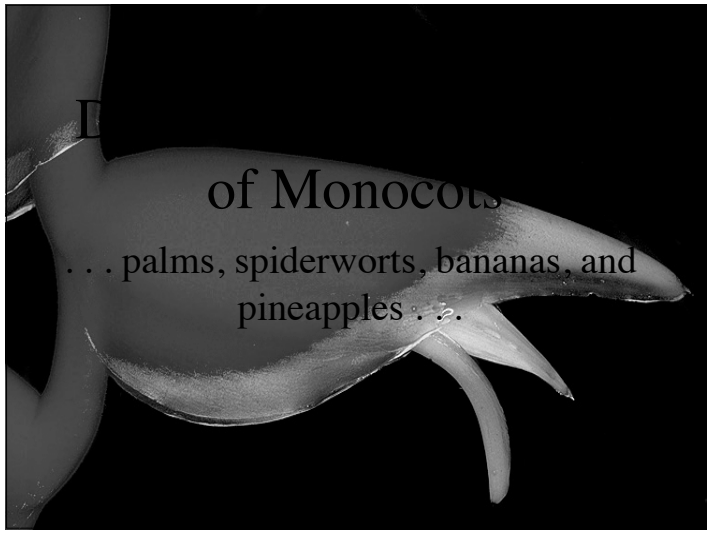
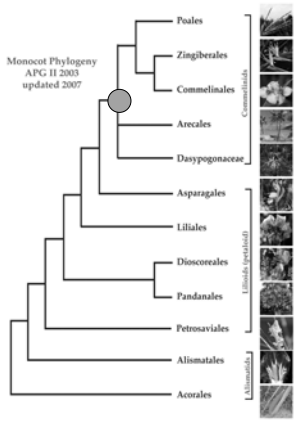


Commelinids

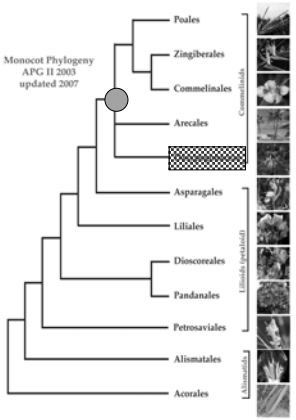
4 main groups:

- Acorales - sister to all monocots
- Alismatids
  - inc. Aroids - jack in the pulpit
- Lilioids (lilies, orchids, yams)
  - non-monophyletic
  - petaloid
- Commelinids
  - Arecales – palms
  - Commelinales – spiderwort
  - Zingiberales –banana
  - Poales
    - pineapple
    - grasses & sedges

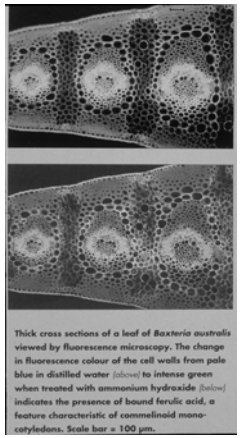


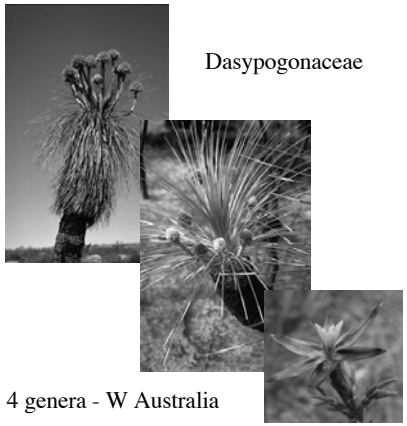
Commelinids

- largest group of monocots ranging from palms to grasses
- strongly monophyletic!
- bound ferulic acid in cell walls (fluoresce under UV with ammonium hydroxide added)
- this feature allowed placement of Dasypogonaceae



Commelinids


Thick cross sections of a leaf of *Baxteria australis* viewed by fluorescence microscopy. The change in fluorescence colour of the cell walls from pale blue in distilled water *(above)* to intense green when treated with ammonium hydroxide *(below)* indicates the presence of bound ferulic acid, a feature characteristic of commelinoid monocotyledons. Scale bar = 100 µm.



