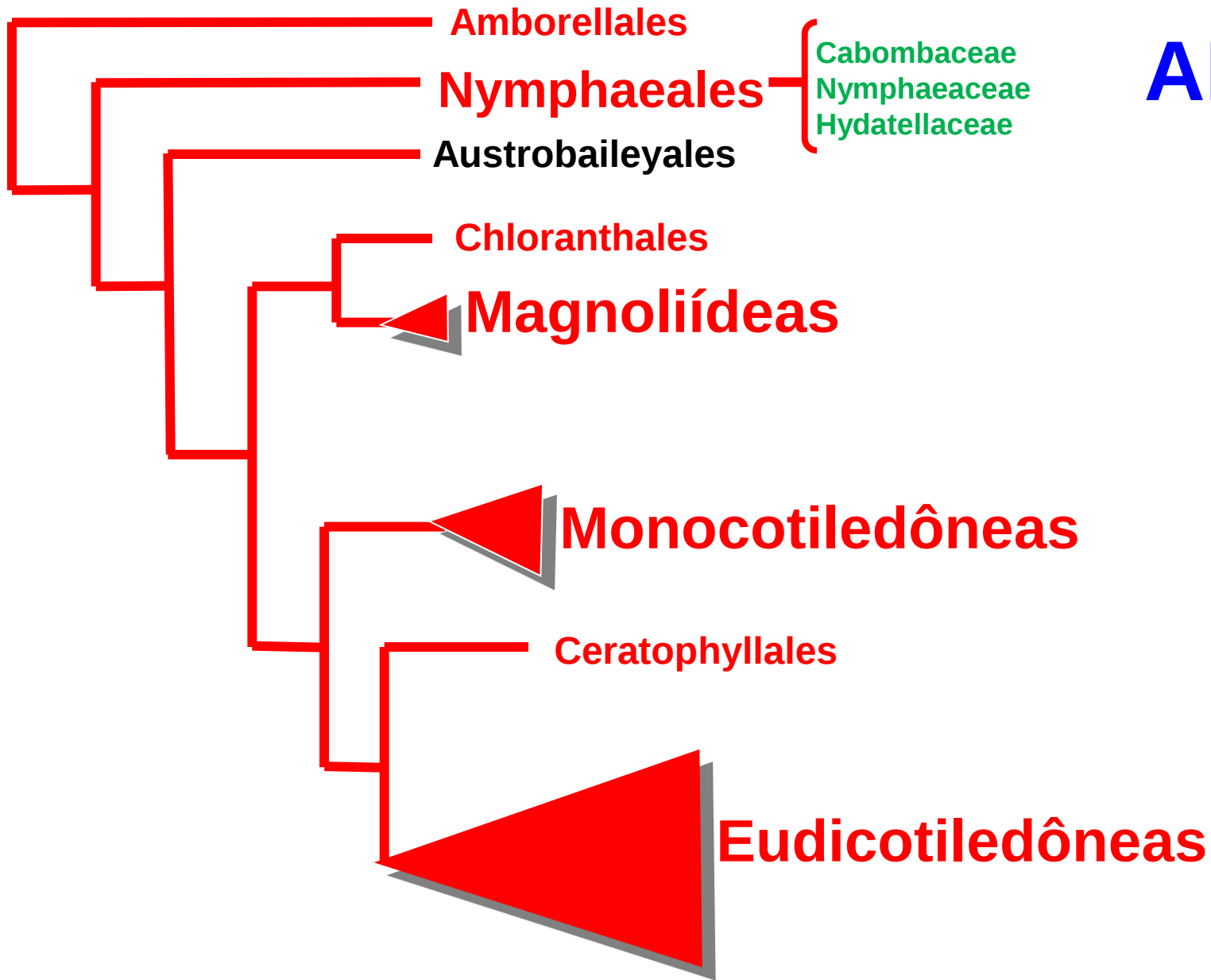
**Muitas características ditas “basais” em grupos-irmãos
podem ser independentemente derivadas
e altamente especializadas.**

Exemplo:

**As adaptações morfológicas e ecofisiológicas de
Nymphaeales ao ambiente aquático.**

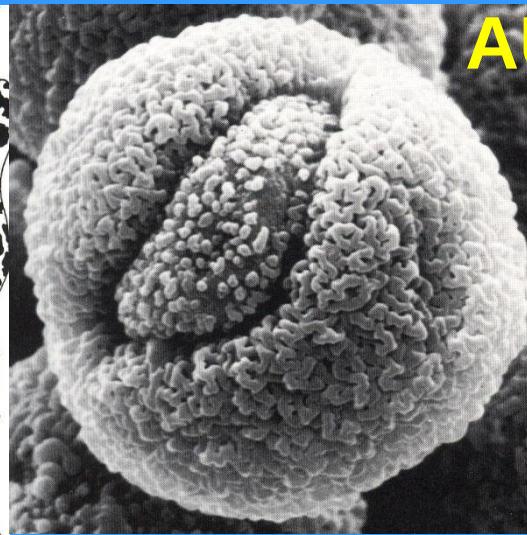


APG-III 2009

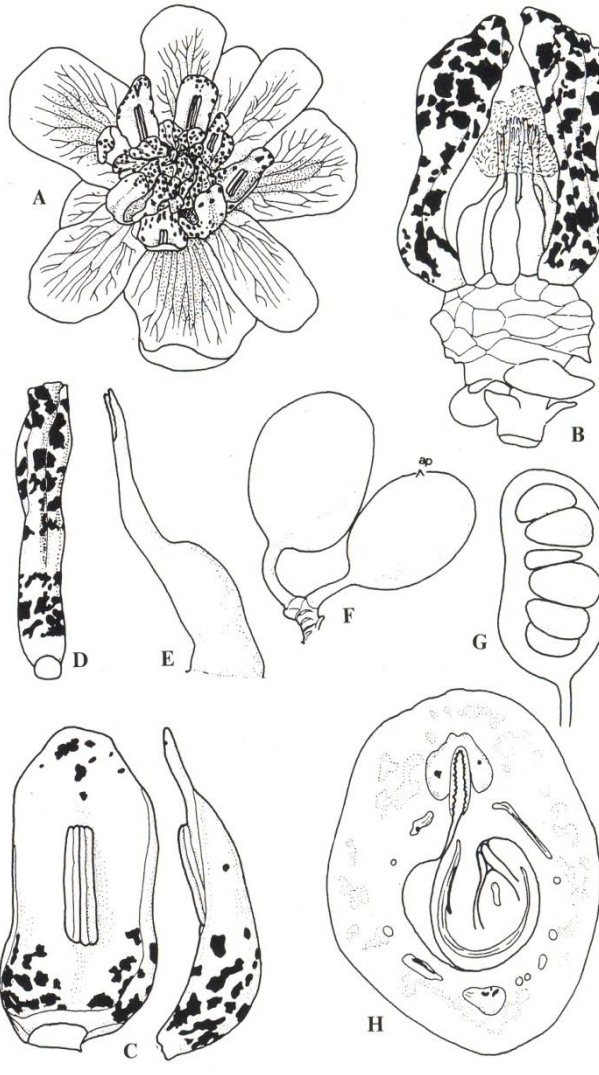


www.mobot.org/MOBOT/research/APweb
(Stevens 2010)

AUSTROBAILEYALES



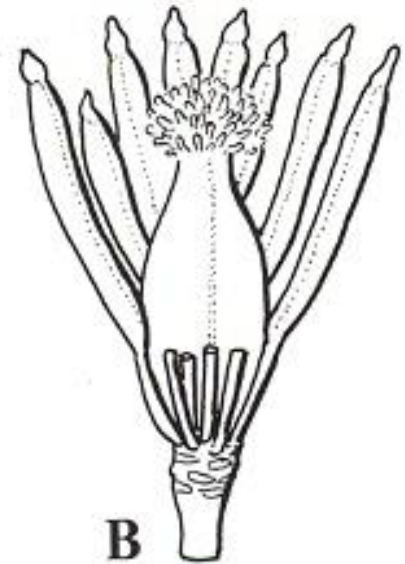
*Austrobaileya
scandens*



Austrobaileyaceae

Endress 1993

Trimenia papuana
Trimeniaceae



B



E



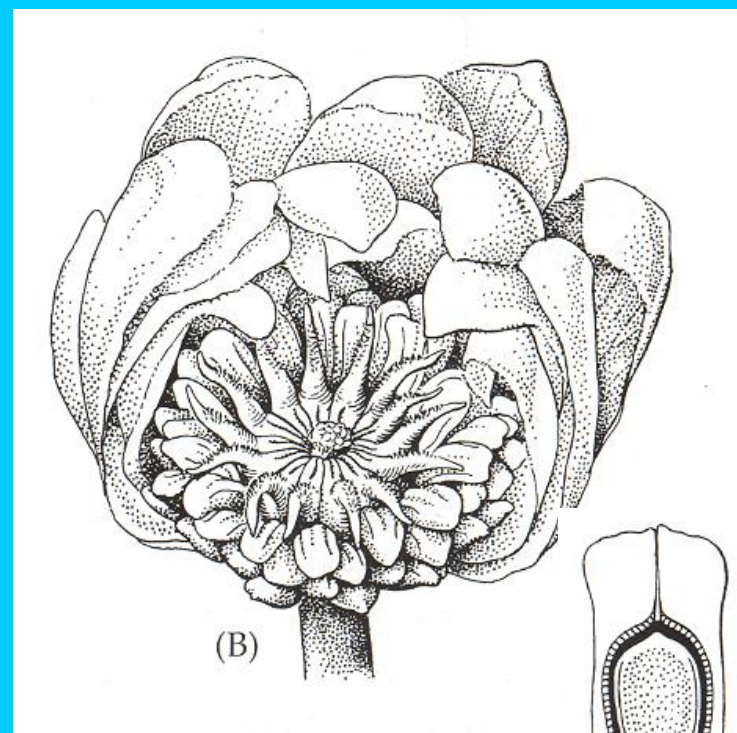
F

Philipson 1993

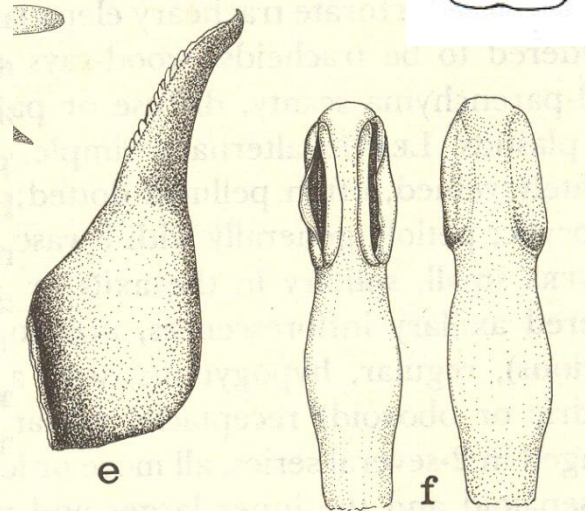
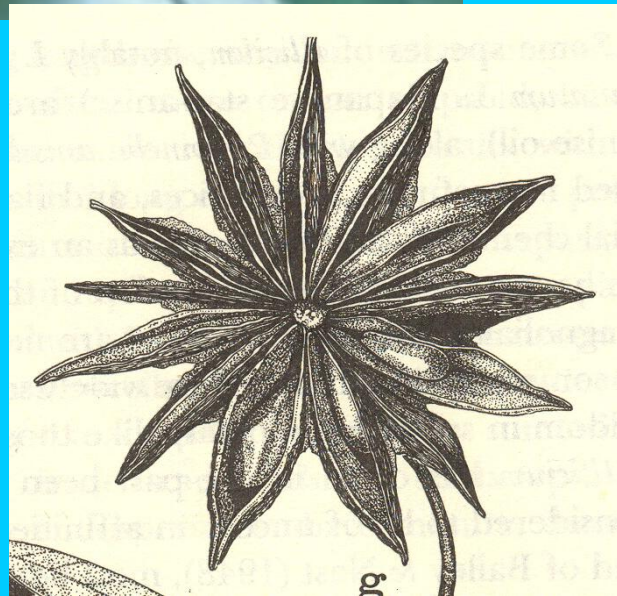
AUSTROBAILEYALES



Illicium floridanum, Illiciaceae



Keng 1993



Cronquist 1981

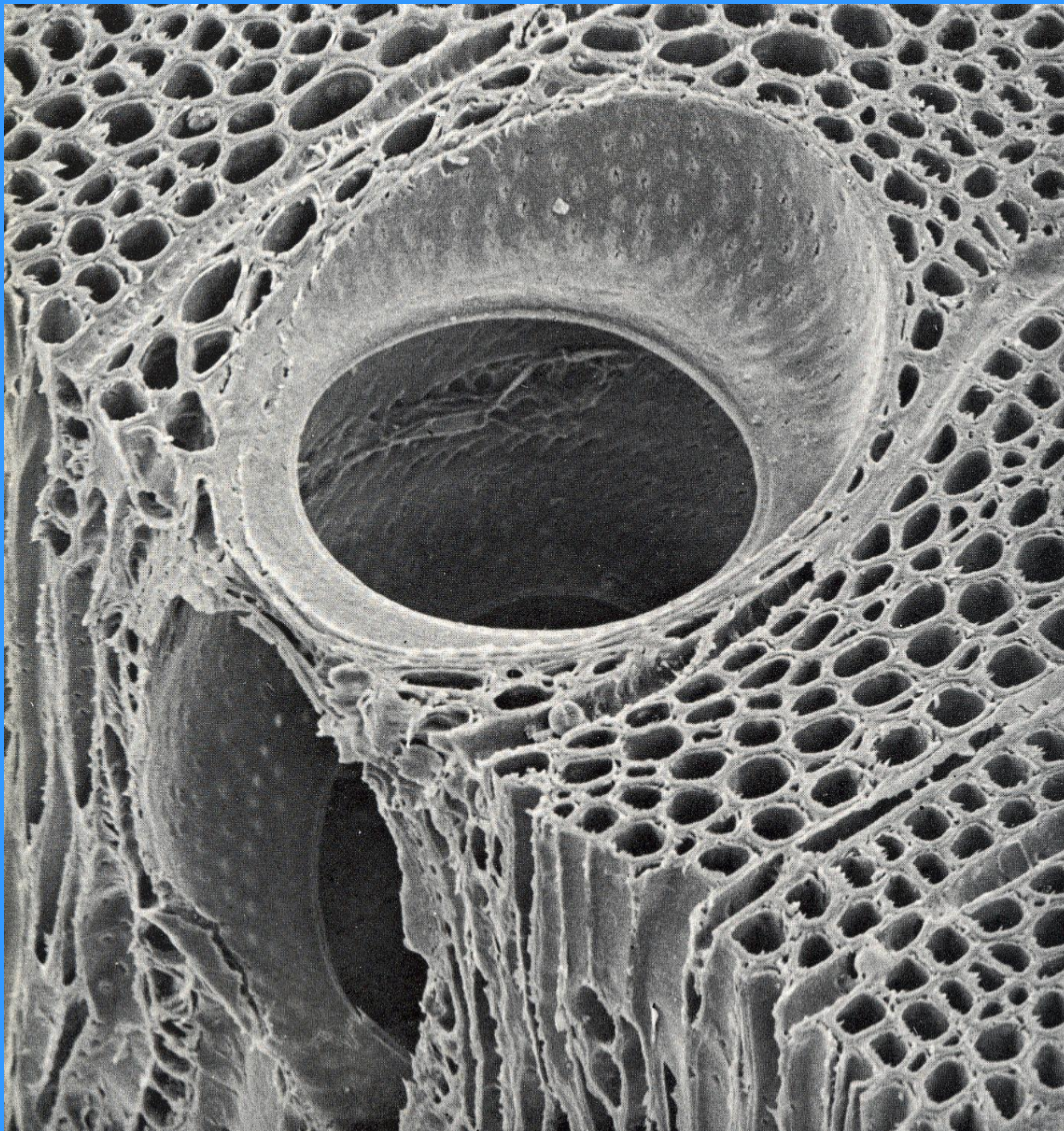
AUSTROBAILEYALES



Illicium floridanum
Illiciaceae

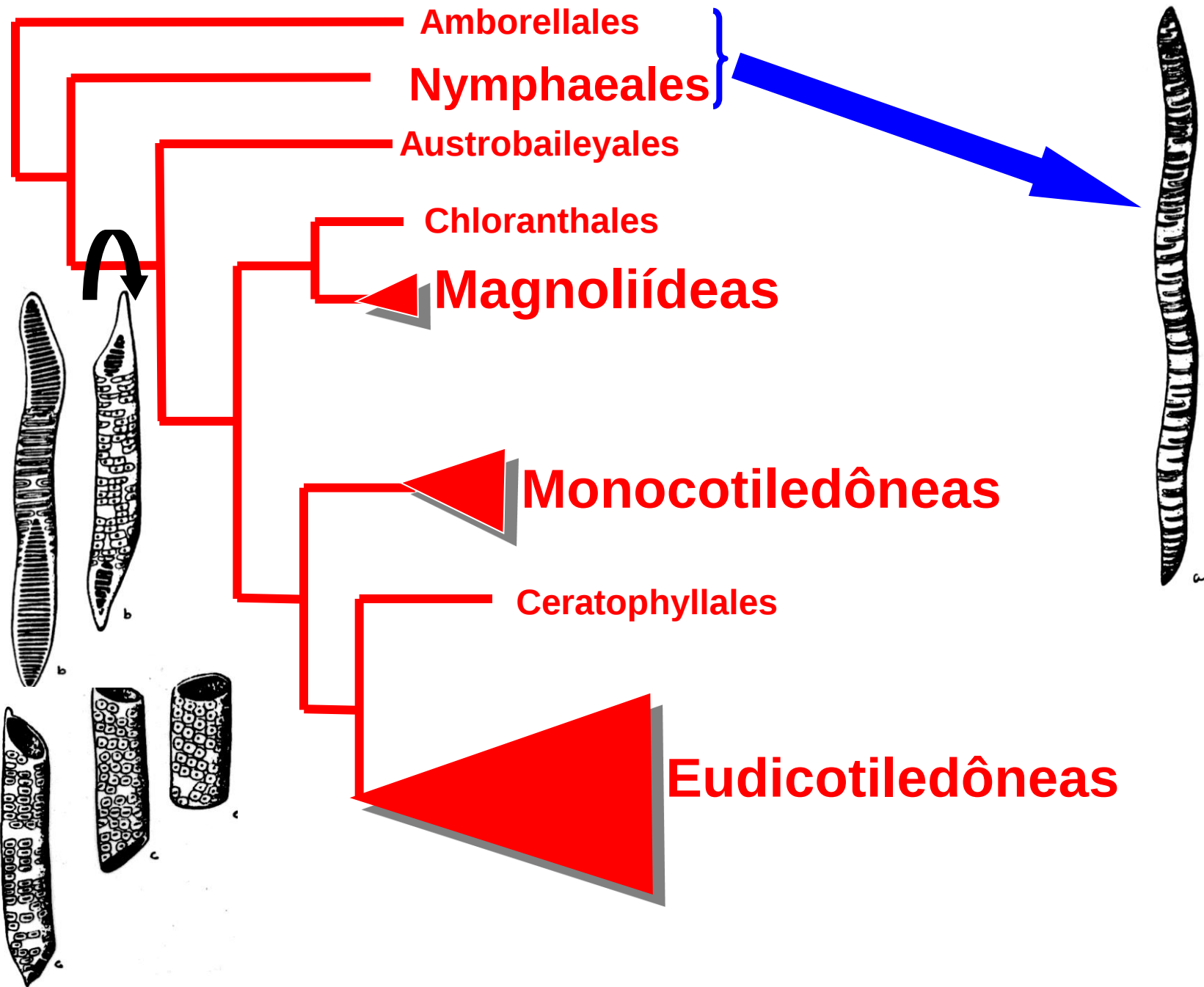
Thien et al. 2009

Fig. 3. Flower of *Illicium floridanum* (×2). Upright carpels are no longer receptive to pollen. Anthers are just beginning to dehisce (see head of arrow) indicating start of male phase.

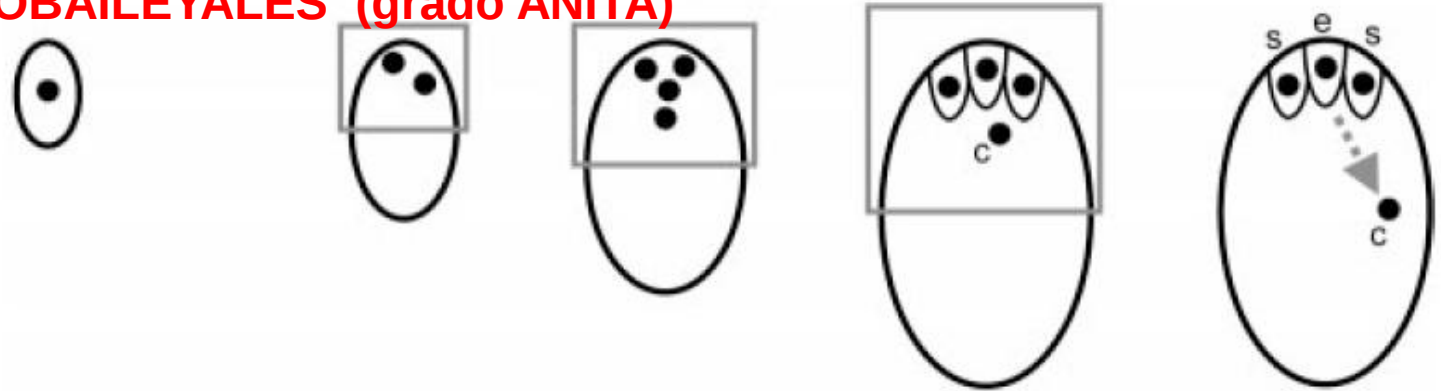


VASOS

**Meylan &
Butterfield
1972**



AUSTROBAILEYALES (grado ANITA)



