

# Klasifikacija biljaka sa sjemenom (Spermatophyta)

- Ginkgooidae
  - Gnetidae
  - Pinidae
  - Cycadidae
  - Magnoliidae
- Gymnospermae
- Angiospermae
-

# Cycadidae, Pinidae, Gnetidae, Ginkgooidae



**Cycas**



**Pinus**



**Gnetum**

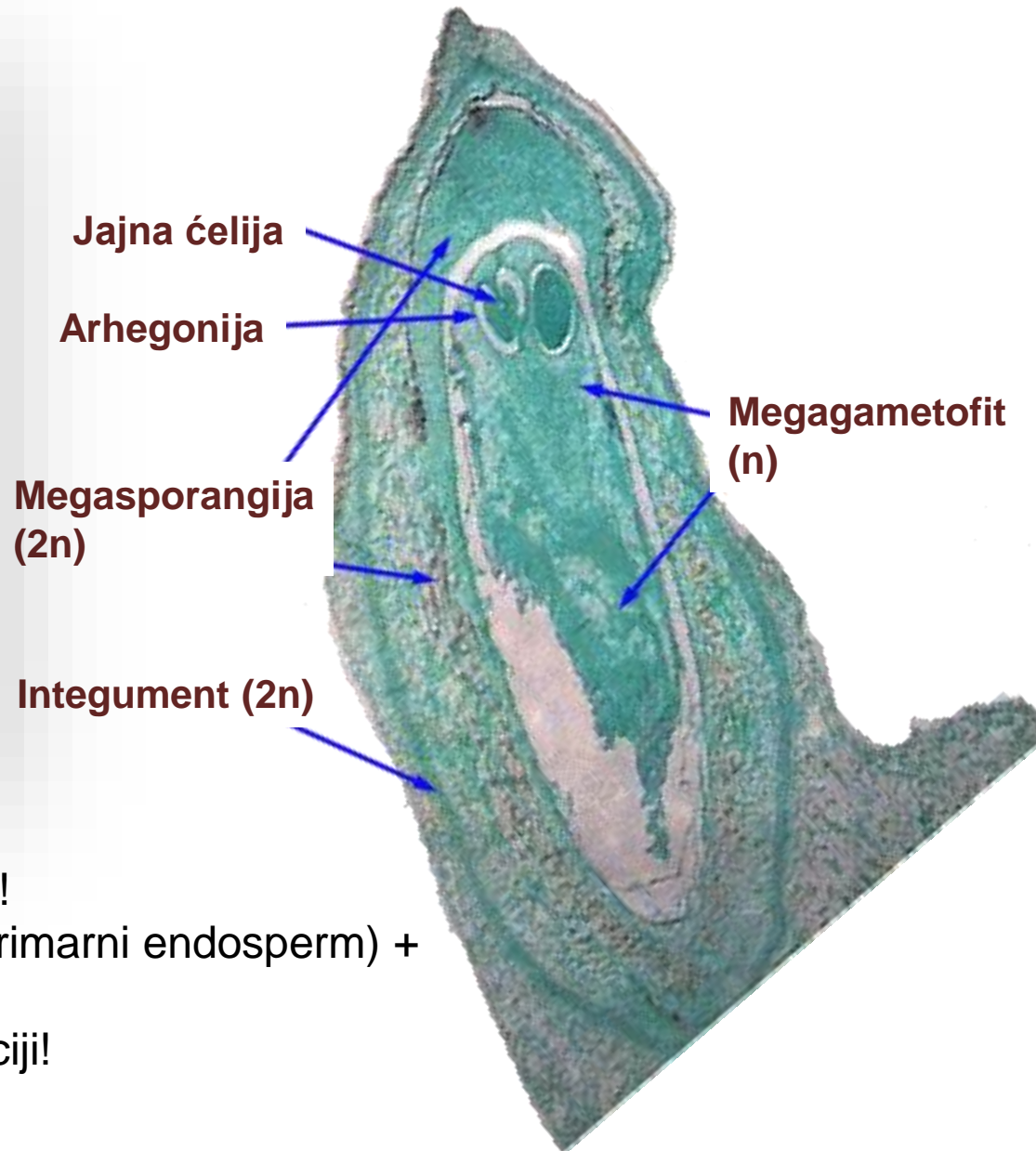
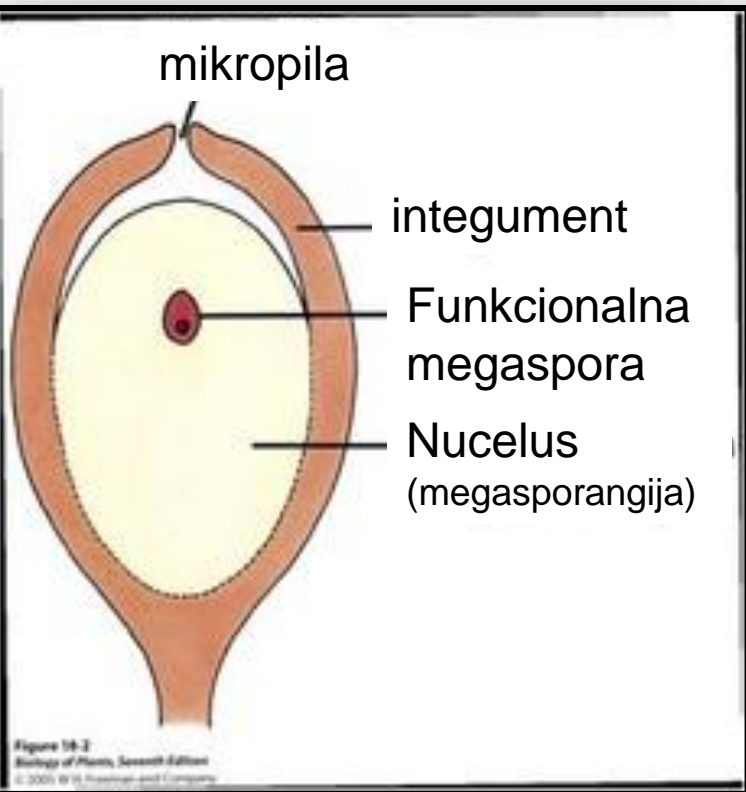