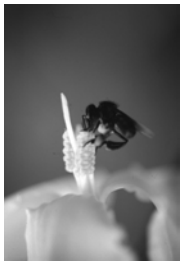
Dasypogonaceae

4 genera - W Australia

Commelinids

• theme: reduction of flower, loss of nectar, loss of zoophily, evolution of bracts

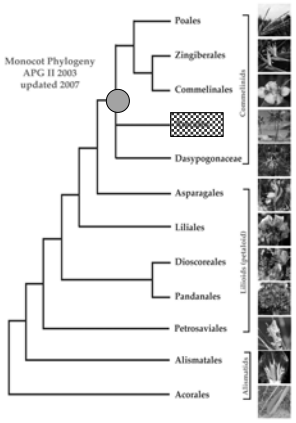
pickeral weed



rapatead

eliad

*Arecaceae - palms

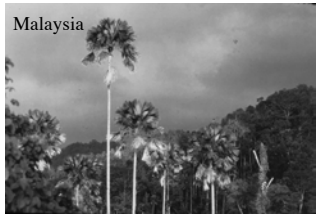


• the order has one family - also called Palmae

• 190 genera and 2400 species of trees and shrubs

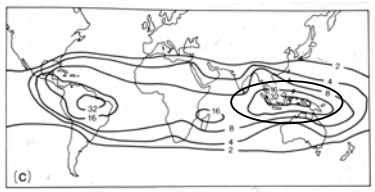
• tropics, subtropics, deserts, Mediterranean biomes

*Arecaceae - palms



• greatest center of diversity in Malay archipelago, then Amazonia

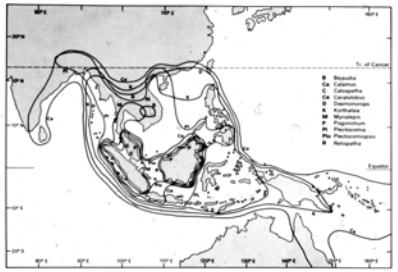
• depauperate in Africa, but diverse in Madagascar



*Arecaceae - palms

• Rattan palms - a plant group that honors the Wallace Biogeographic Line

• Asian distribution with few species passing through Sulawesi or New Guinea



Rattan palm & generic distributions

*Arecaceae - palms

Great morphological diversity: in stature

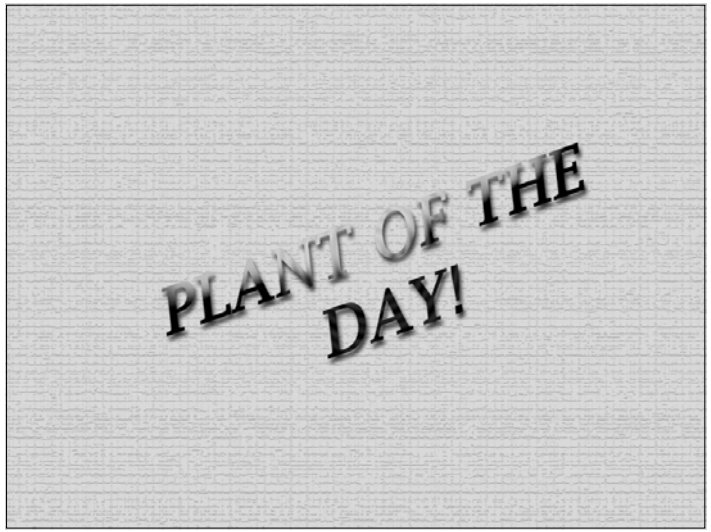
Syagrus - lilliput palm of Paraguay

Jubaea - Chilean wine palm

*Arecaceae - palms

Great morphological diversity: largest seed of seed plants

Lodoicea maldivica - Seychelles palm or double nut



*Arecaceae - palms

Great morphological diversity: largest leaf

Raffia - rattan

Corypha

. . . and largest inflorescence

*Arecaceae - palms

Vegetative characteristics

- "woody" stems via primary thickening meristem or diffuse secondary growth
- essentially hardened leaf bases
- single apical meristem: succeptible to frost

Roystonia

*Arecaceae - palms

Vegetative characteristics

- palmate or pinnate compound, sheathing, plicate or folded

*Arecaceae - palms

Floral characteristics

- inflorescence surrounded by spathe - once allied with aroids

*Arecaceae - palms

Floral characteristics

- flowers unisexual or bisexual

CA 3 CO 3 A 3,6,∞ G 3 or (3)