**Williams &
Friedman
2004**

Maioria das angiospermas

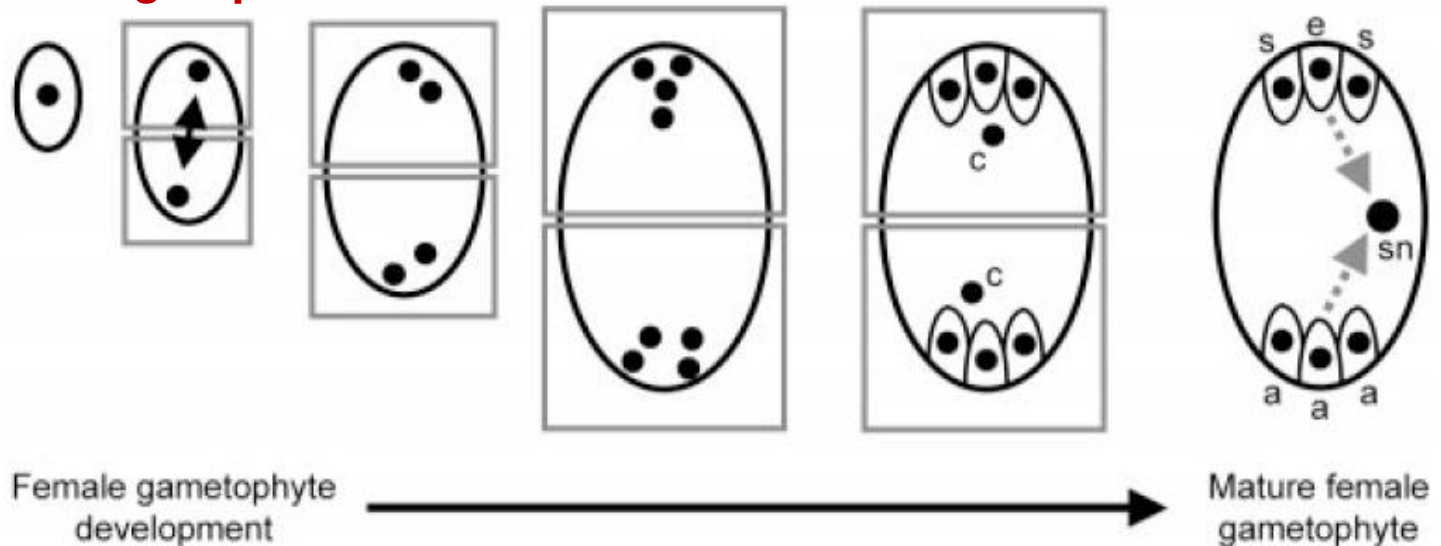
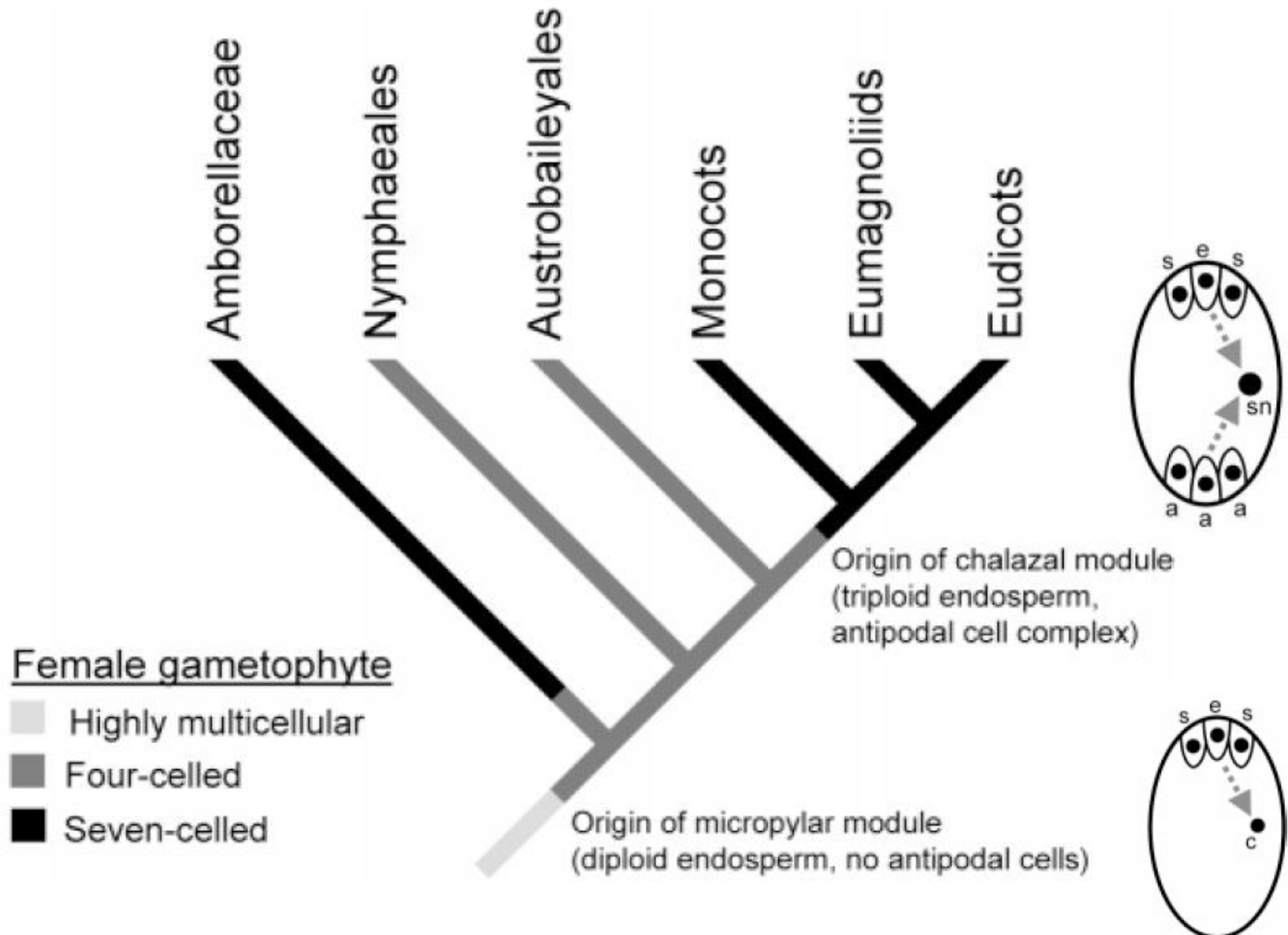
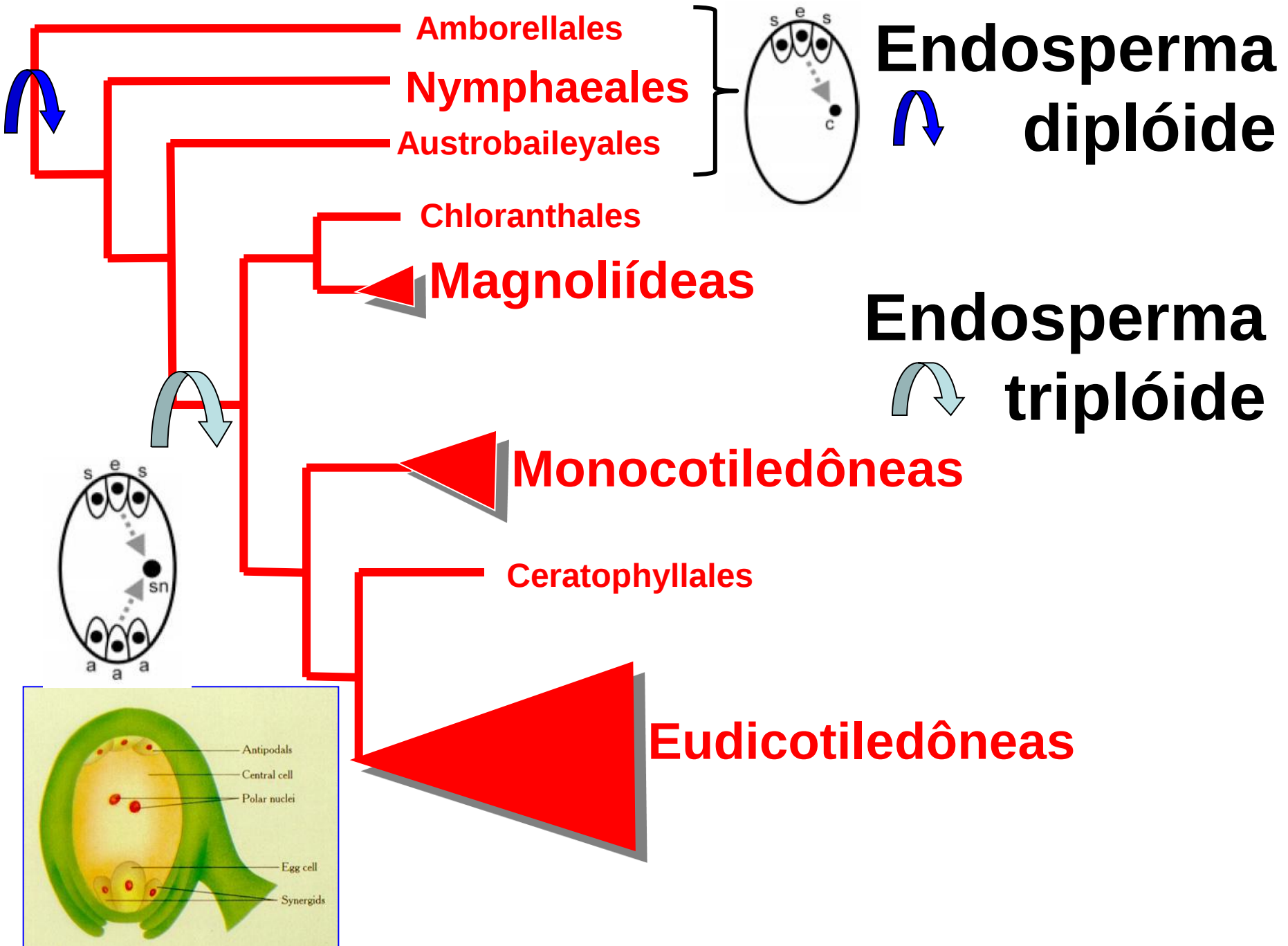


Fig. 6. Comparative development of female gametophytes of early angiosperms. The *Illicium*-like four-celled/four-nucleate female gametophyte of Austrobaileyales is at the top, and the reconstructed seven-celled/eight-nucleate female gametophyte of the common ancestor of the clade that includes monocots, eumagnoliids, and eudicots is below. Female gametophytes of an-

Williams & Friedman 2004



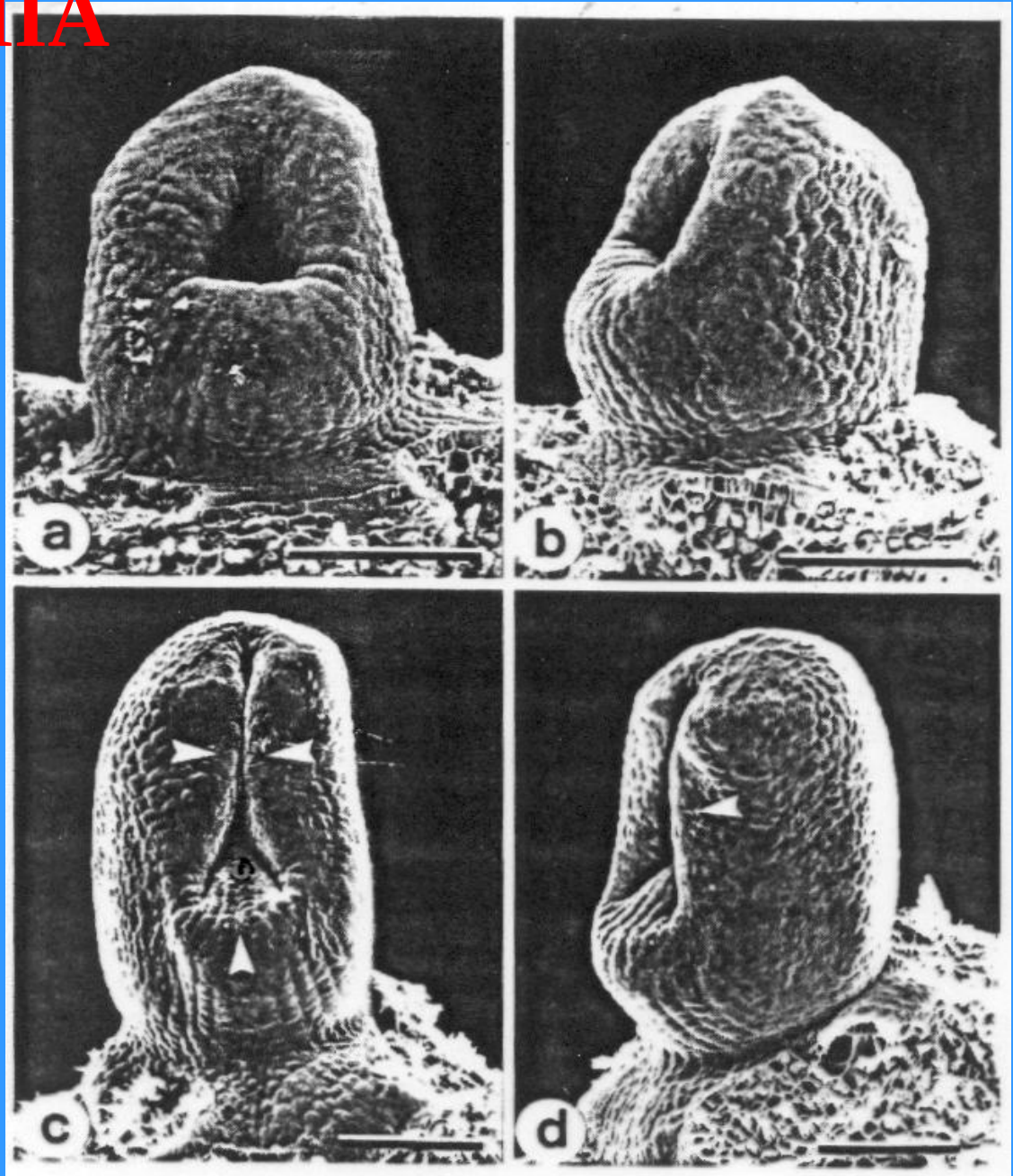


ANGIOSPERMIA

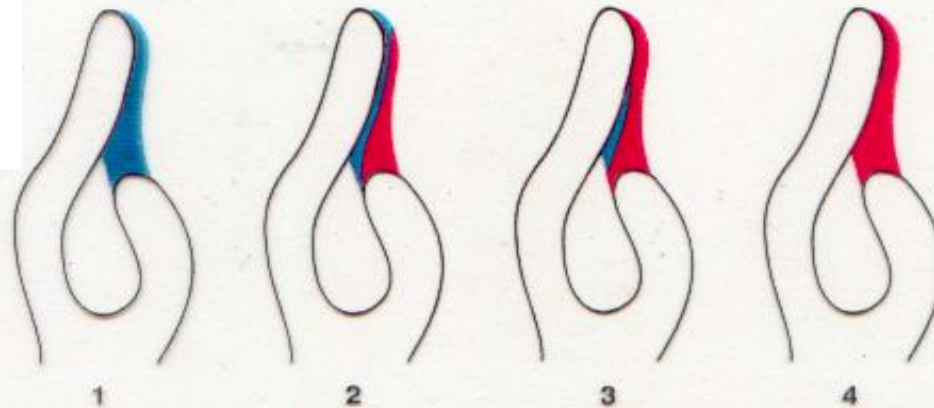
Fechamento
carpelar em
Laurus nobilis
(Lauraceae)

Fusão posgênita
das margens
carpelaes

Endress 1997



Tipos de angiospermia



ANITA



Amborella



Austrobaileya



Kadsura



Illicium



Ascarina



Trimenia



Cabomba



Nymphaea

Magnoliídeas



Asimina



Annona



Degeneria



Eupomatia



Galbulimima



Myristica



Canella



Tasmannia



Drimys



Zyggogynum



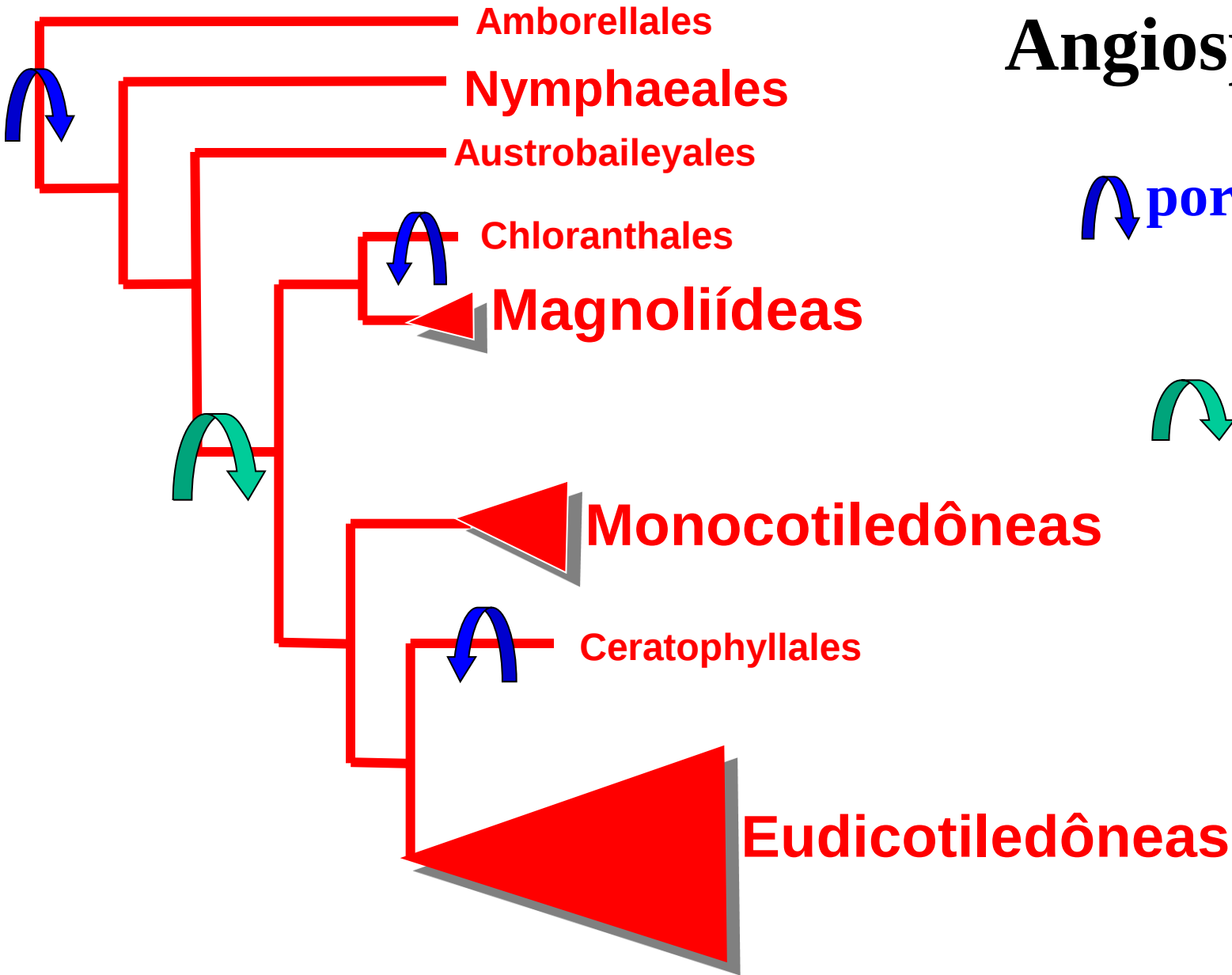
Liriodendron

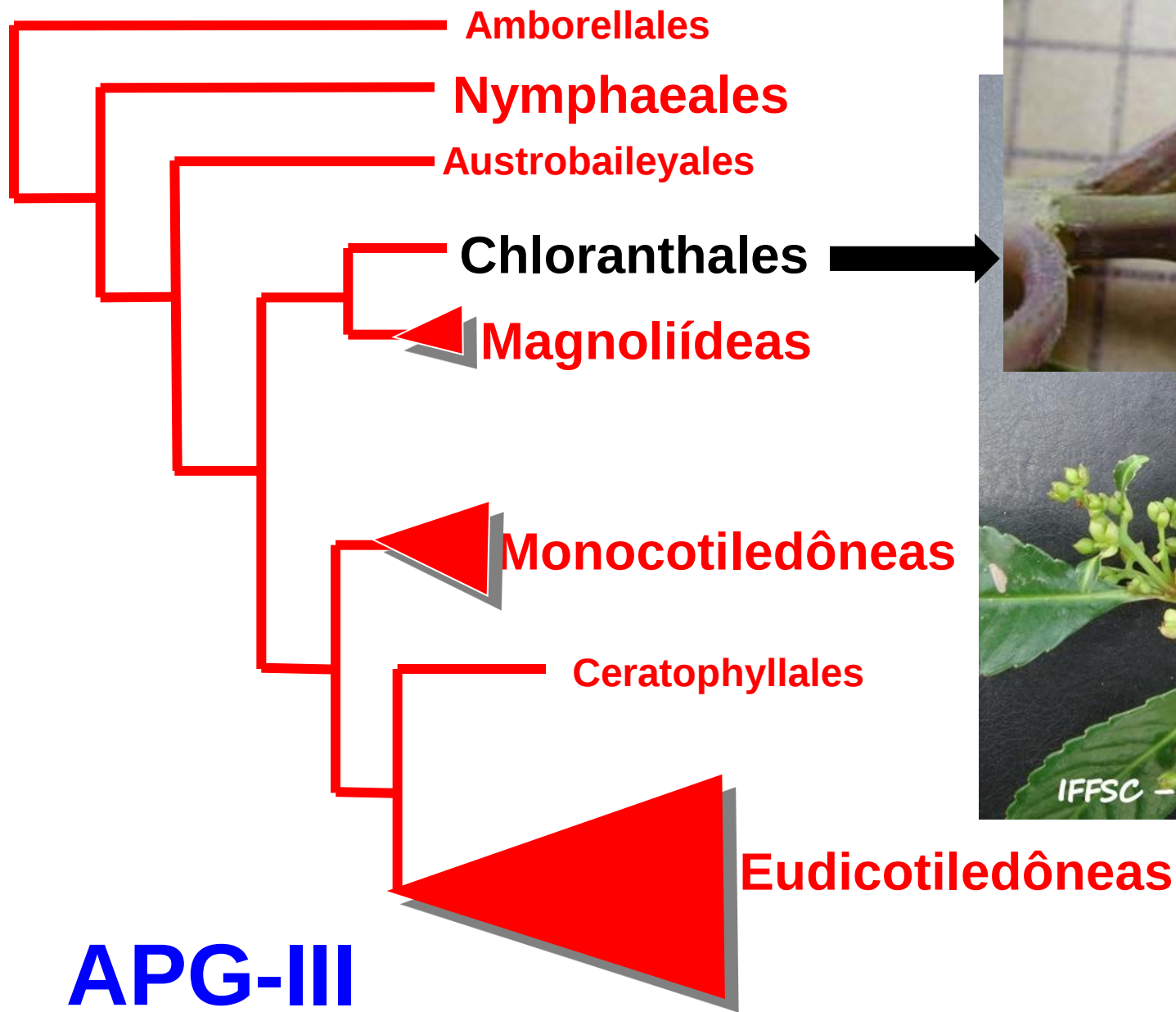
Endress & Igersheim 2000

Angiospermia

por secreção

fusão
posgênita



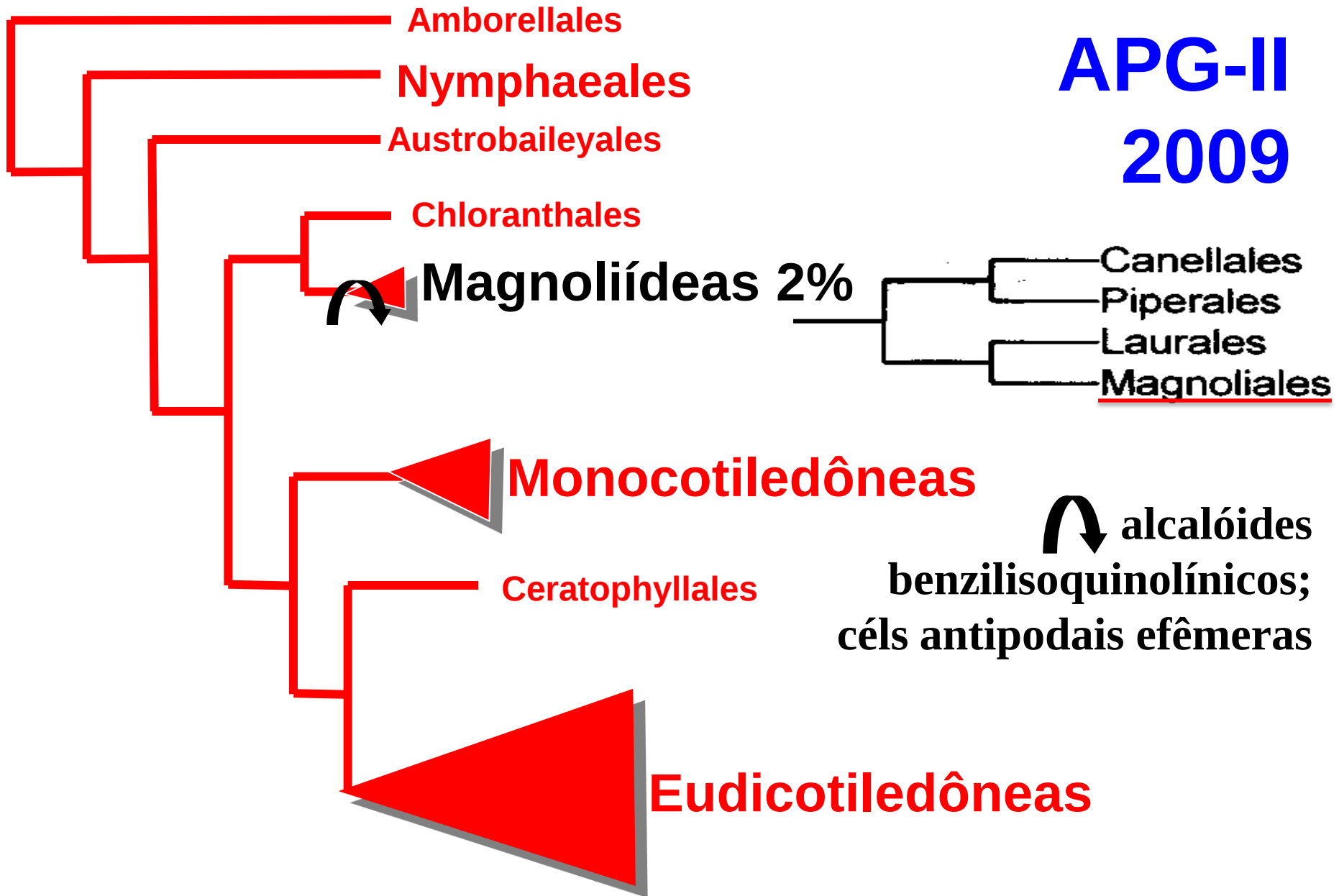


*Hedyosmum
brasiliense*



APG-III
2009

APG-II 2009



www.mobot.org/MOBOT/research/APweb

(Stevens 2010)

MAGNOLIALES

6 famílias

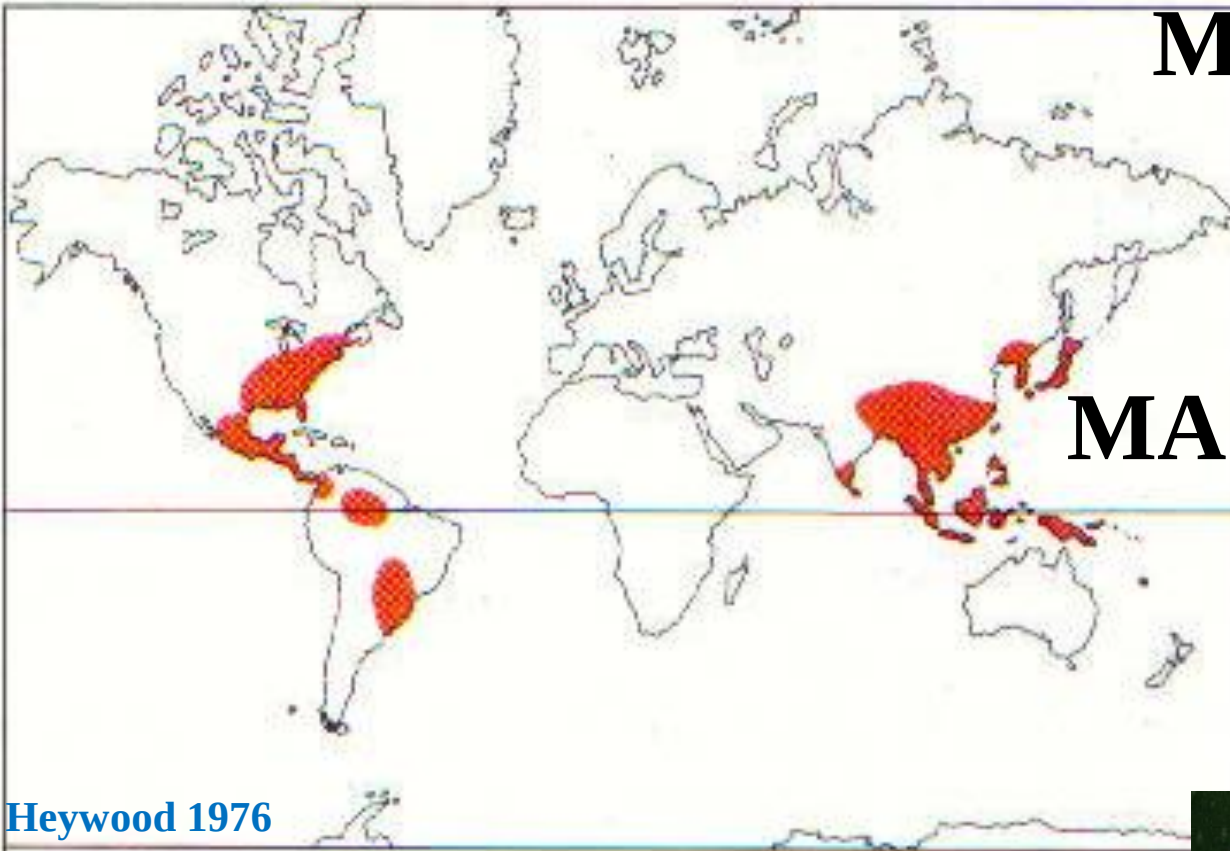
3000 spp.

MAGNOLIACEAE

-folhas alternas

- **estípulas**

-células oleíferas



Heywood 1976

Number of genera: 12

Number of species: about 220

Distribution: centered in temperate and tropical SE Asia.

Economic uses: valued ornamentals (*Magnolia* and *Liriodendron*) and some useful timbers.





Judd et al. 2002

Liriodendron tulipifera
MAGNOLIACEAE

* K3 C3+3 A ∞ G ∞



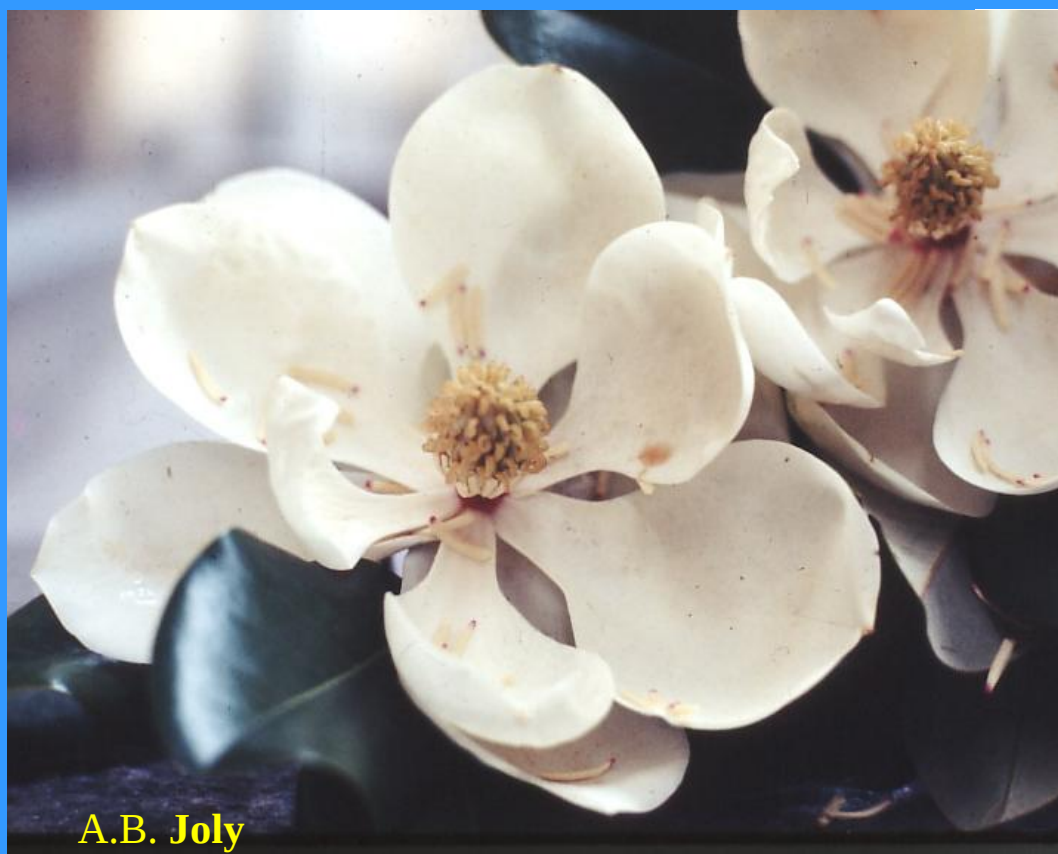
Magnolia grandiflora
Magnoliaceae
© G. D. Carr

MAGNOLIALES MAGNOLIACEAE

Magnolia grandiflora
Flor na abertura



Magnolia grandiflora
Magnoliaceae
© G.D. Carr



A.B. Joly

MAGNOLIALES
MAGNOLIACEAE

Magnolia grandiflora
Flor após fecundação





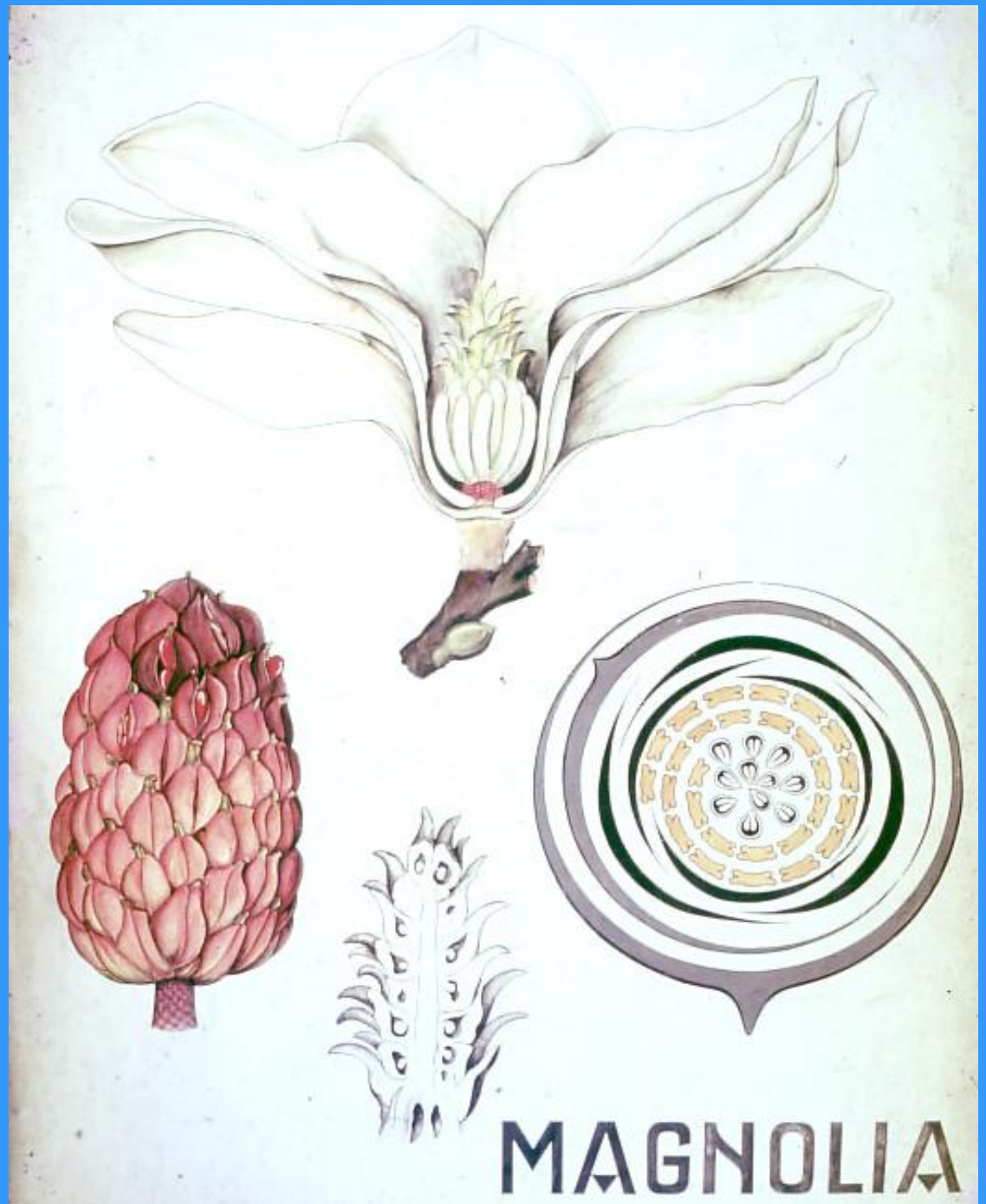
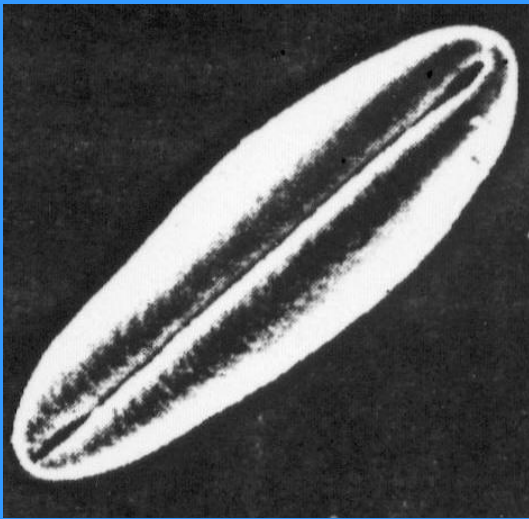
Magnolia grandiflora
Magnoliaceae
© G. D. Carr



Magnolia grandiflora
Magnoliaceae
© G. D. Carr

MAGNOLIACEAE

Magnolia grandiflora
FRUTO

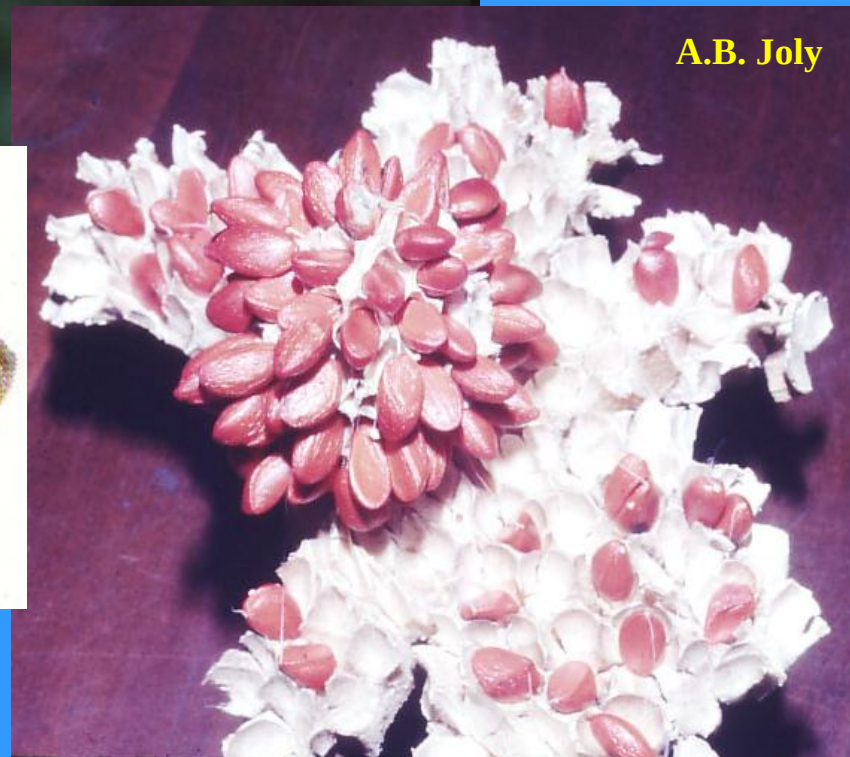




J.R. Pirani



Heywood 1976



A.B. Joly

Talauma ovata
MAGNOLIACEAE



Michelia figo



Michelia champaca

MAGNOLIACEAE

MAGNOLIALES

ANNONACEAE



Heywood 1976

Number of genera: about 120

Number of species: about 2,000

Distribution: pantropical, but centered in the Old World tropics.

Economic uses: cultivated for fruits (sweetsop, soursop) and aromatic oils.

MAGNOLIALES
ANNONACEAE
Xylopi **aromatica**



K3 C3+3 A_{∞} **G1- ∞**

ANNONACEAE

Guatteria



Annona

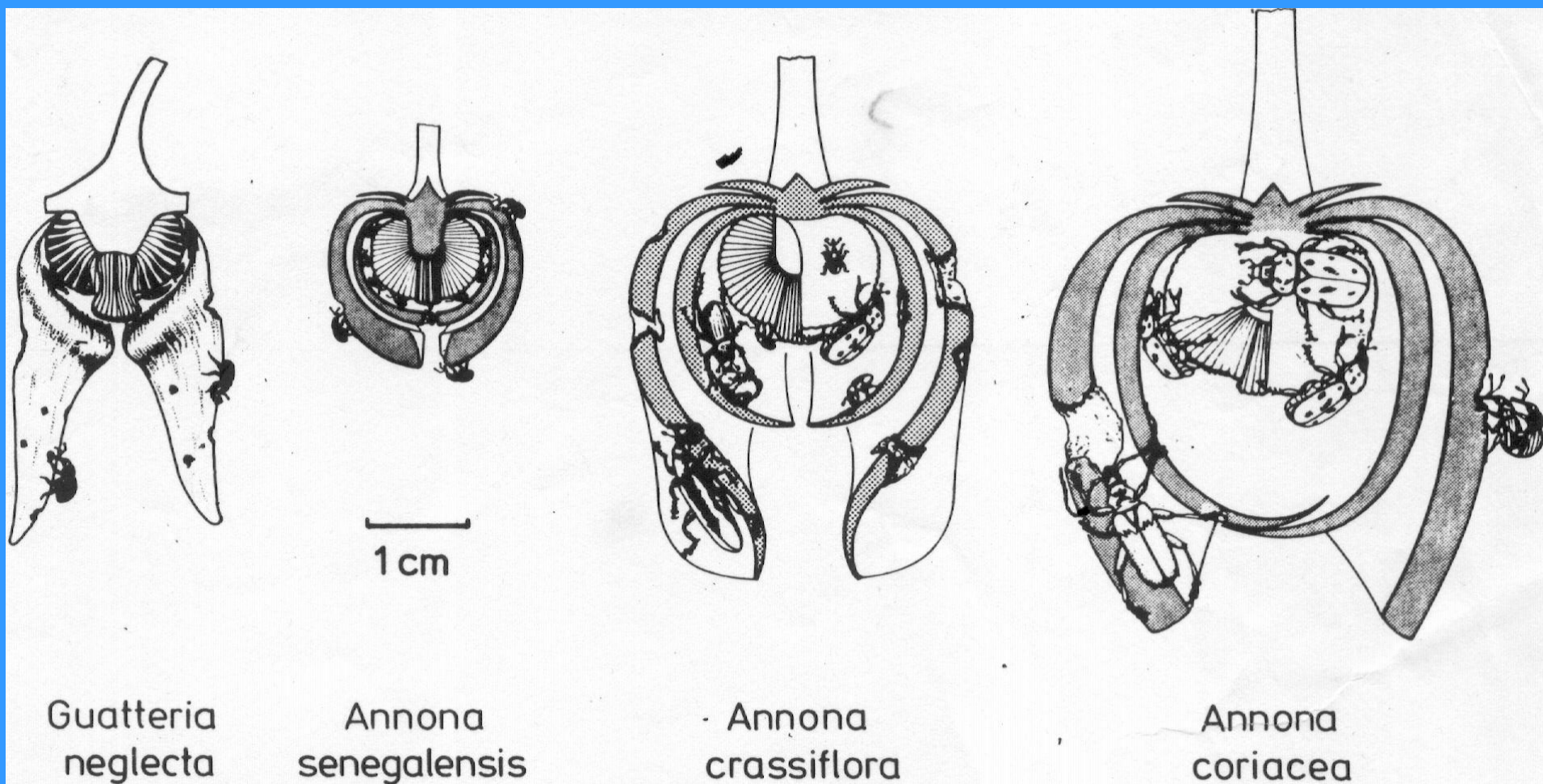


Fig. 6. Flowers of Annonaceae and differences in adaptation to beetle pollination. *Guatteria neglecta* with Nitidulidae as pollinators and Curculionidae as predators of the petals. *Annona senegalensis* with Curculionidae as pollinators and predators. *Annona crassiflora* with Dynastinae and Curculionidae as pollinators and predators. *Annona coriacea* with Dynastinae as exclusive pollinators and Curculionidae and Cerambycidae as predators.