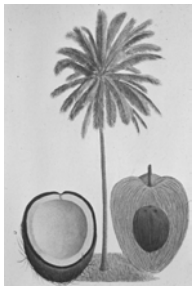
*Arecaceae - palms

Floral characteristics

• fruit a 1-seeded berry or drupe


Areca Betel palm


Cocos coconut



*Arecaceae - palms

Classification: 5 subfamilies

• Nypoideae and Calamoideae are first diverging


Nypa fruticans
salt marsh


Calamus radicalis
Hawaii

*Arecaceae - palms

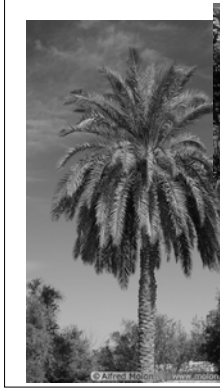
Important palms: food

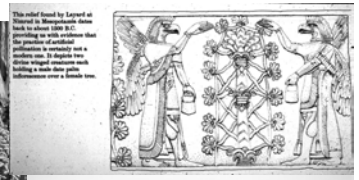

Cocos nucifera - coconut

*Arecaceae - palms

Important palms: food

Phoenix - Date palm





*Arecaceae - palms

Important palms: oil, wax

*Arecaceae - palms

Important palms: horticulture

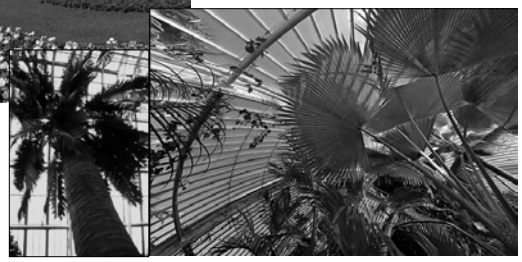
Roystonea - Royal Palm

Washingtonia in Santa Monica

*Arecaceae - palms

Important palms: horticulture

Palm House at Kew Royal Botanic Garden - largest glass house in the world with the largest glass house plant - Chilean wine palm



Commelinids

4 main groups:

- Acorales - sister to all monocots
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  - inc. Aroids - jack in the pulpit
- Lilioids (lilies, orchids, yams)
  - non-monophyletic
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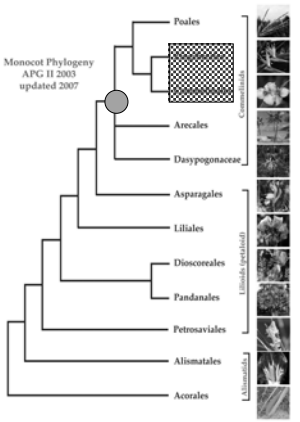
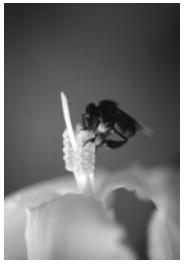
  - Zingiberales –banana
  - Poales
    - pineapple
    - grasses & sedges



Commelinids

• theme: reduction of flower, loss of nectar, loss of zoophily, evolution of bracts

pickeral weed



rapatead

eliad

Commelinales + Zingiberales

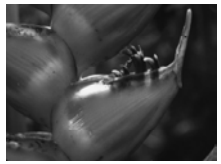
• 2 closely related tropical orders
• primarily nectar bearing but with losses
• bracted inflorescences

pickeral weed

nectar

spiderwort

pollen only



heliconia

nectar + bracts

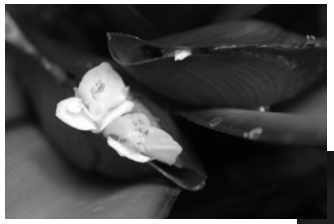
Commelinaceae - spiderwort

Commelina erecta - Erect dayflower

Family of small herbs with succulent stems, stems jointed; leaves sheathing. Family does not produce nectar, but showy flowers for insect pollen gathering.

Tradescantia ohiensis - spiderwort

Commelinaceae - spiderwort



Rhoeo - Moses in a cradle

Inflorescence often bracted

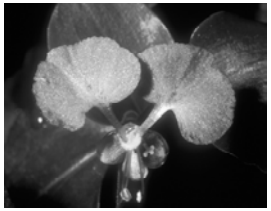
Tradescantia ohiensis - spiderwort

Commelinaceae - spiderwort

Flowers actinomorphic or zygomorphic

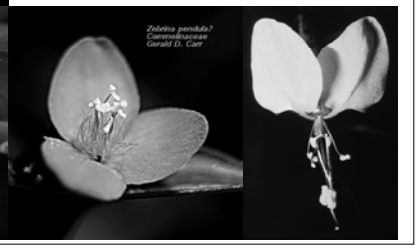
CA 3 CO 3 A 6 G (3)

Commelina communis - day flower



Tradescantia ohiensis - spiderwort

Commelinaceae - spiderwort



- species rich in pantropics, especially Africa
- floral diversity is enormous

Pontederiaceae - pickerel weed

Aquatic family of emergents or floaters. Water hyacinth (*Eichhornia*) from tropical America is invasive species in subtropical areas of the world.