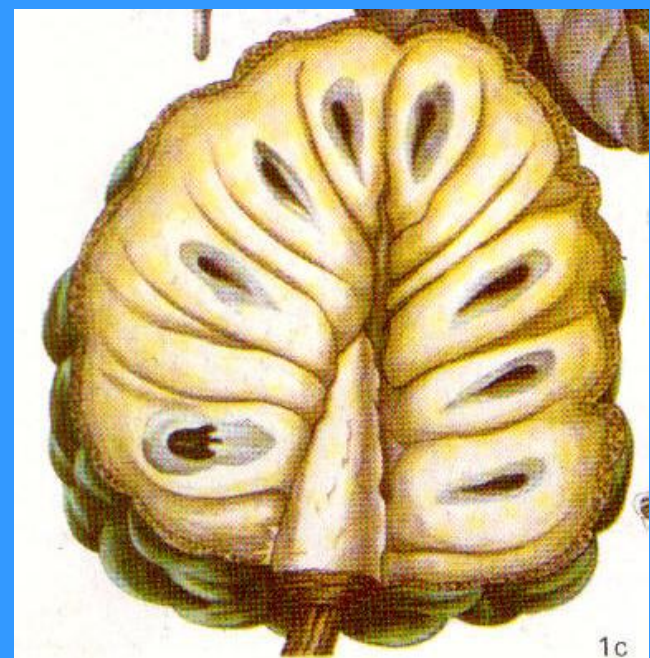


ANNONACEAE
frutos

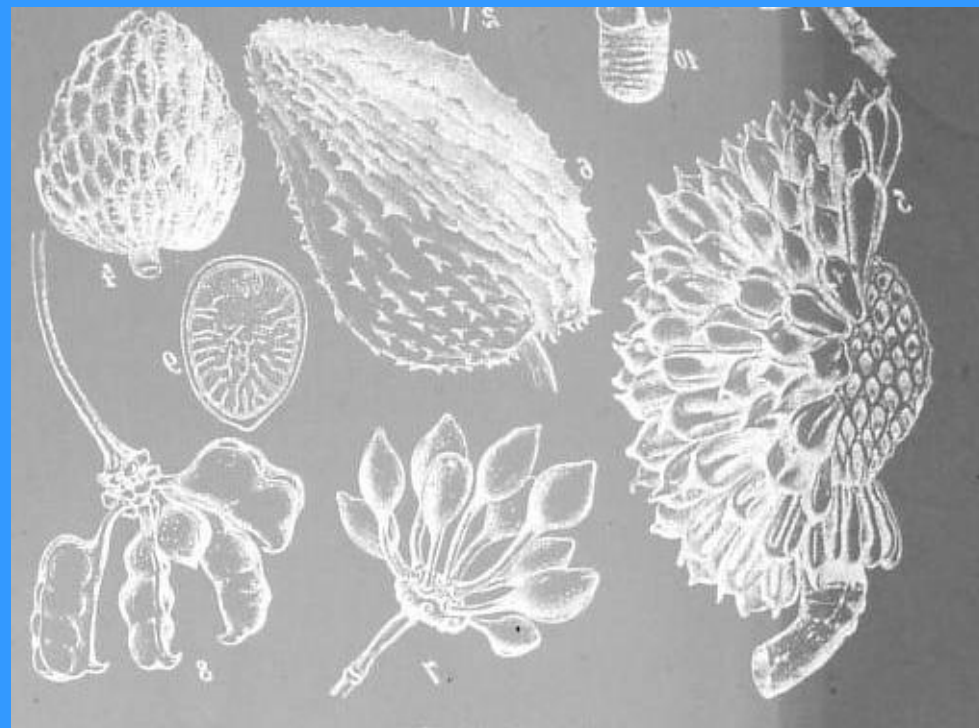




Annona muricata



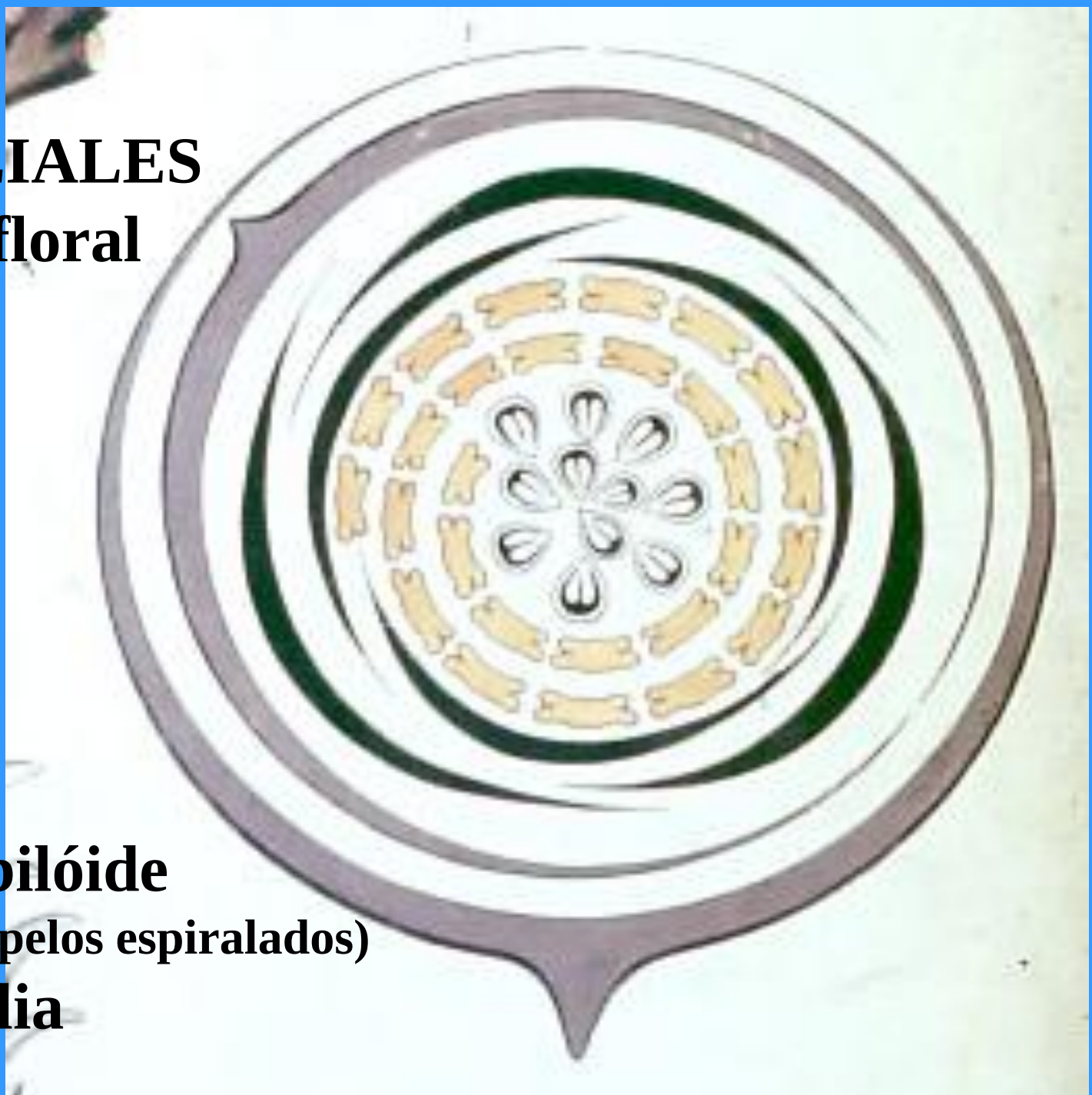
1c



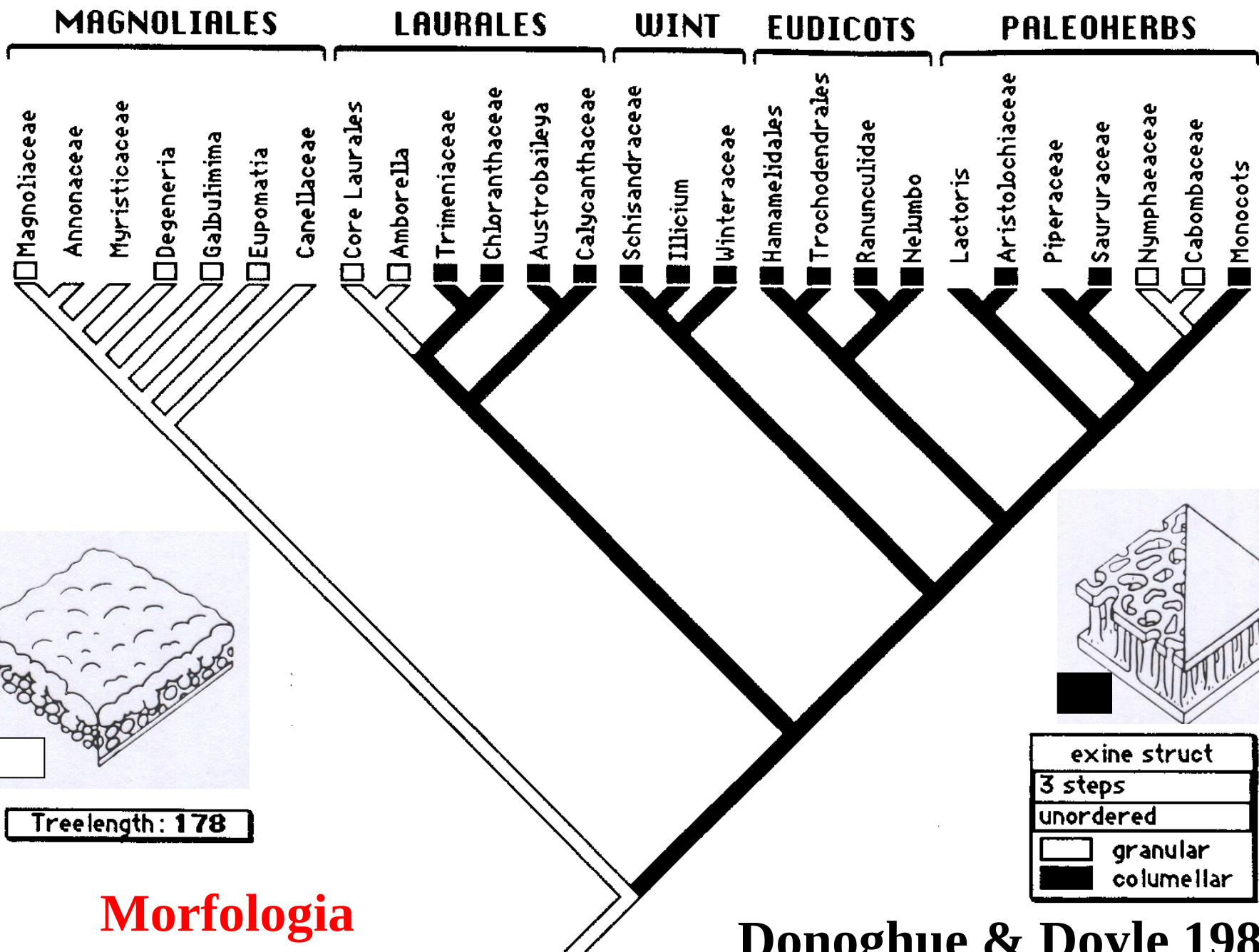
Duguetia marcgraviana

MAGNOLIALES

diagrama floral

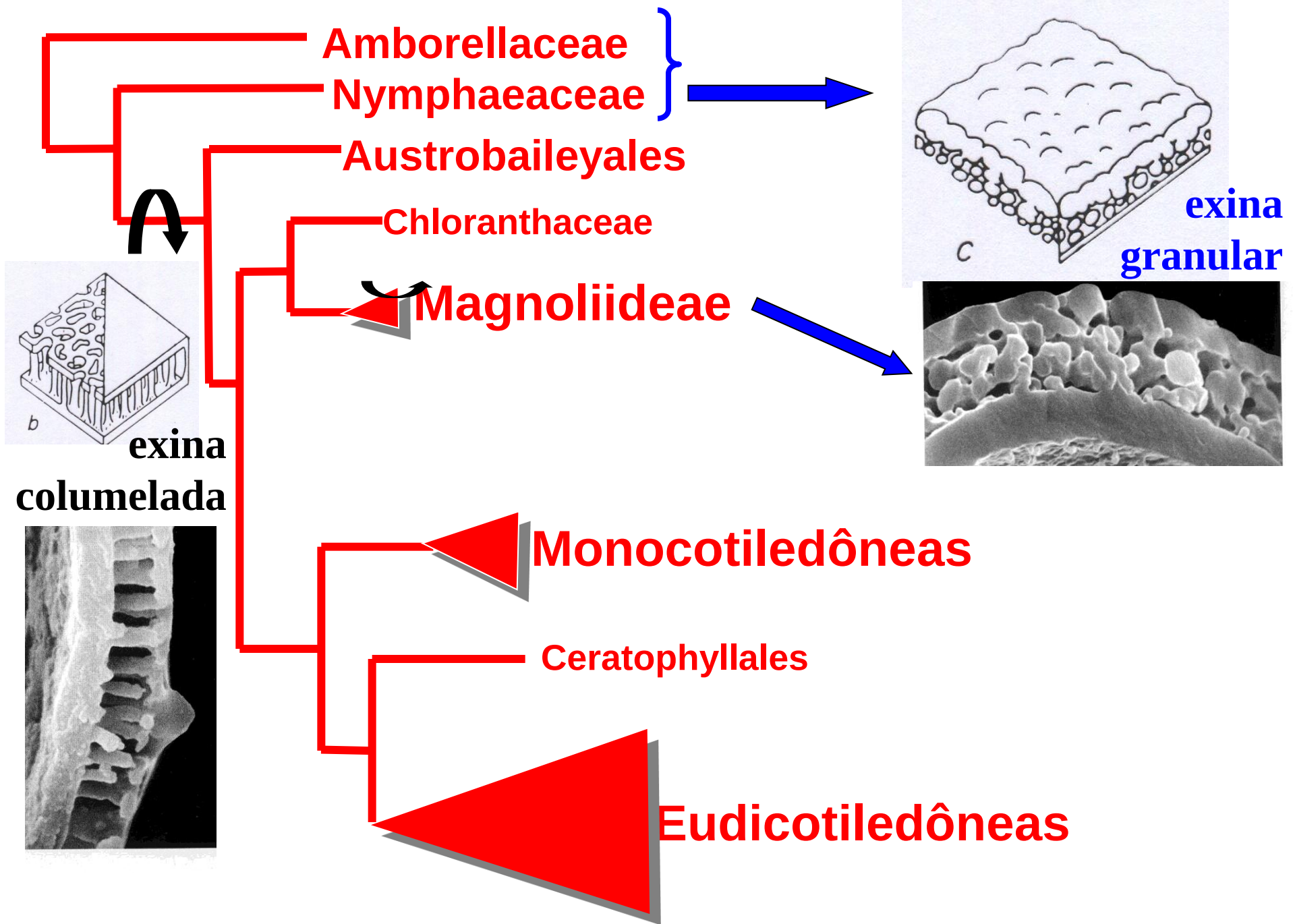


- flor estrobilóide**
(estames e carpelos espiralados)
- cantarofilia**

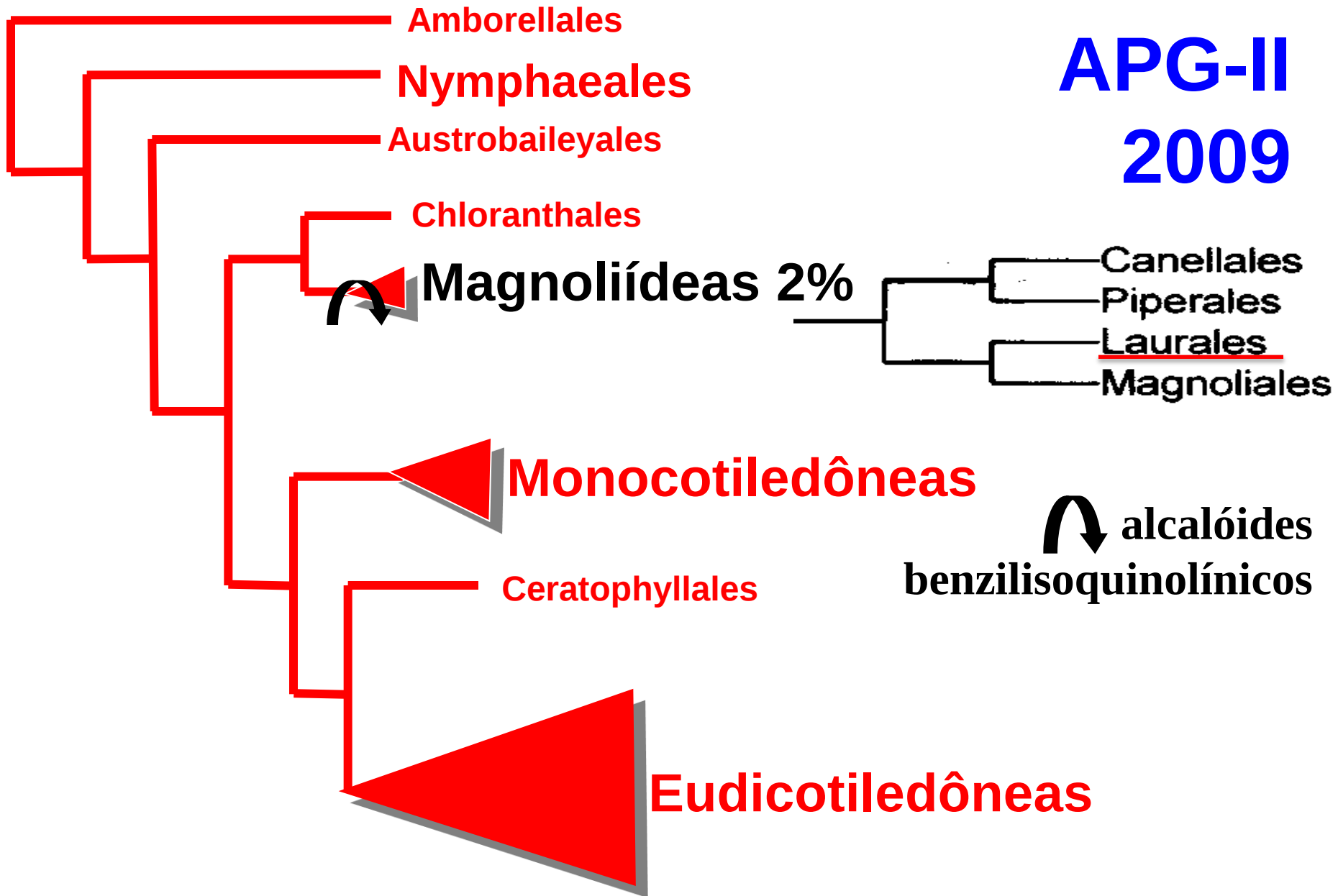


Morfologia

Donoghue & Doyle 1989



APG-II 2009



www.mobot.org/MOBOT/research/APweb

(Stevens 2010)

LAURALES

7 famílias

2850 spp.

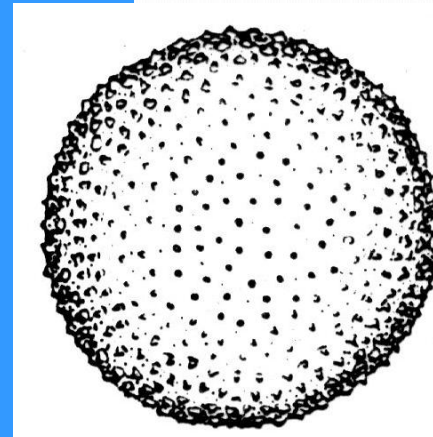
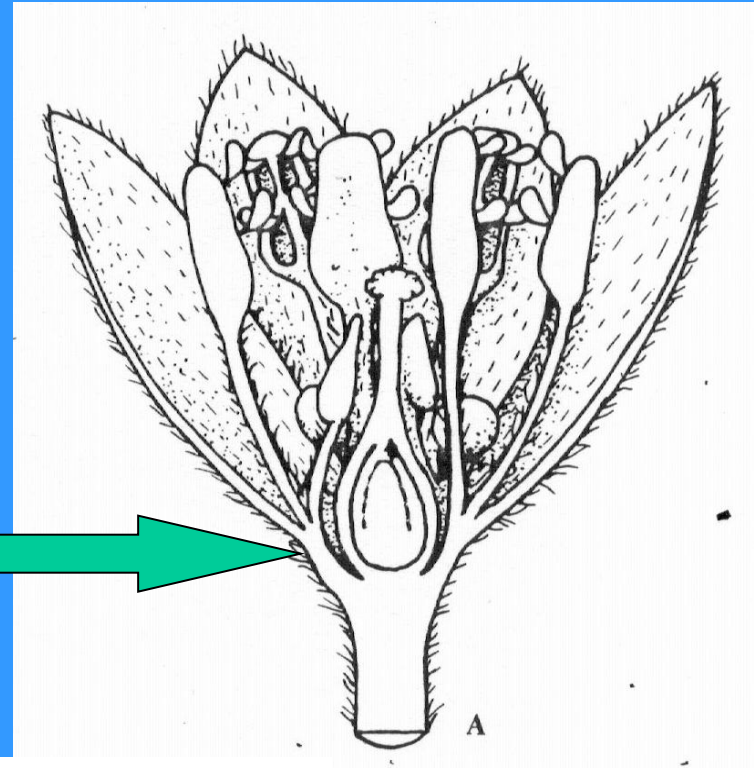
Novidades evolutivas:

Hipanto

(flores períginas a epíginas)

Estaminódios

Pólen inaperturado

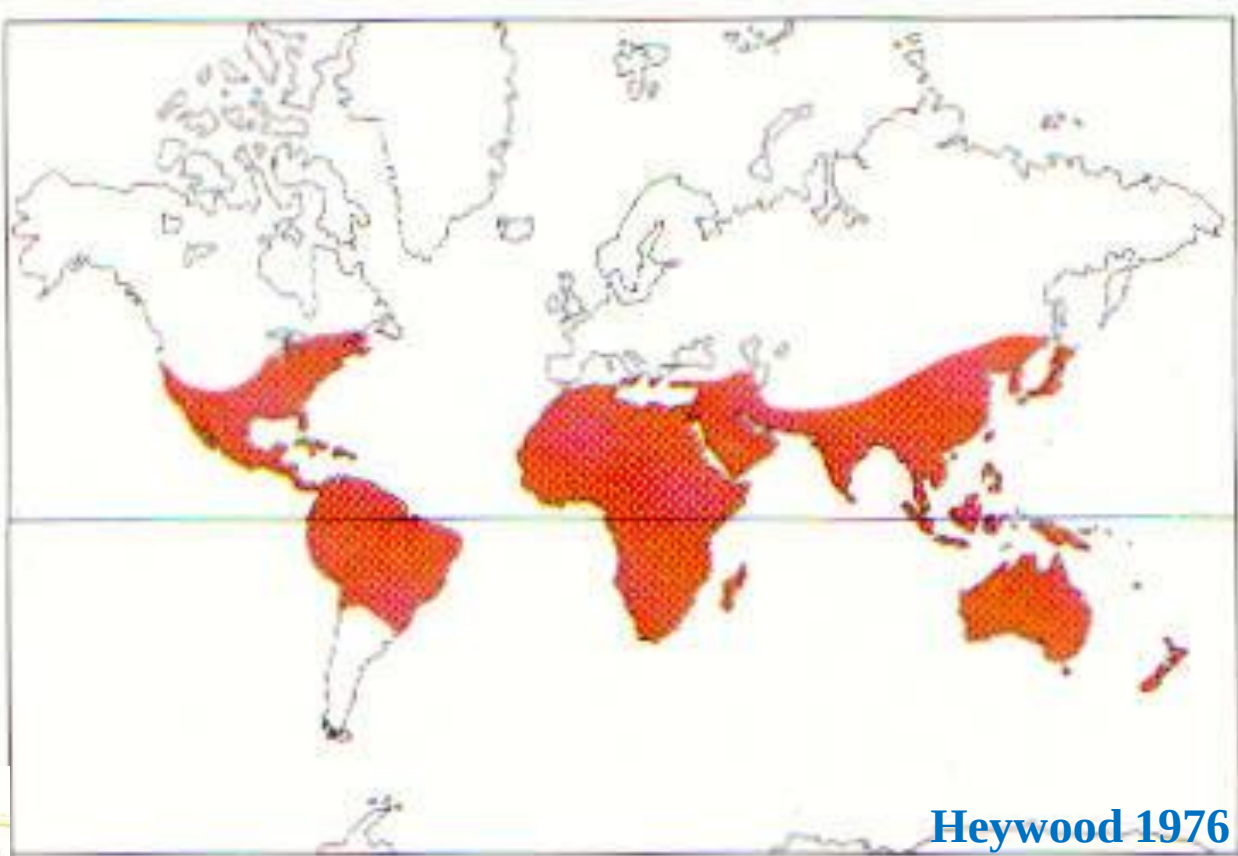


*Cinnamomum
camphora*
Erdtman 1952

LAURALES

LAURACEAE

2500 spp.



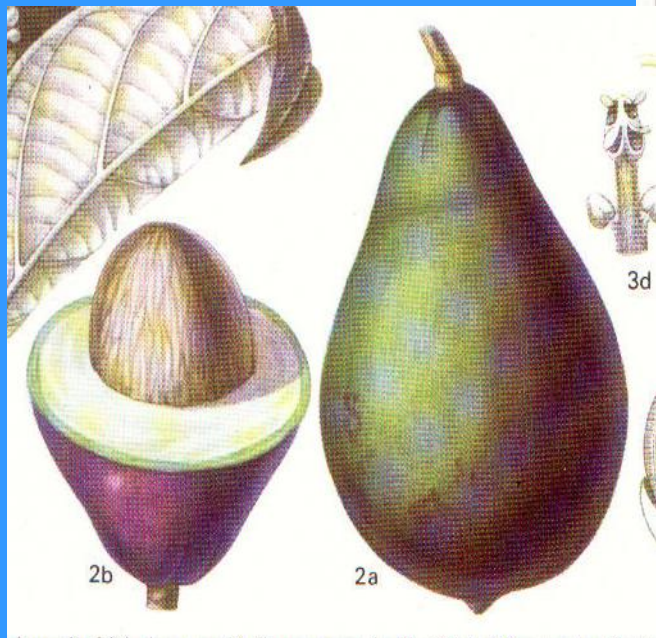
Heywood 1976

Number of genera: about 32

Number of species: about 2,500

Distribution: tropics and subtropics, centered in SE Asia and Brazil.

Economic uses: avocado, cinnamon, camphor, sassafras oil, bay leaves, timber, and some ornamental species.





Cinnamomum



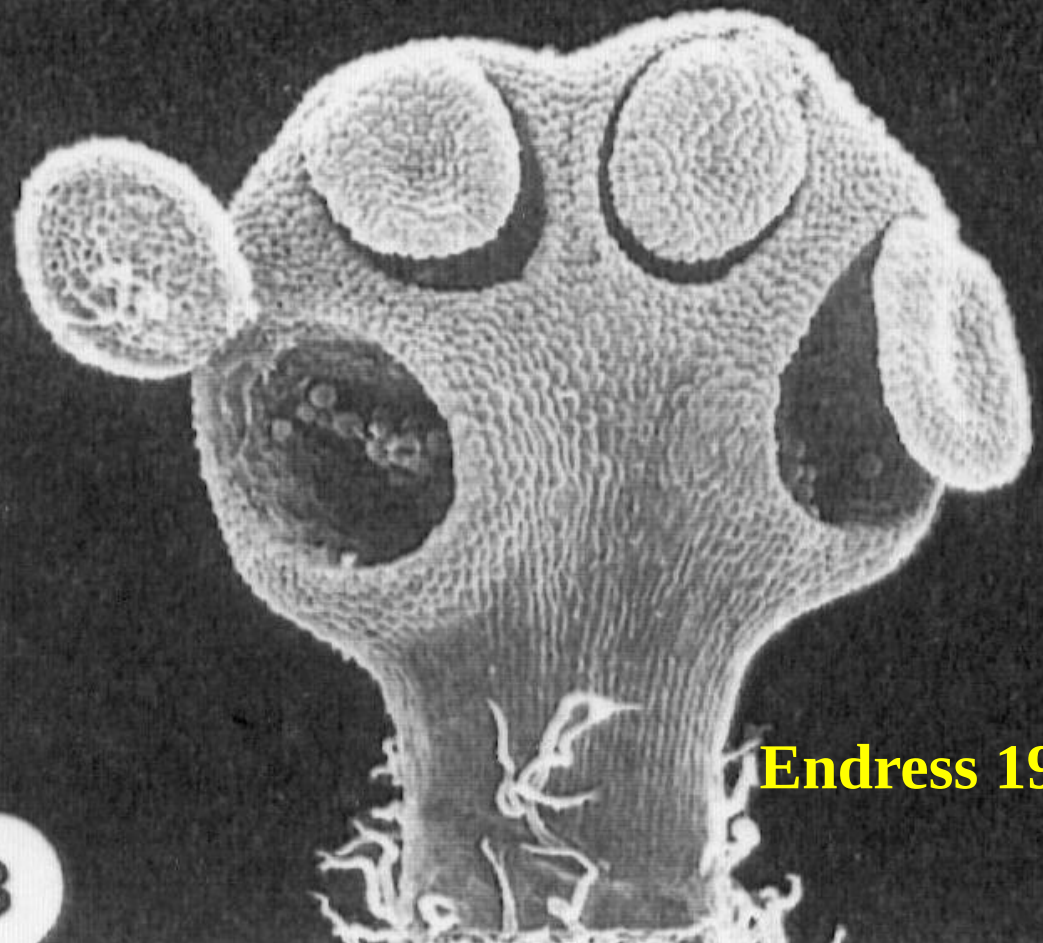
LAURACEAE



Umbellularia

LAURACEAE

Cinnamomum camphora



Endress 1994

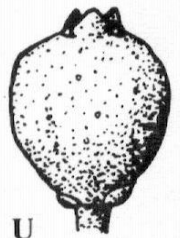
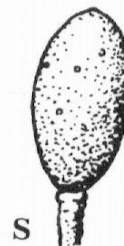
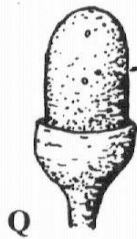
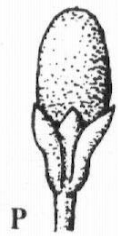
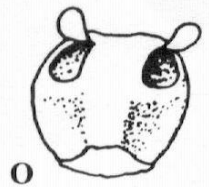
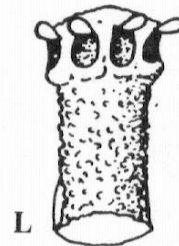
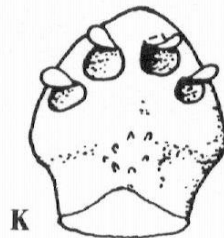
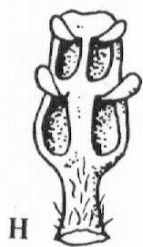
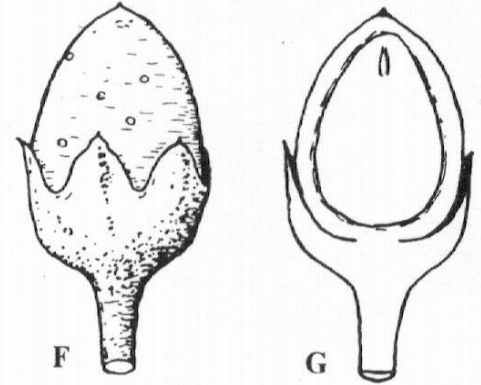
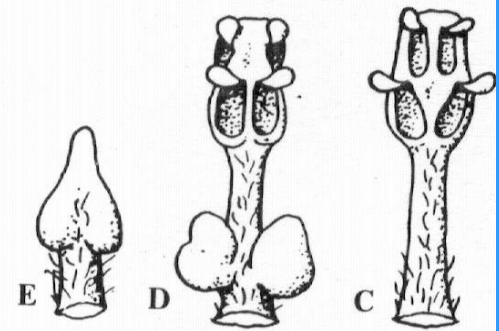
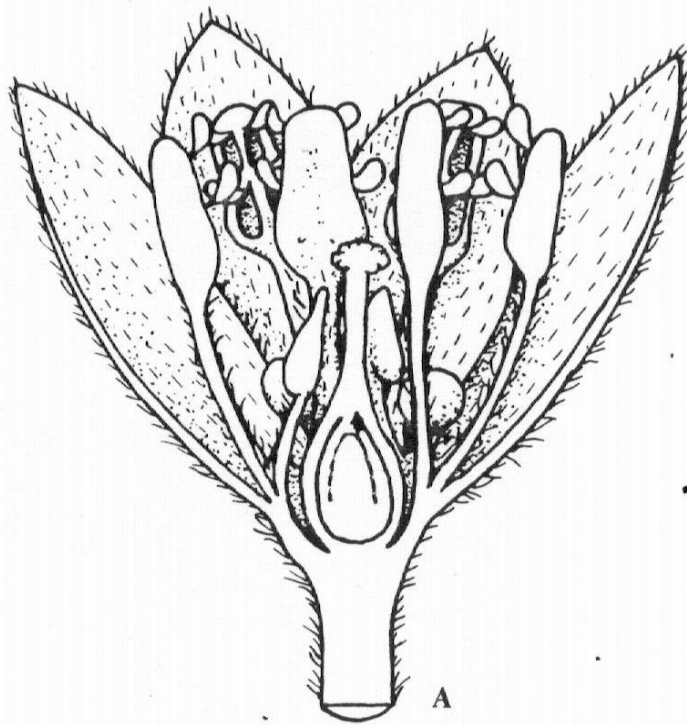
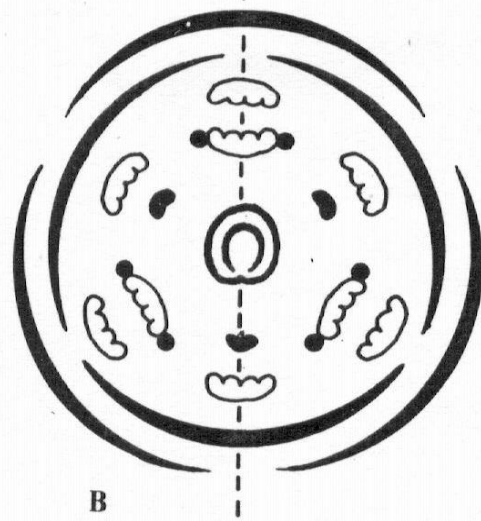


Sassafras



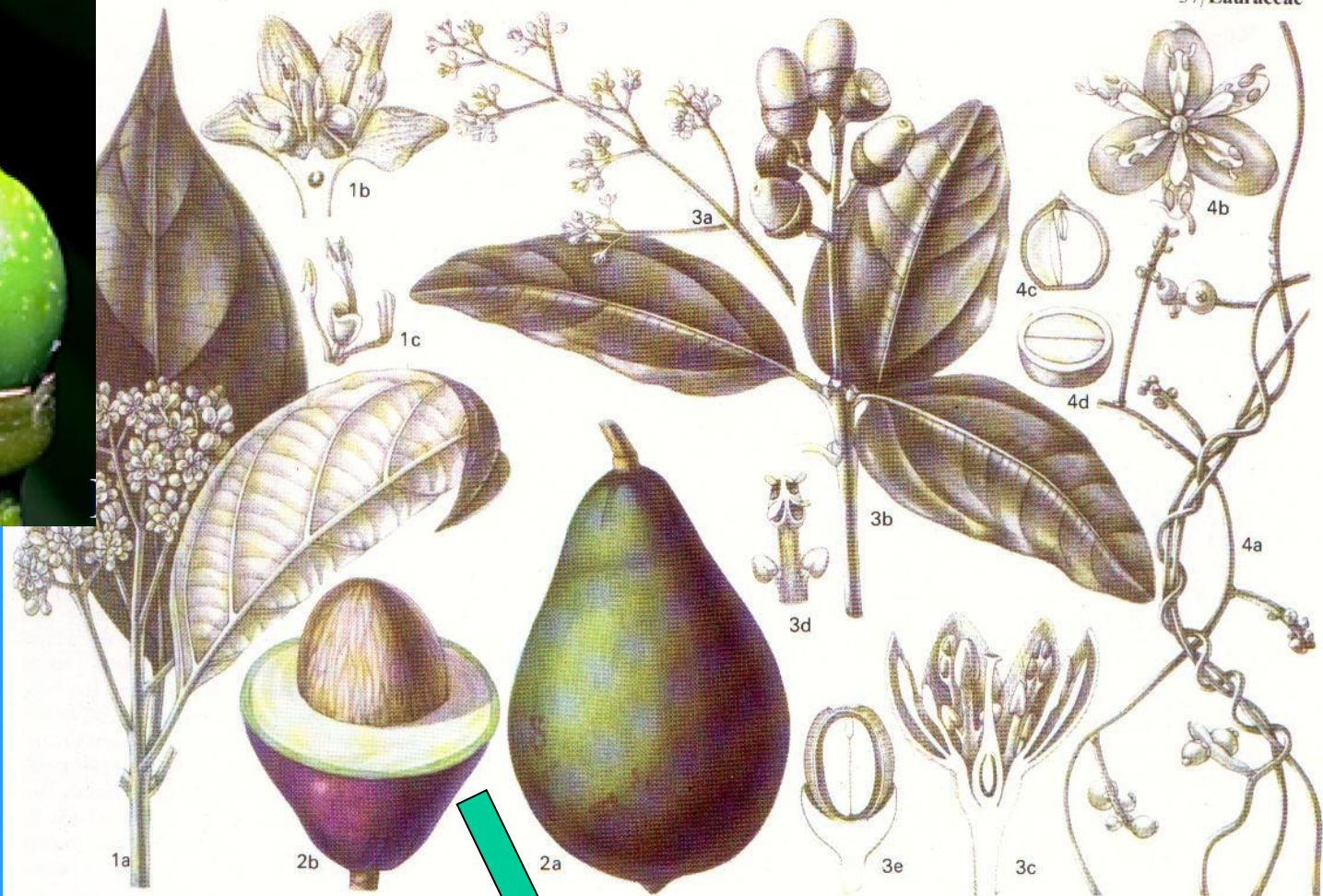
Umbellularia

LAURACEAE



Cinnamomum zeylanicum
Lauraceae
Gerald D. Carr

Cinnamomum



Lauraceae. 1 *Hypodaphnis zenkeri* (a) shoot and inflorescence ($\times \frac{2}{3}$); (b) half flower ($\times 4$); (c) stamen from second whorl, two from third whorl and gland ($\times 4$). 2 *Persea gratissima* (avocado) fruit (a) entire and (b) cut away to reveal hard seed ($\times \frac{2}{3}$). 3 *Cinnamomum litseifolium* (a) inflorescence ($\times \frac{2}{3}$); (b) shoot with fruits enclosed in fleshy cupules ($\times \frac{2}{3}$); (c) half flower showing introrse and extrorse dehiscence of anthers ($\times 8$); (d) stamen with glandular bases and anthers dehiscing by flaps ($\times 2$); (e) half flower ($\times 1$). 4 *Cassytha filiformis* (a) habit of this parasitic plant ($\times \frac{2}{3}$); (b) flower from above ($\times 8$); fruit in vertical (c) and cross (d) section ($\times 2$).

Persea

LAURACEAE

Heywood 1974

Ocotea

LAURALES LAURACEAE

Cassytha

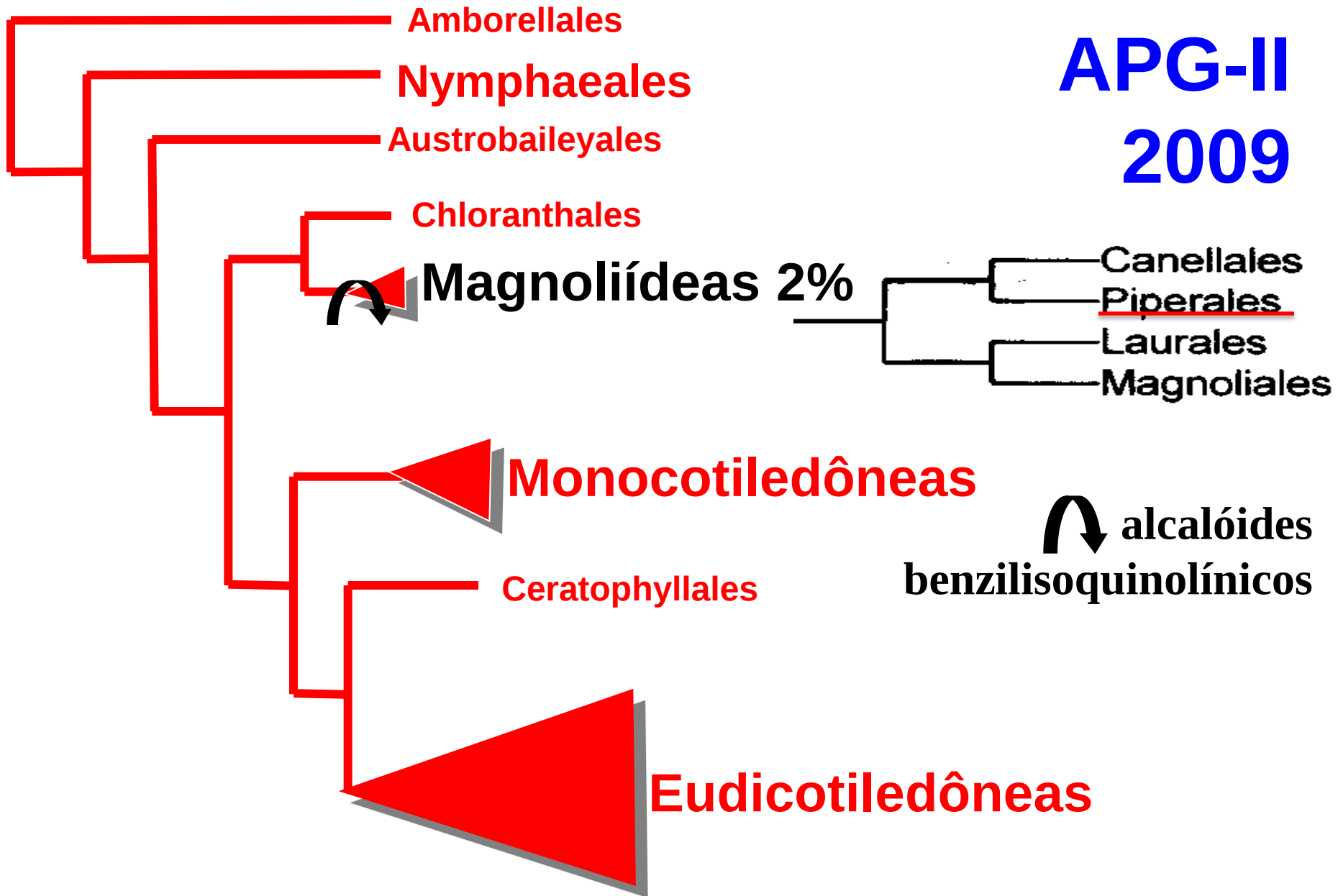
Cassytha filiformis
Lauraceae
G. K. Linney



Cassytha filiformis
Lauraceae
R. L. Stemmermann



APG-II 2009

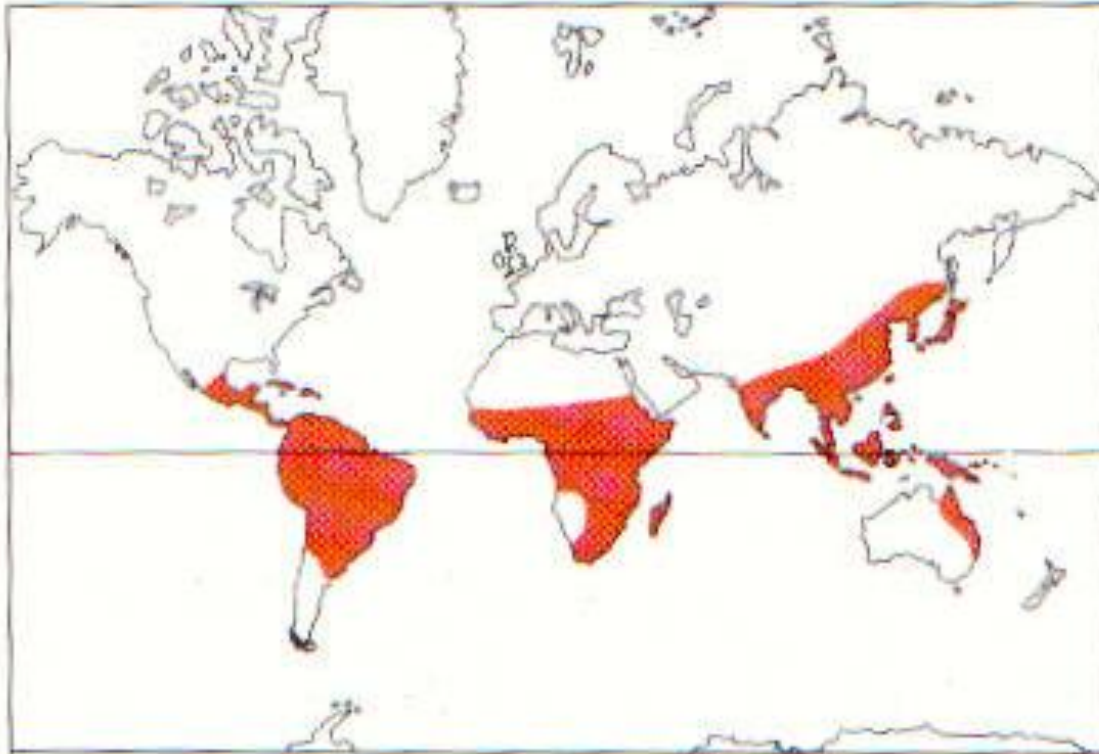


www.mobot.org/MOBOT/research/APweb

(Stevens 2010)

PIPERACEAE

Pepper and Kava



Heywood 1976

Number of genera: about 5

Number of species: about 2,000

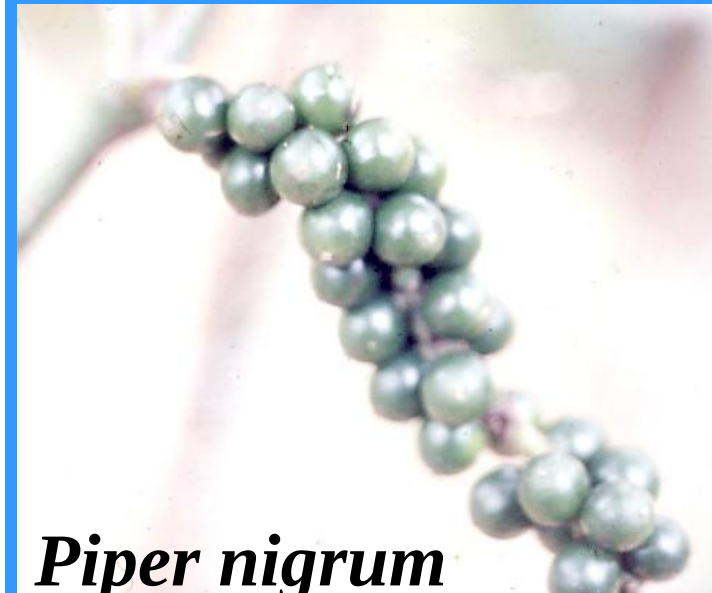
Distribution: pantropical, frequently in rain forests.

Economic uses: pepper and kava.

PIPERALES

4 famílias

4090 spp.