Eichhornia crassipes
Water hyacinth
invading Florida

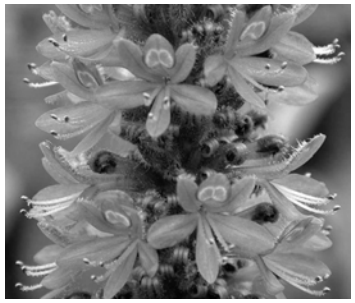
Pontederiaceae - pickerel weed

Pickerel weed has glossy heart-shaped leaves, superficially like *Sagittaria* but without net venation. Flowers are in congested showy purple inflorescences.

Pontederia cordata - Pickerel weed

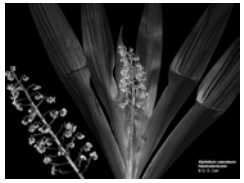
Pontederiaceae - pickerel weed

Flowers are showy, insect pollinated with nectar glands - previously placed in Liliales!



Pontederia cordata - Pickerel weed

Haemodoraceae - kangaroo paw



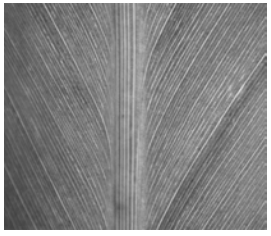
Anigozanthus - kangaroo paw

Small family with floral nectar, species radiations in Australia and South Africa

Zingiberales

- strongly supported group of 8 tropical families
- rhizomatous monocots with showy, nectared, but highly bracted flowers
- 3 shared features:

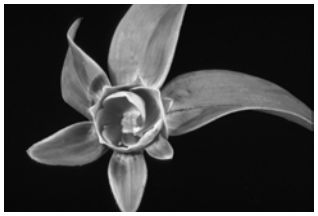
1. Parallel-pinnate leaves, often distichous

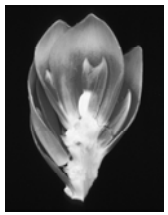


Zingiberales

- strongly supported group of 8 tropical families
- rhizomatous monocots with showy, nectared, but highly bracted flowers
- 3 shared features:

2. Bracted flowers and inflorescences



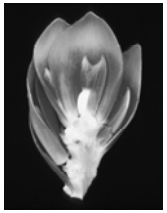


Zingiberales

- strongly supported group of 8 tropical families
- rhizomatous monocots with showy, nectared, but highly bracted flowers
- 3 shared features:

3. Inferior ovary






Zingiberales

- order fairly well known based on DNA and morphology
- show interesting trends in (1) fusion of perianth and (2) stamen loss and staminode development

DNA-based Zingiberales "rhizogram" by John Kress

Costus floral pattern

3 fused sepals

3 separate petals

5 fused sterile anthers (labellum)

1 fertile anther

Poales I - showy flowers

4 main groups:

- Acorales - sister to all monocots
- Alismatids
  - inc. Aroids - jack in the pulpit
- Lilioids (lilies, orchids, yams)
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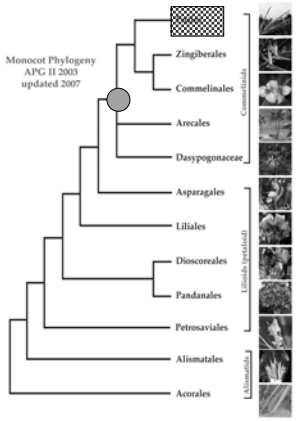
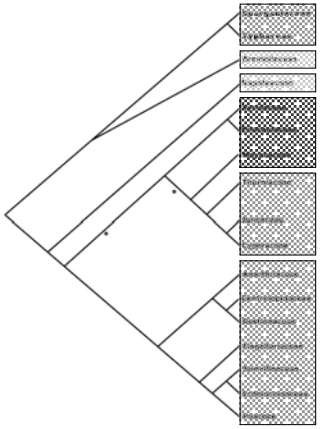