Piper nigrum

Novidade evolutiva:
câmbio pouco ativo
(lianas ou ervas)



Piper mythisticum
Piperaceae
© G. D. Carr



Piper methysticum
Piperaceae
© G. D. Carr



Piper methysticum
Piperaceae
© G. D. Carr

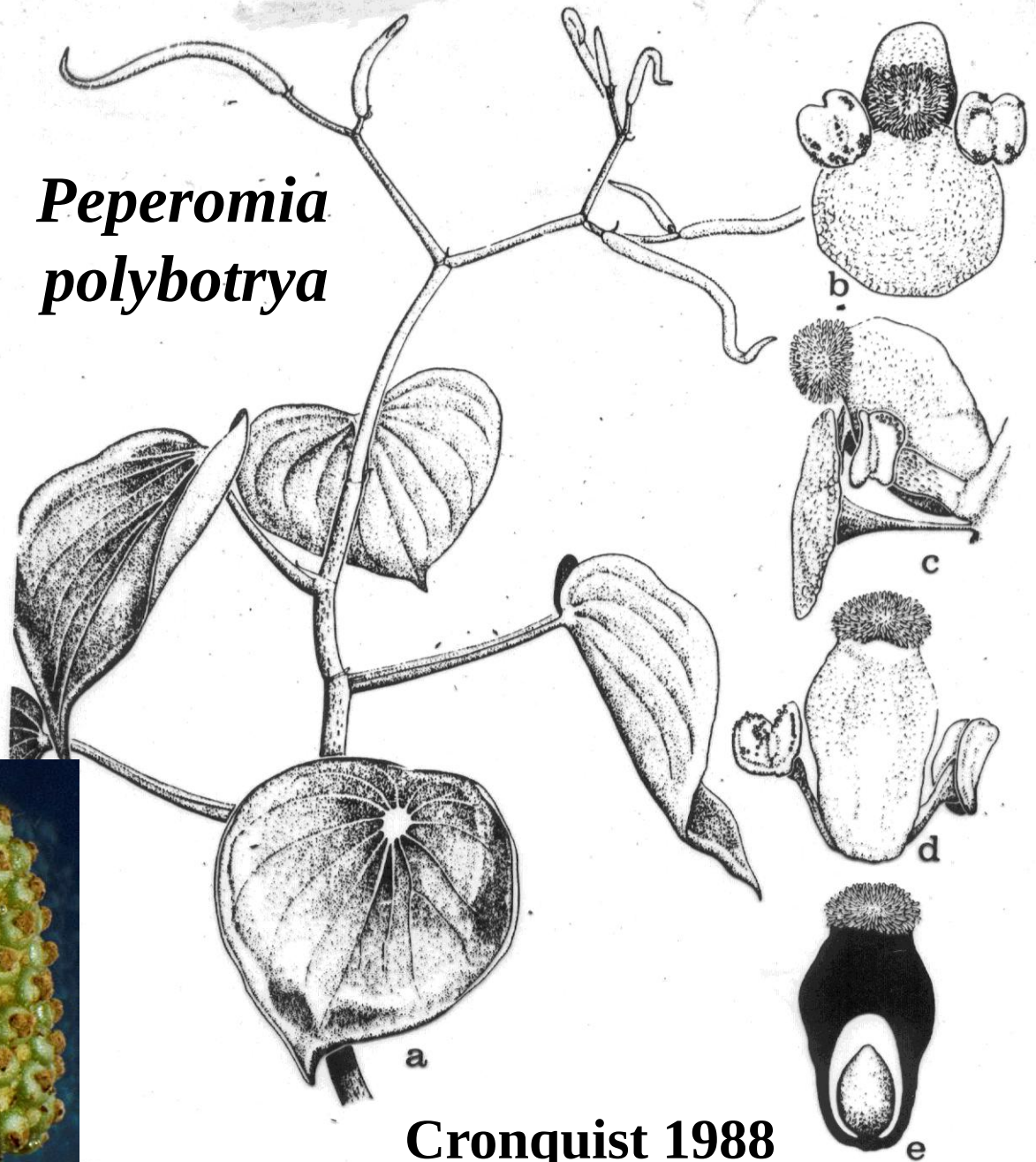
PIPERALES PIPERACEAE

Piper

**PIPERALES
PIPERACEAE**

*Peperomia
polybotrya*

Piper



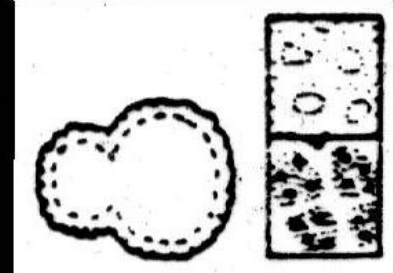
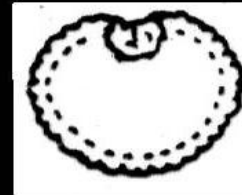
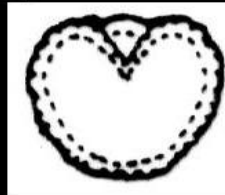
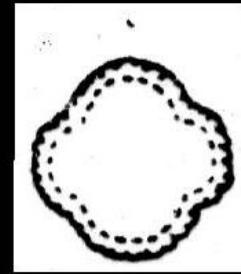
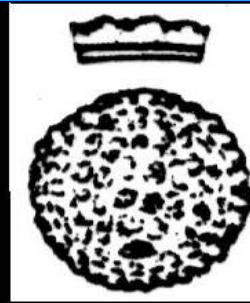
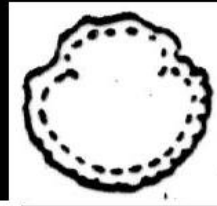
Cronquist 1988



PIPERACEAE

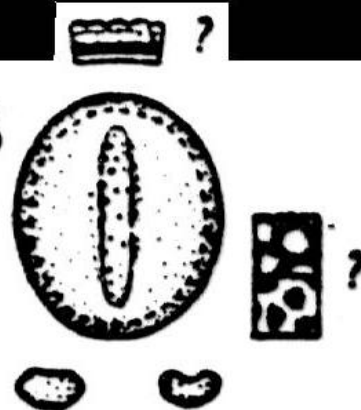
A. Peperomia

A

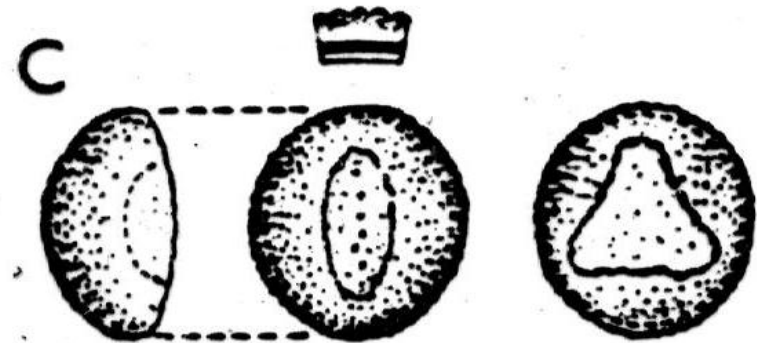


B. Heckeria

B



C



C. Piper

PIPERACEAE

polinização

Figueiredo & Sazima
2000

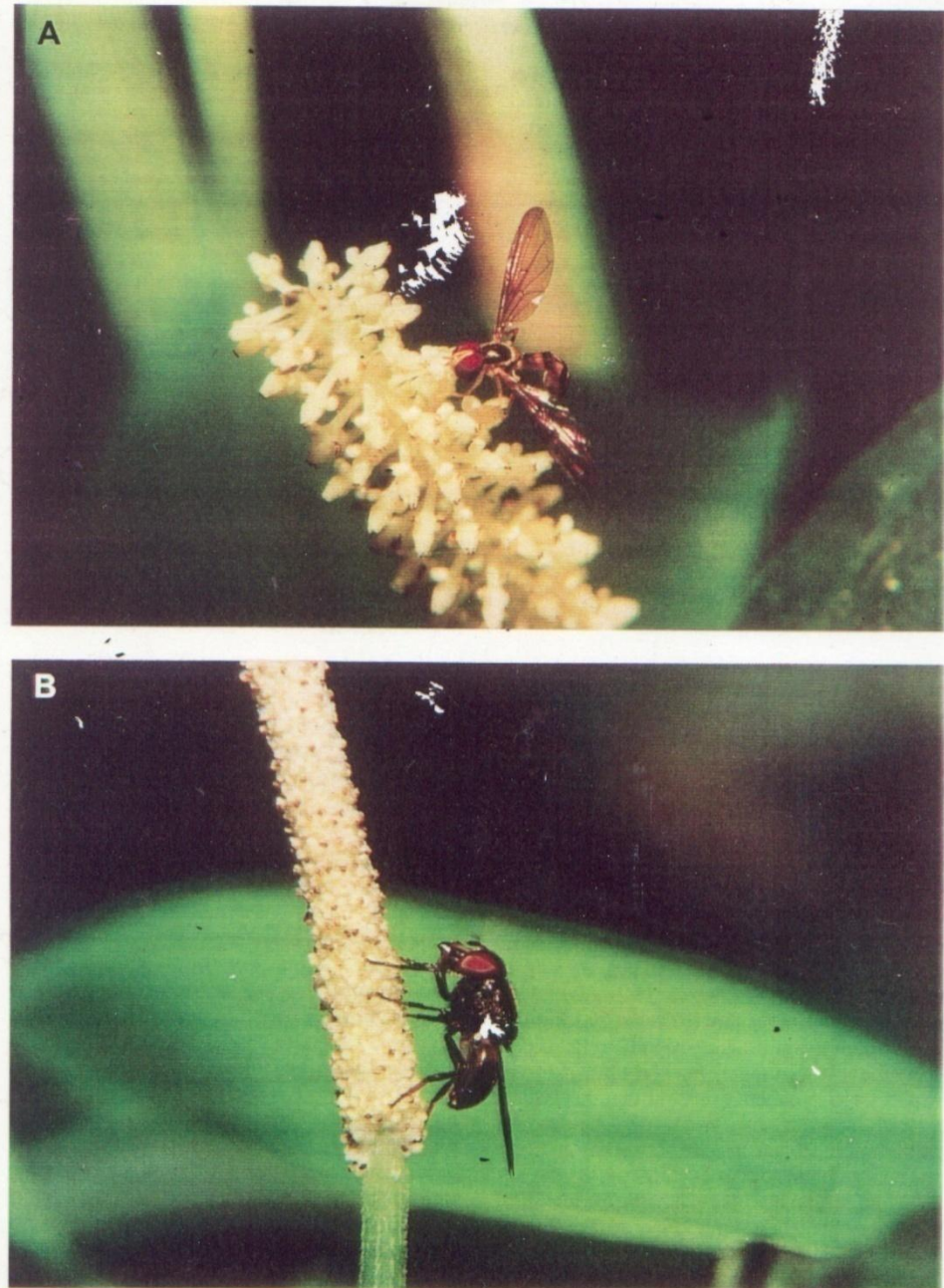


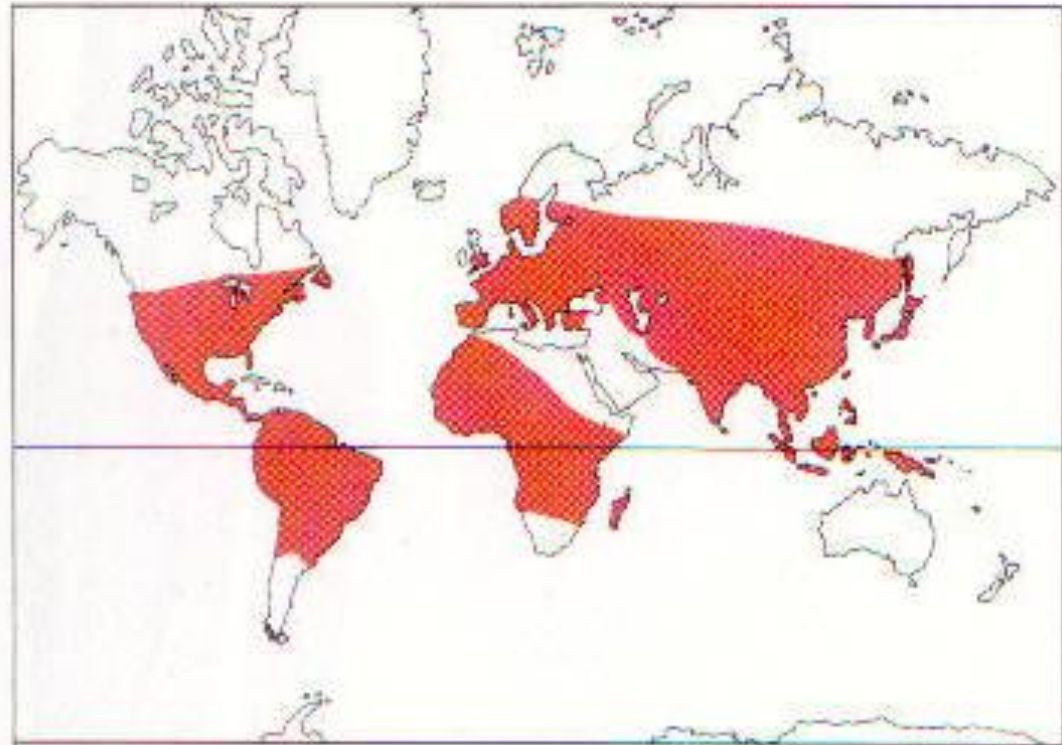
FIG. 2. A, Inflorescence of *Ottonia martiana* showing its minute flowers. A small hoverfly, *Ocyptamus* sp. (Diptera: Syrphidae), length approx. 8 mm, is visiting the inflorescence. B, *Copestylum tripunctatum* (Syrphidae), 15 mm in length, visiting a hermaphrodite inflorescence.

PIPERALES



ARISTOLOCHIACEAE

Aristolochias and Asarums



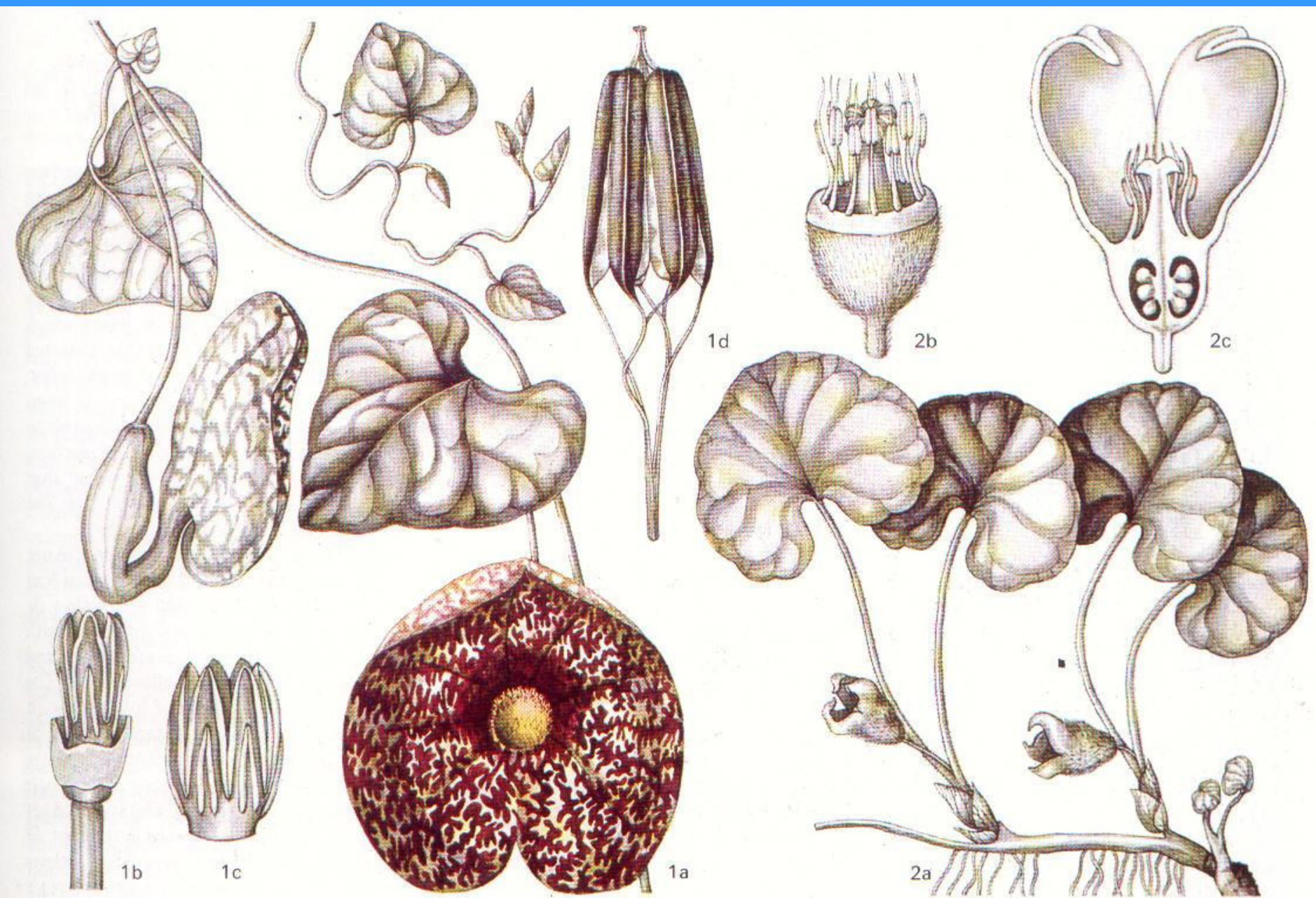
Number of genera: 7

Number of species: about 625

Distribution: tropical and temperate Asia, Africa, Europe, N & S America; usually in forests, often woody lianas.

Economic uses: floriculture.

Heywood 1976



ARISTOLOCHIACEAE

Heywood 1976

Megaselia Phoridae



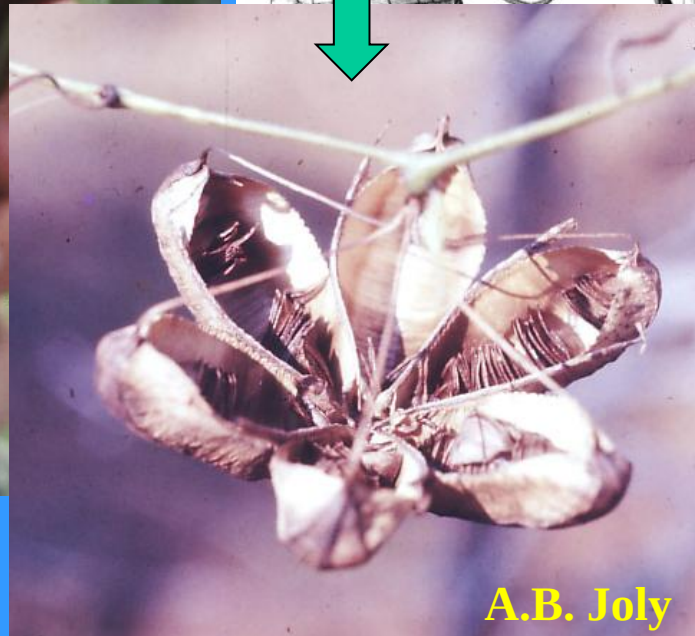
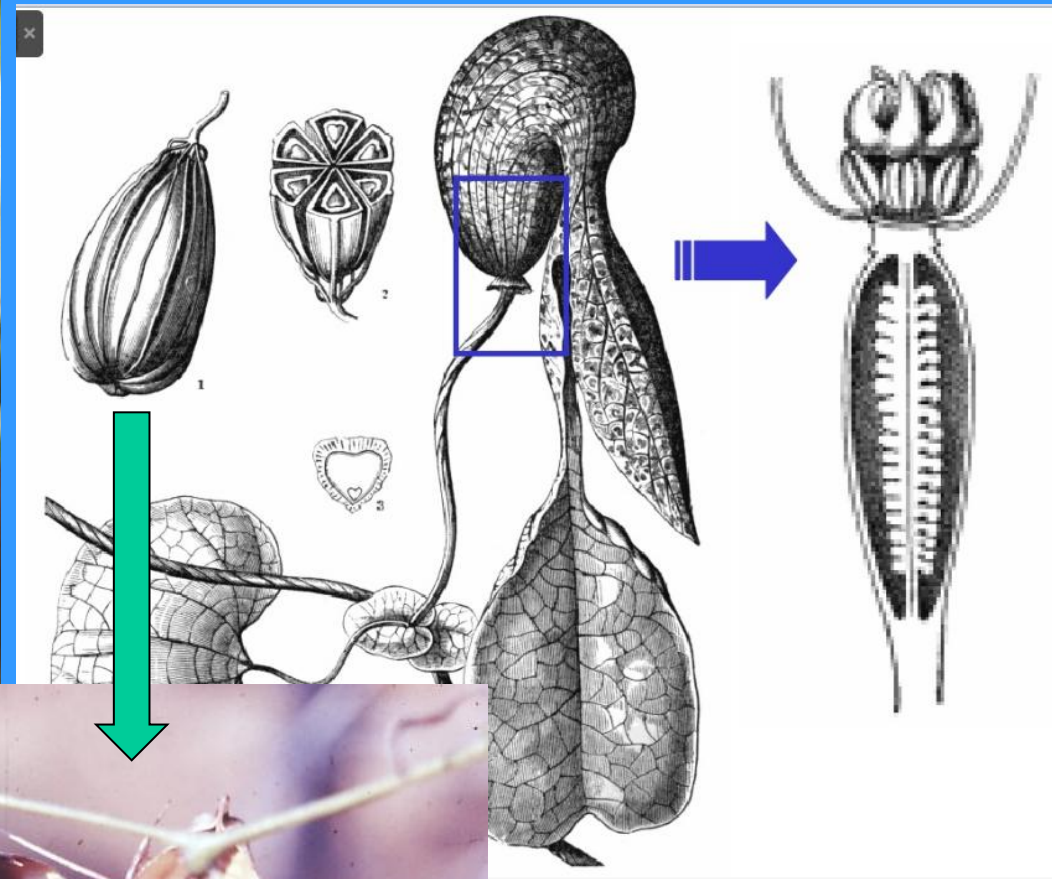
PIPERALES - ARISTOLOCHIACEAE

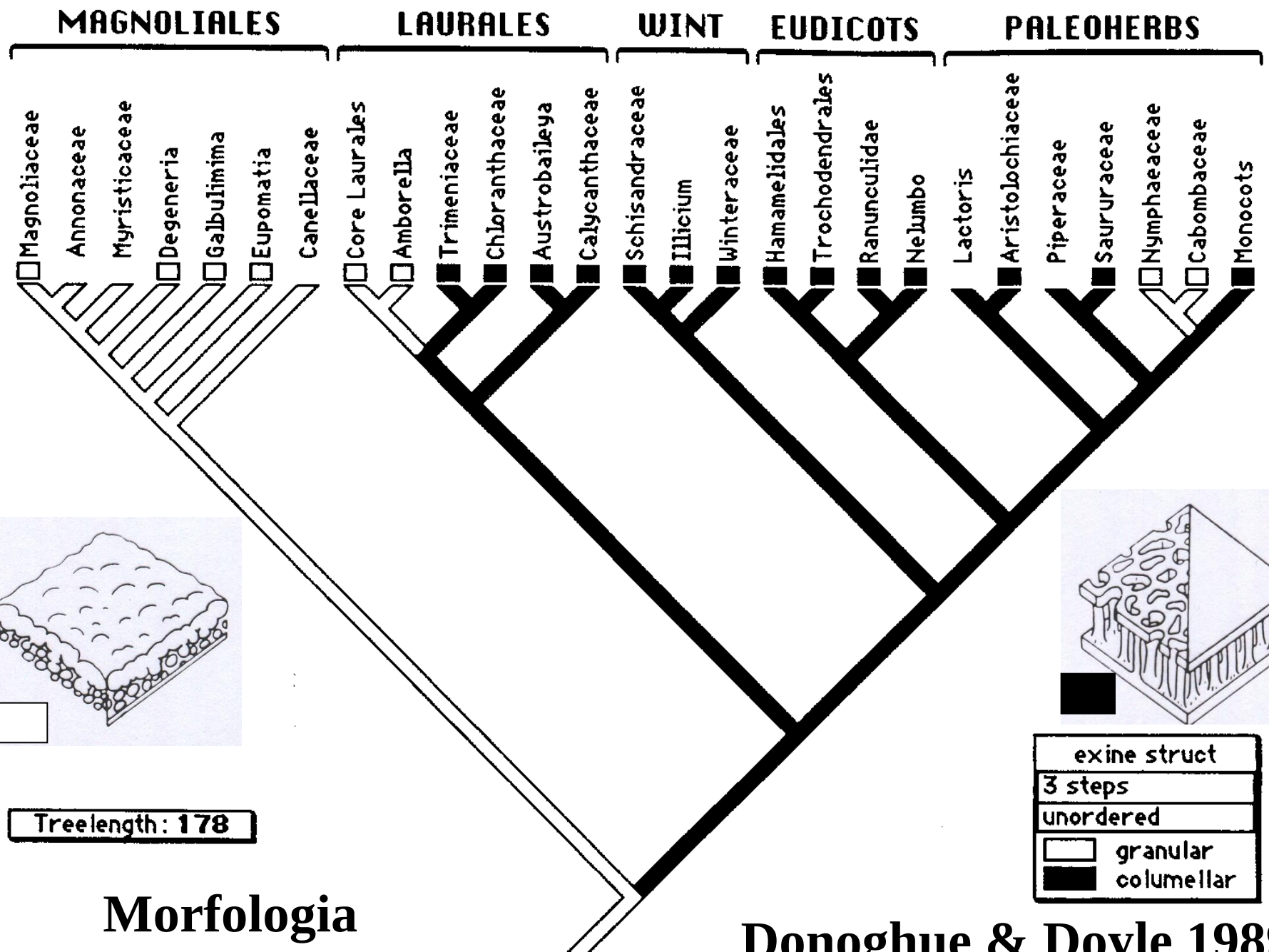


*Aristolochia
gigantea*

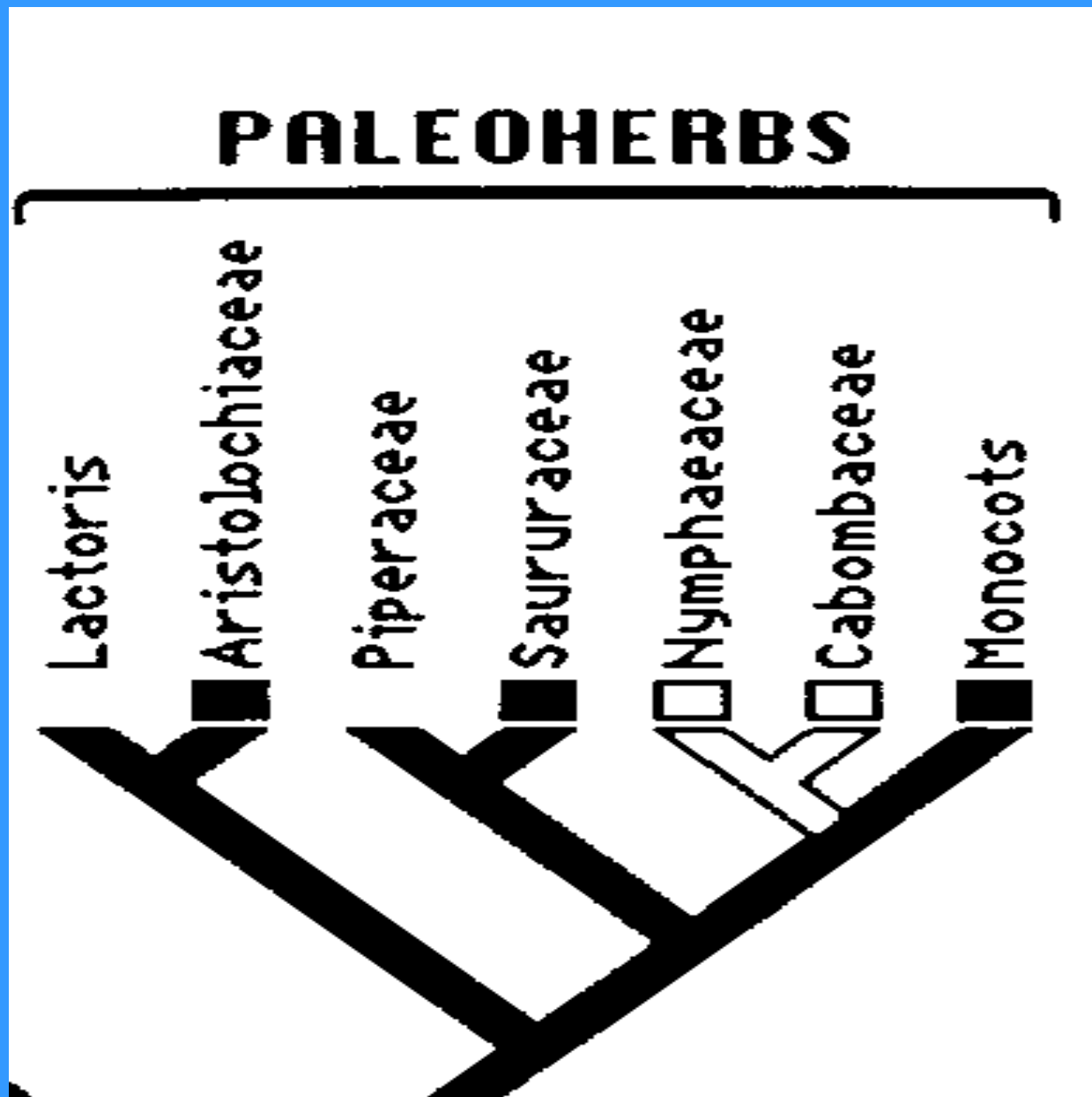


ARISTOLOCHIACEAE



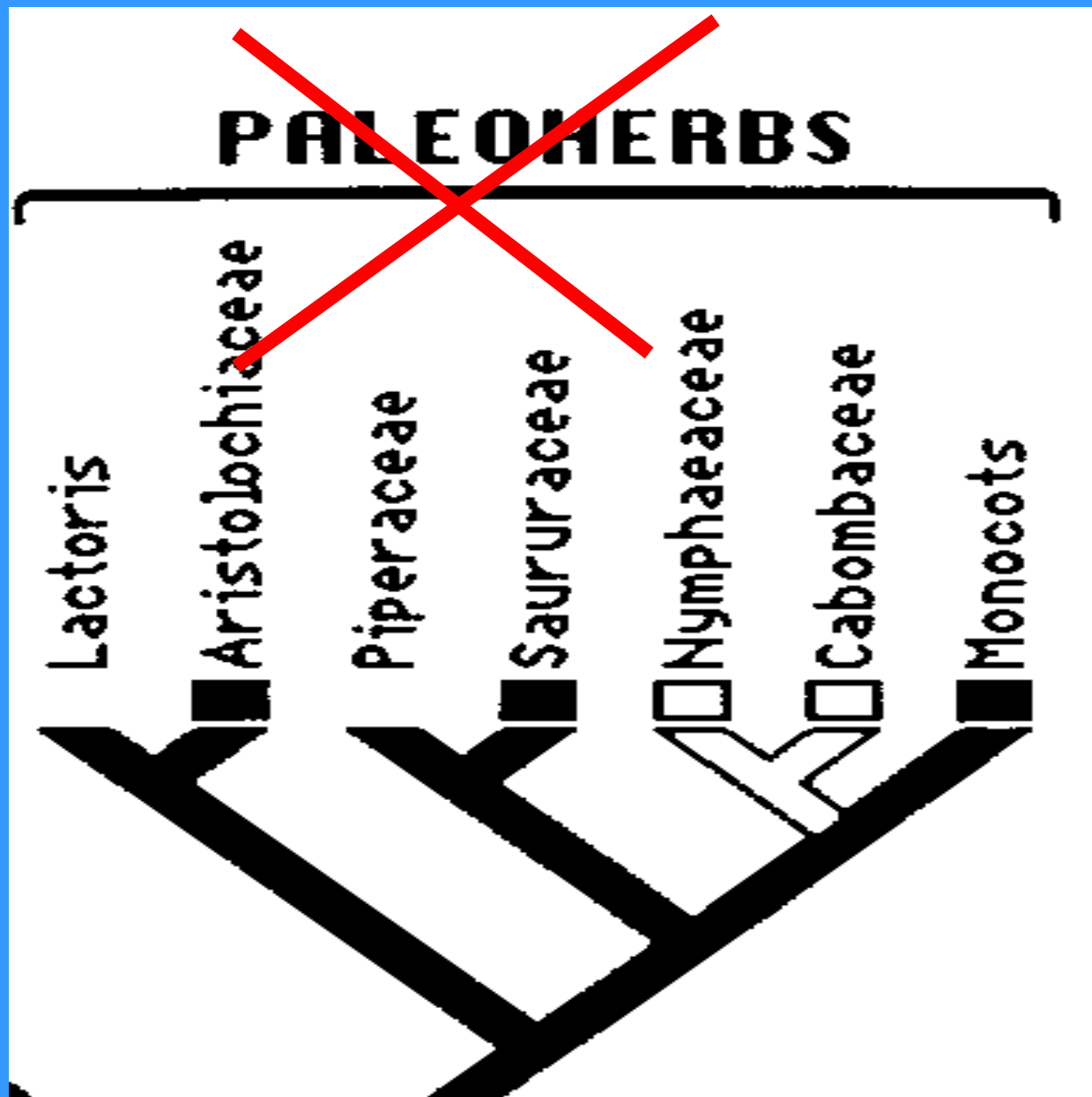


Donoghue & Doyle 1989



Morfologia

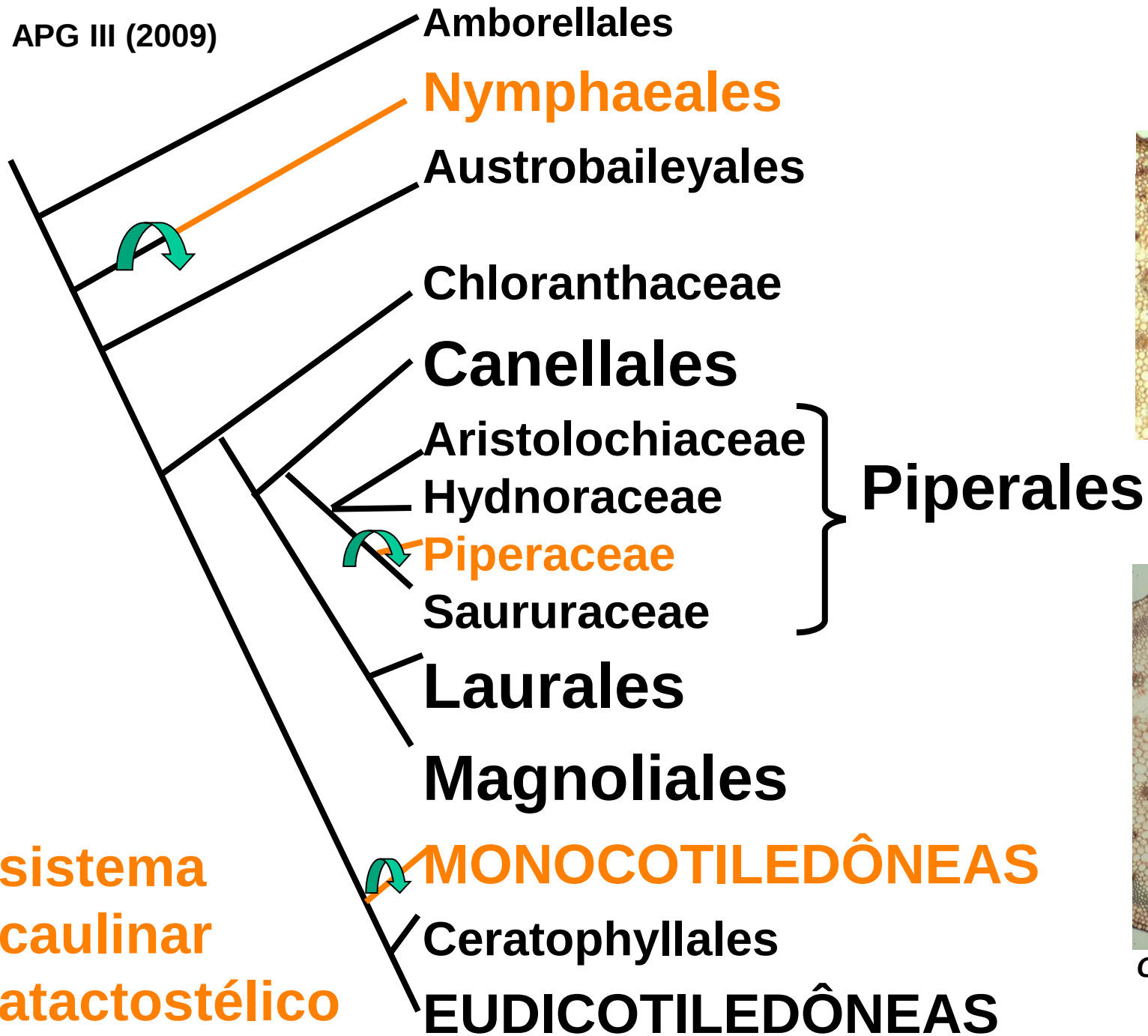
Donoghue & Doyle 1989



Morfologia

Donoghue & Doyle 1989

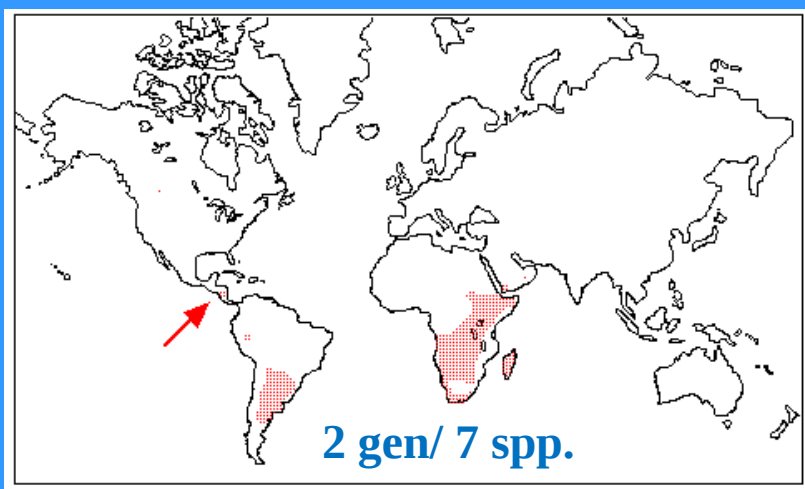
APG III (2009)