Poales I - showy flowers



- showy flowers, insect or bird pollinated

- +/- reduced flowers, insect or wind pollinated

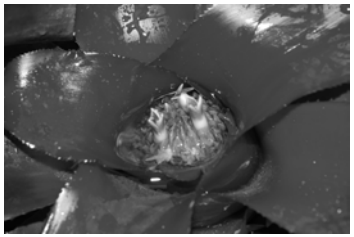
- reduced flowers, wind pollinated

*Bromeliaceae - pineapples

• mainly epiphytic, but terrestrial as well in inhospitable regions

*Bromeliaceae - pineapples

• key adaptations: CAM photosynthesis, modified trichomes or scales, "tank" formation



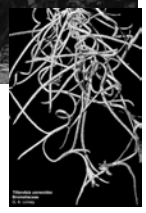
Tank (water impounding)

Scales (water & nutrient uptake)

*Bromeliaceae - pineapples

• key adaptations: CAM photosynthesis, modified trichomes or scales, "tank" formation

• scales very visible in Spanish moss

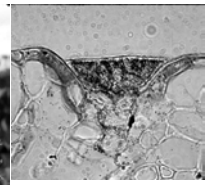


Tillandsia usneoides in South Carolina live oaks

*Bromeliaceae - pineapples

• preadaptations to carnivory in *Brocchinia* and *Catopsis*

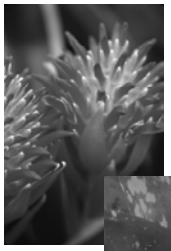
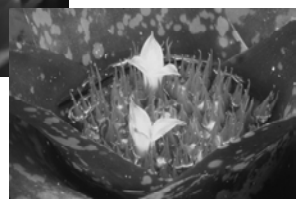
Brocchinia



Amino acids radioactively labeled being incorporated into the scales of *Brocchinia*

*Bromeliaceae - pineapples

• inflorescence heavily bracted and often the attractant

*Bromeliaceae - pineapples

CA 3 CO 3 A 6 $\underline{G}$ (3) or $\overline{\underline{G}}$ (3)

• petals showy, but not the sepals

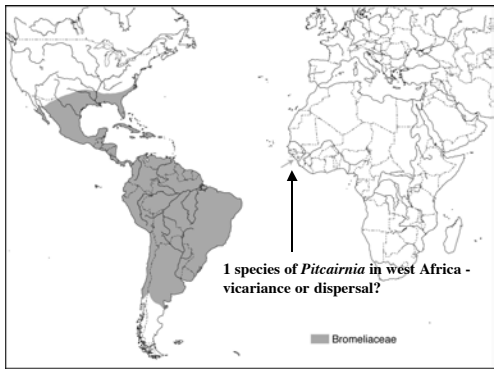
• 2 sets of 3 stamens

• superior or inferior ovary, with twisted styles

• berry or capsule


*Bromeliaceae - pineapples

• bromeliads are an American family: 2600 species, 56 genera



*Bromeliaceae - pineapples

• pineapple not native to Hawaii - along with two other ingredients of Hawaiian Punch

*Bromeliaceae - pineapples

• classification traditionally had three subfamilies

tillandsioids pitcairnioids bromelioids

Incan ceremonial dance

*Bromeliaceae - pineapples

• tillandsioids

Tillandsia usneoides and *T. grandis*

Vriesea

*Bromeliaceae - pineapples

• bromelioids

Achmea

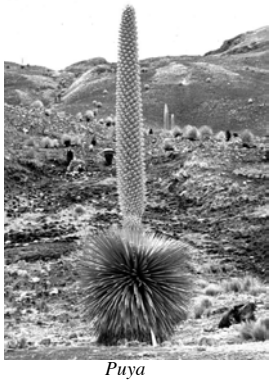
Ananas - pineapple

Neoregelia

*Bromeliaceae - pineapples

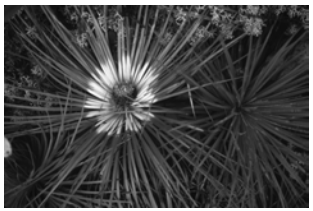
• pitcairnioids

Brocchinia



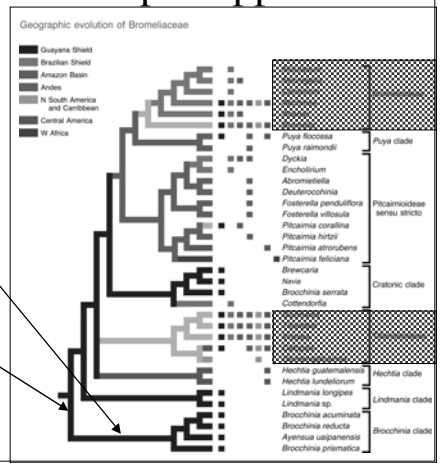
Puya

Navia



*Bromeliaceae - pineapples

- 2 subfamilies natural based on DNA
- pitcairnioids broadly paraphyletic
- *Brocchinia* sister to rest of family
- origin of family in Guayana Shield of South America



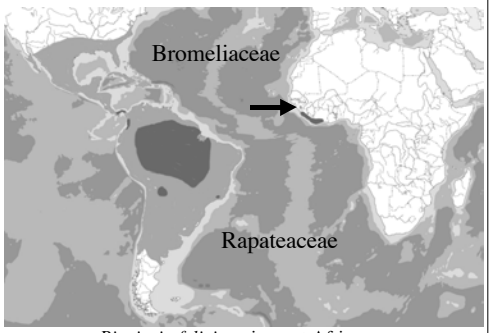
*Bromeliaceae - pineapples

Guayana Highlands of southern Venezuela and adjacent areas of Brazil and Colombia - the higher elevation "tepuis" are rain drenched and extremely nutrient poor

*Bromeliaceae - pineapples

When did the Atlantic disjunction occur?

Pitcairnia saxicola
Costa Rica



Picairnia feliciana in west Africa

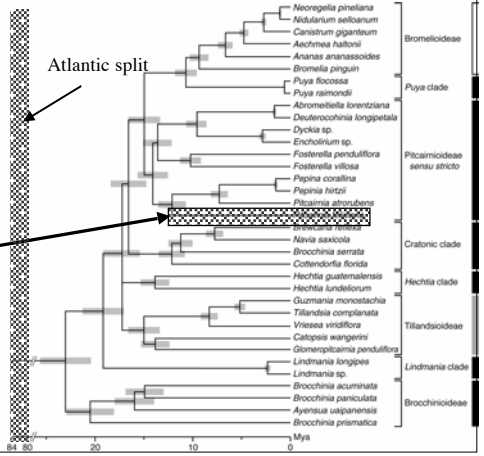
*Bromeliaceae - pineapples

When did the Atlantic disjunction occur?

Atlantic split

Long distance dispersal to Africa! African species divergence is 15-13 mya

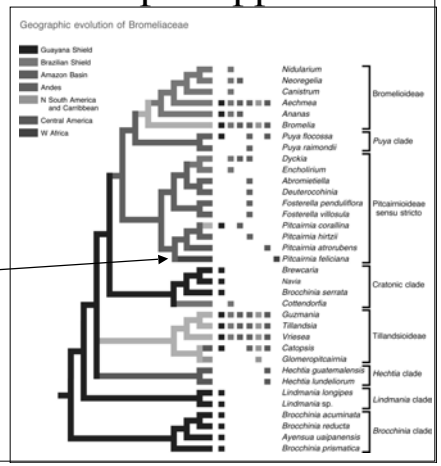
DNA tree calibrated with monocot fossils



*Bromeliaceae - pineapples

Where did the African species come from?

• African species originated from Andes!



Rapateaceae - a tepui family

• 16 genera and nearly 100 species from the Guayana Shield

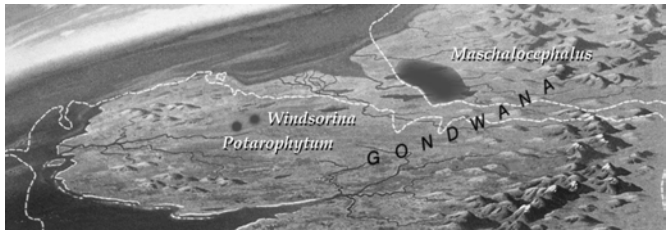
Rapateaceae - a tepui family

• most species are pollinated by pollen-gathering bees

• hummingbird pollination has evolved once in a clade of two genera

Rapateaceae - a tepui family

• most species in the Guayana Shield but one in west Africa



Is the African *Mascolocephalus* a product of Atlantic vicariance with closest Guayana Shield relatives, or a product of long distance dispersal?

Rapateaceae - a tepui family

Recent long distance dispersal to Africa!
African species divergence is 8-6 my
whereas Atlantic separation is 80+ mya