Piper



Chlorophytum



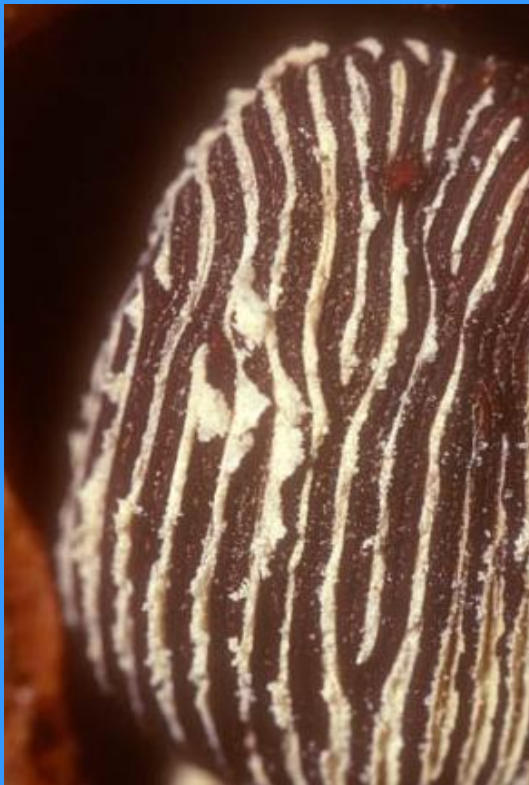
© 1997 Barry Hammel

Prosopanche

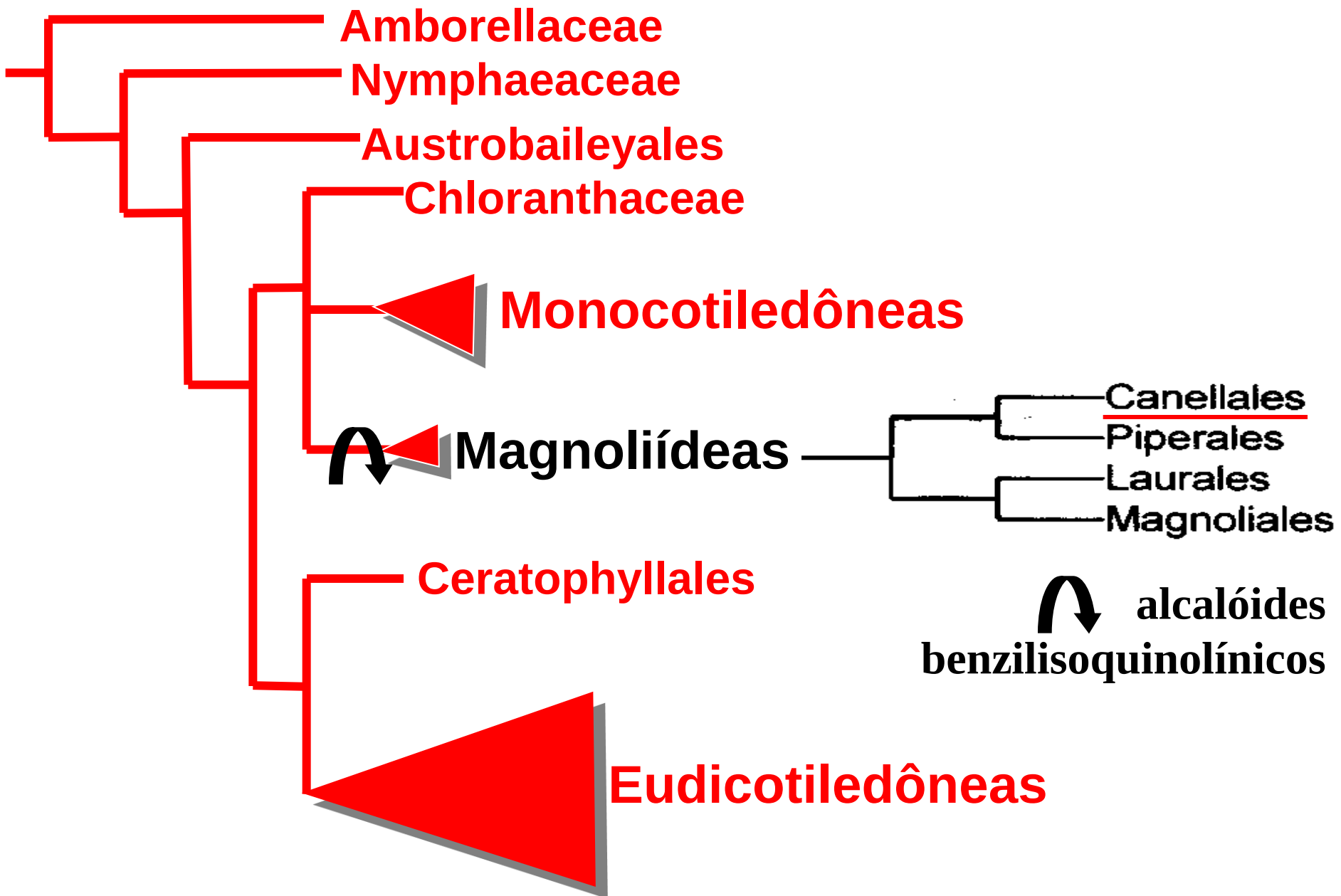


HYDNORACEAE

Prosopanche



Hydnora africana



CANELLALES - 2 fam. 93 spp. - sinapom.= K e C distintos

WINTERACEAE

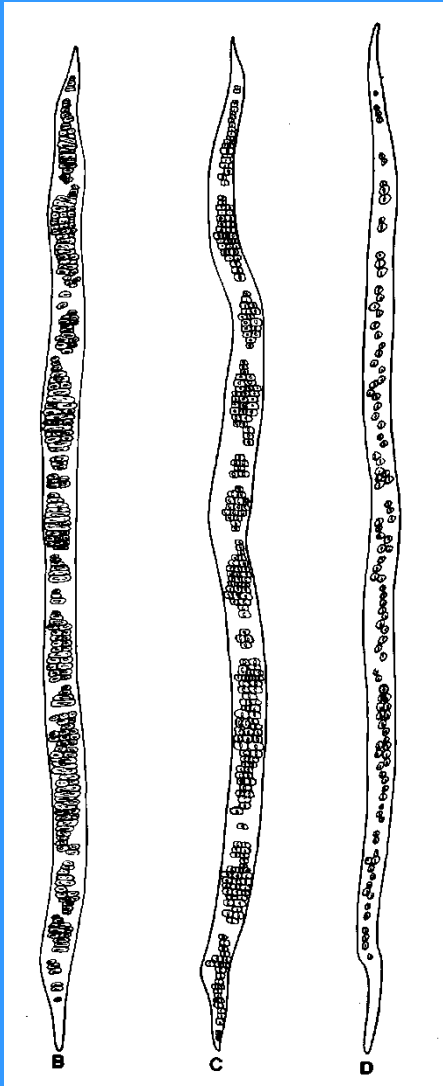
Drymis



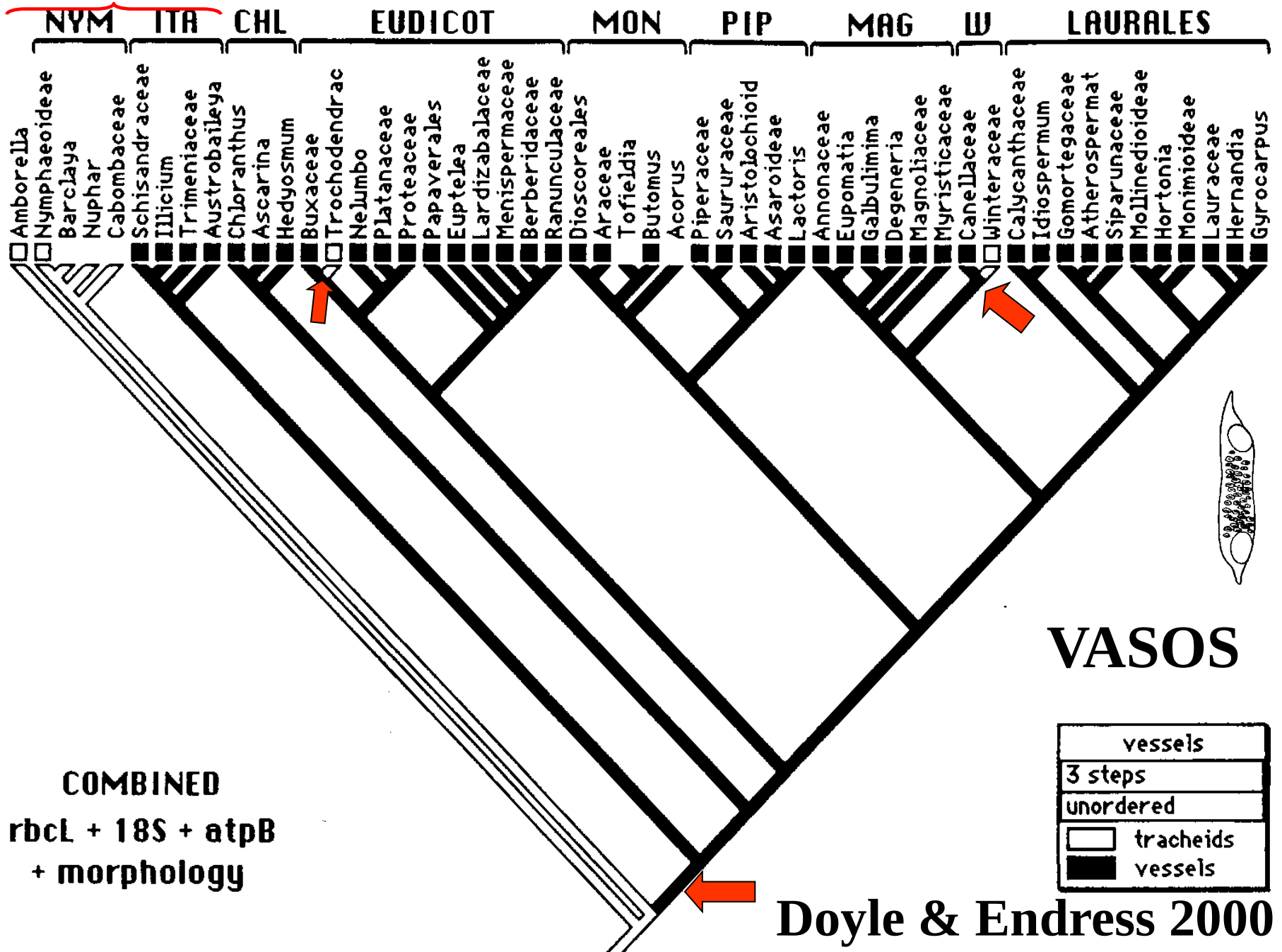
A.B. Joly



Judd et al. 2002 plant systematics



ANITA



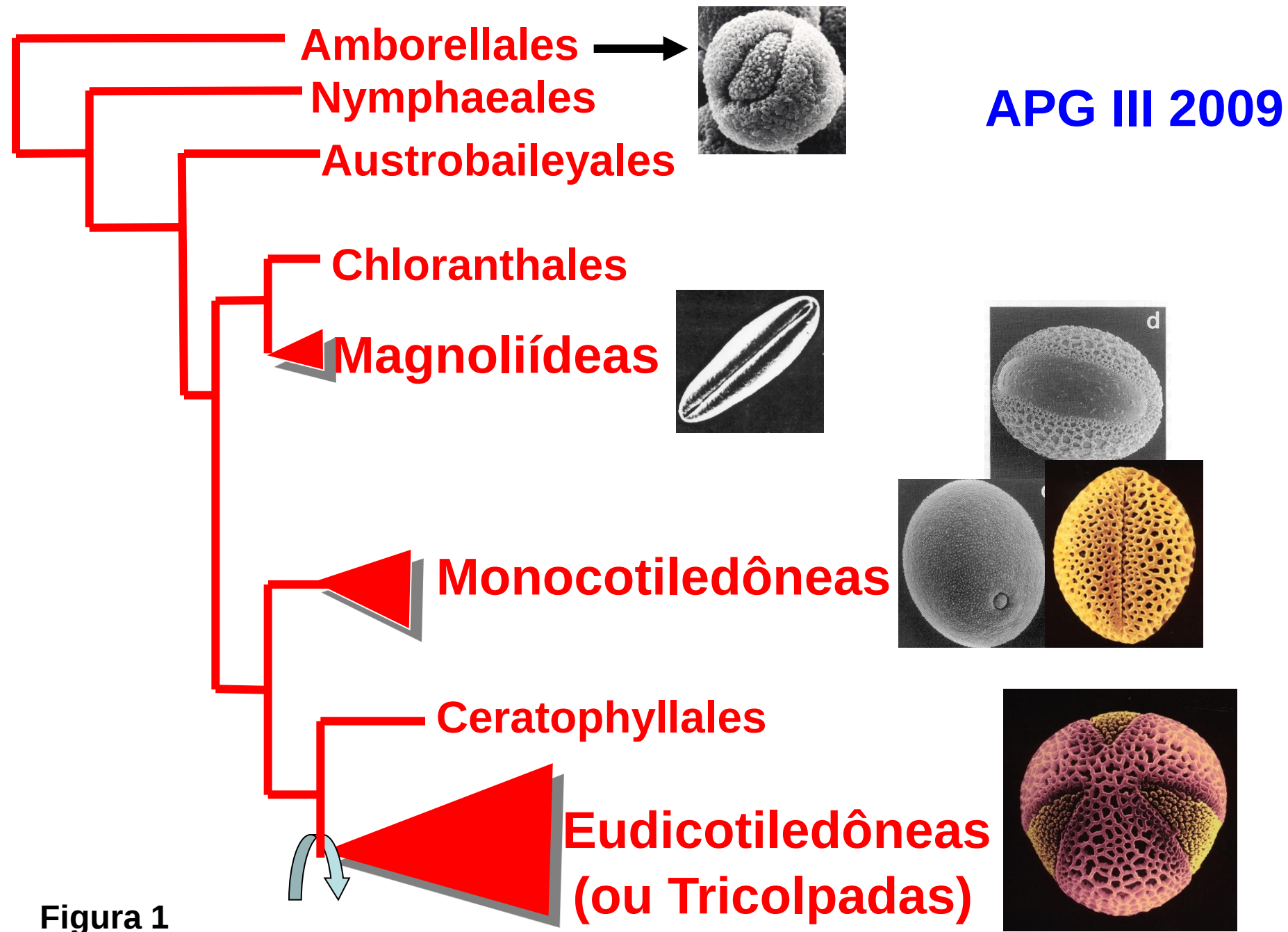


Figura 1

**APGIII
2009**

Amborellales

Nymphaeales

Austrobaileyales



Chloranthaceae

Magnoliídeas



Monocotiledôneas



Ceratophyllales

Eudicotiledôneas

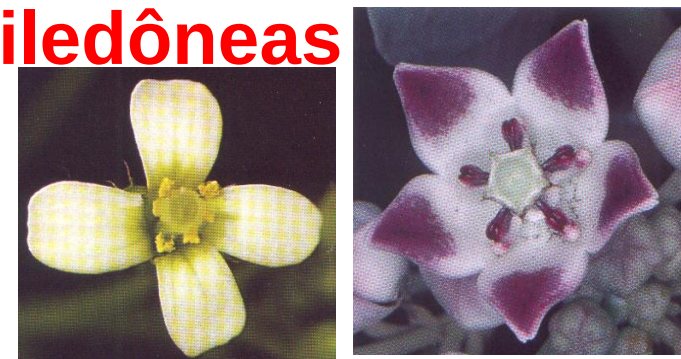


Figura 2

Amborellales

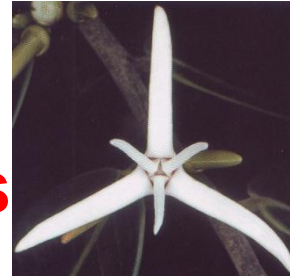
Nymphaeales

Austrobaileyales



Chloranthales

Magnoliídeas



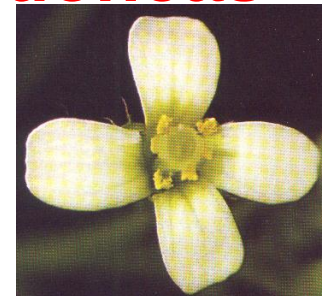
**APG-III
2009**

Monocotiledôneas



Ceratophyllales

Eudicotiledôneas

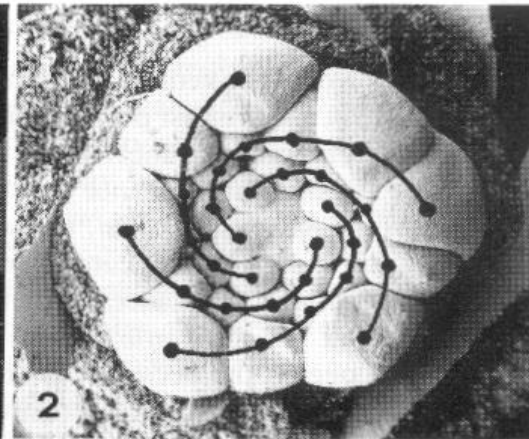
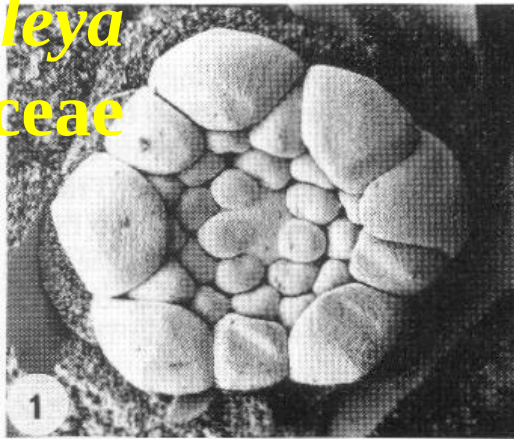


?

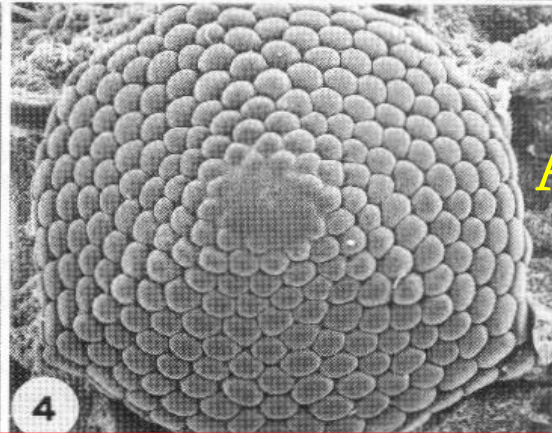
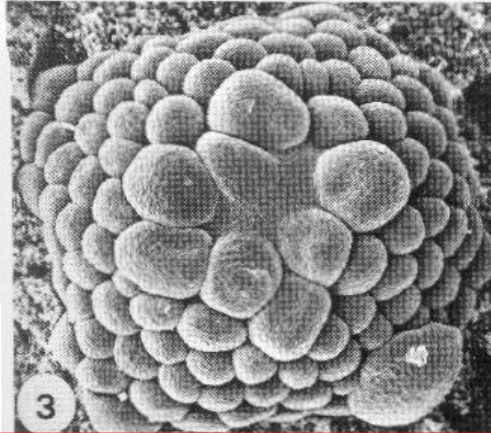


Austrobaileya

Austrobaileyaceae

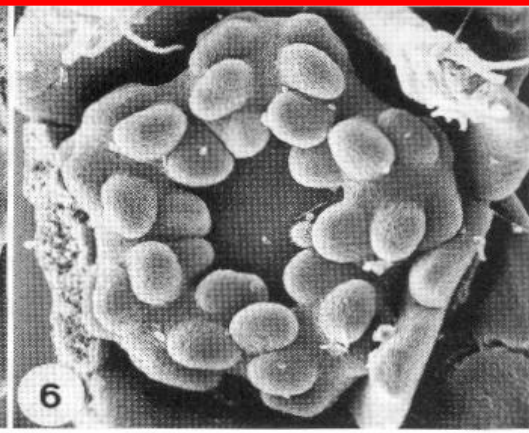
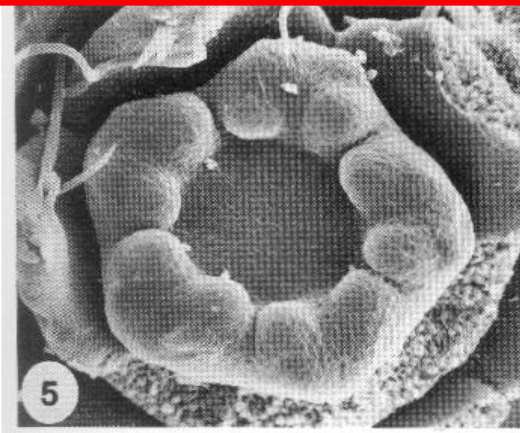


Exospermum
Winteraceae

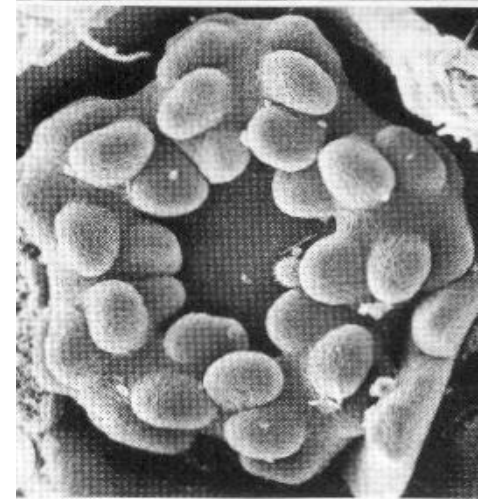
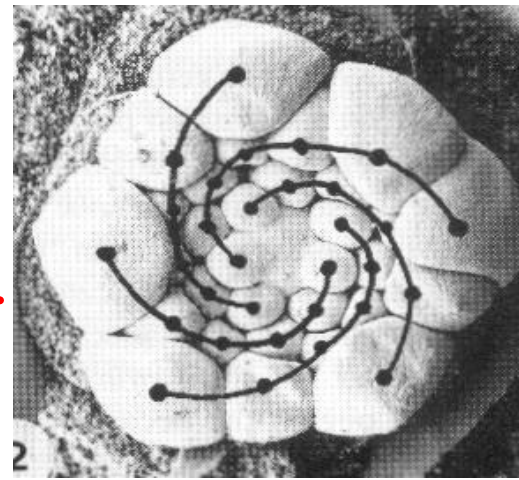
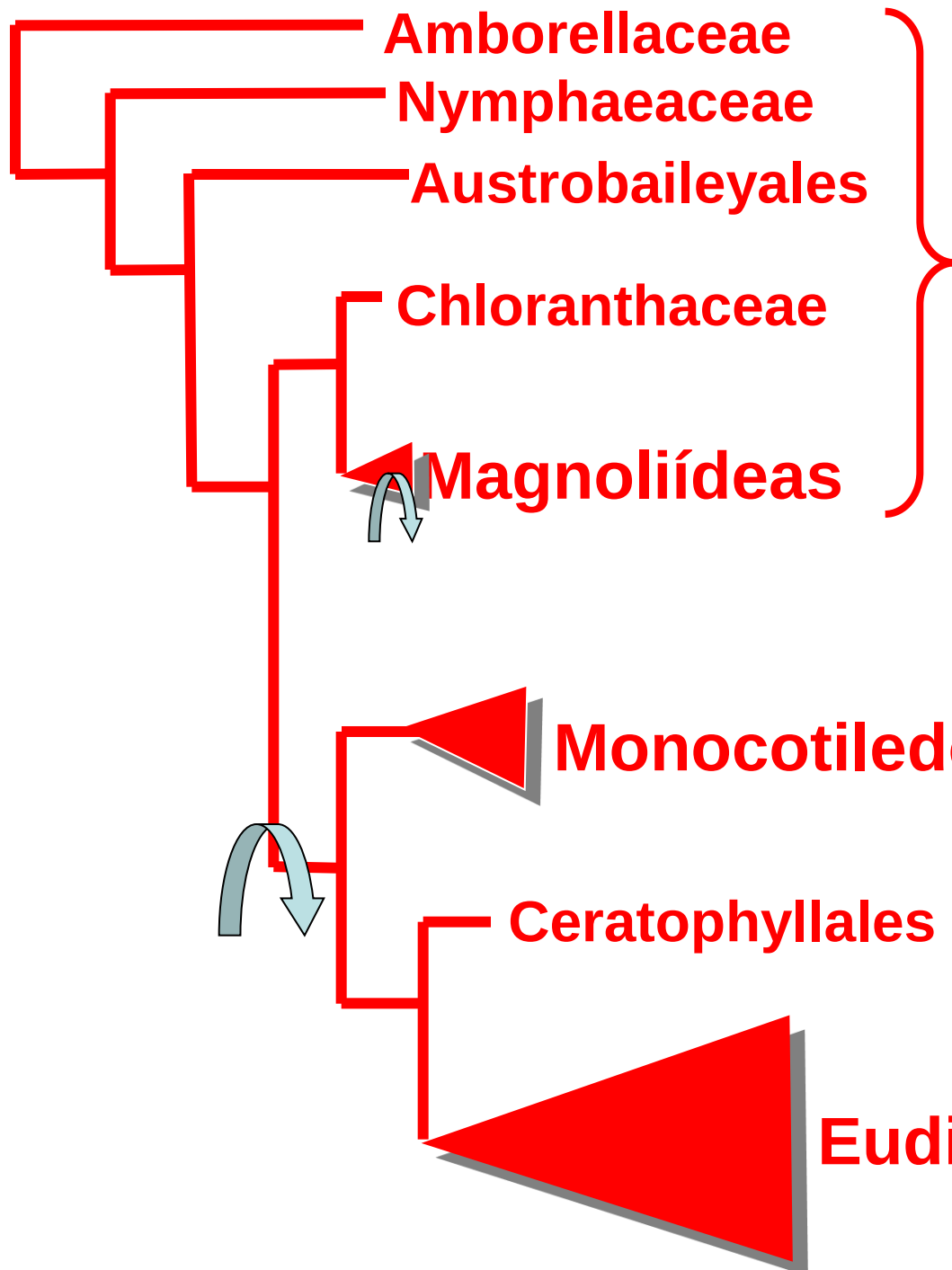


Annona
Annonaceae

Kitaibelia
Malvaceae
EUDICOT.



Endress
1994

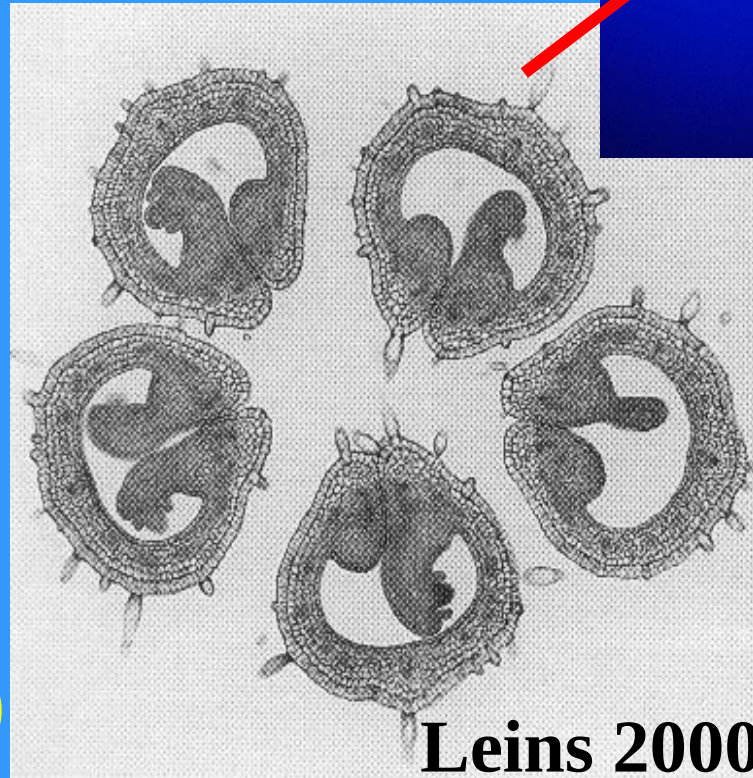


androceu e
gineceu cíclicos

APOCARPIA



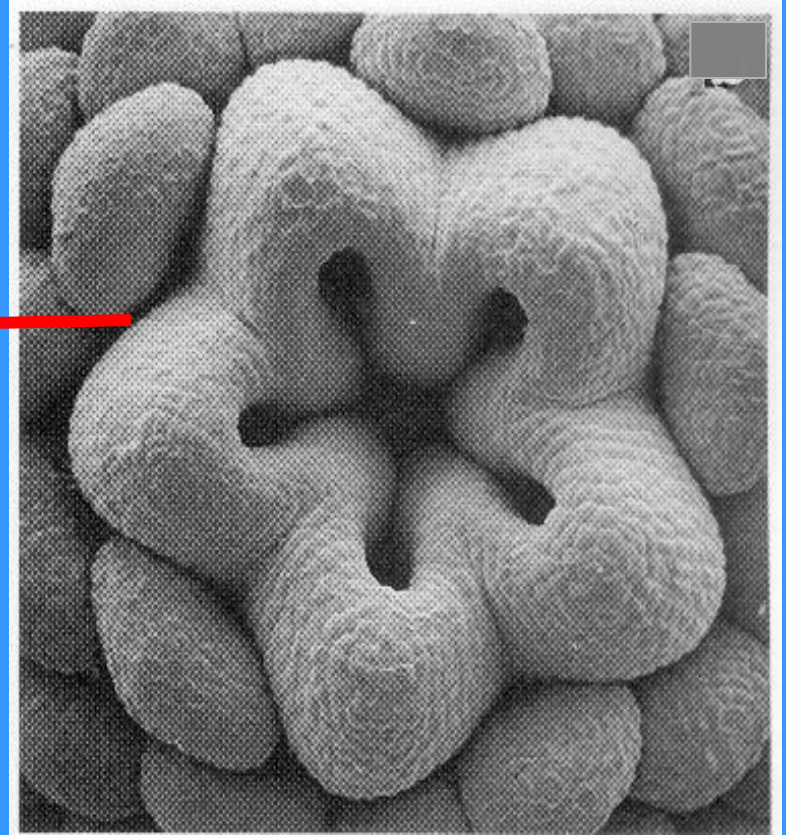
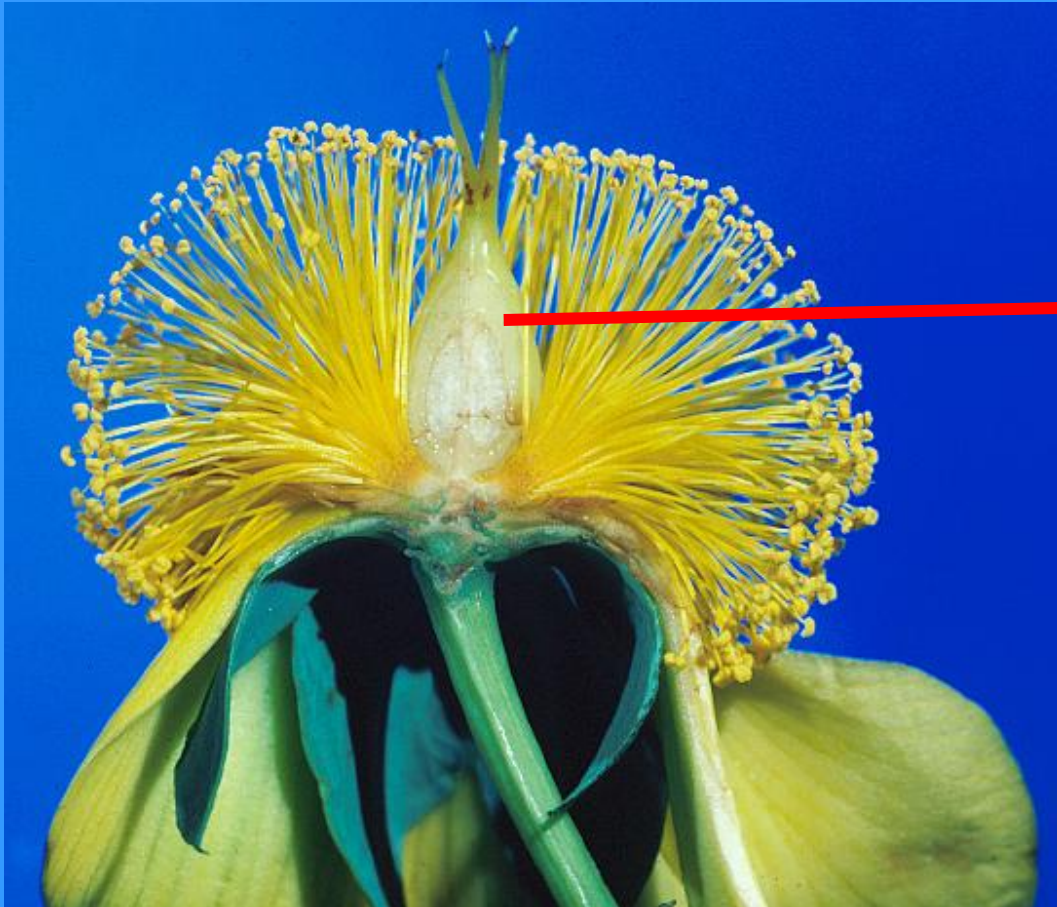
Drymis winteri
(Winteraceae)



Aquilegia atrata
(Ranunculaceae)

Leins 2000

SINCARPIA - conação possibilitada pela 80% das angiospermas organização cíclica



Leins 2000

Hypericum hookerianum
(Guttiferae)