**Ginkgo**

Sjemeni zametak  
Anemofilija  
Trajan primarni korijen  
.....

# Opšta građa sjemenog zametka

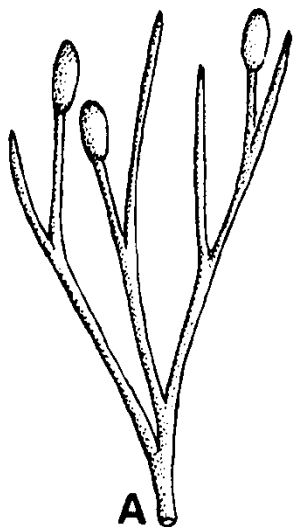
# Sjemeni zametak bora (Pinus spp.)



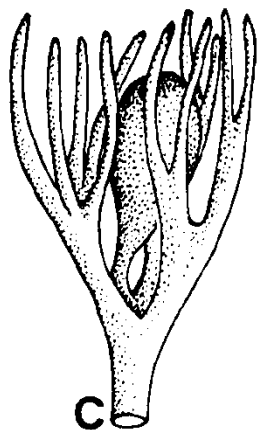
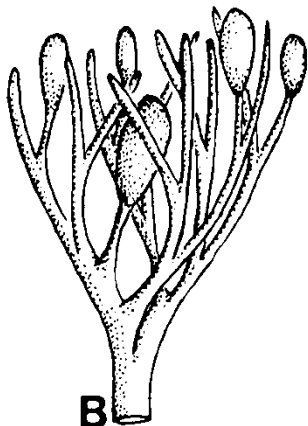
Nucelus je homolog megasporangiji!  
U megaspori se razvija protaljum (primarni endosperm) +  
2 arhegonije sa jajnom ćelijom.  
Integument- nova tvorevina u evoluciji!

## Evolucija sjemenog zametka

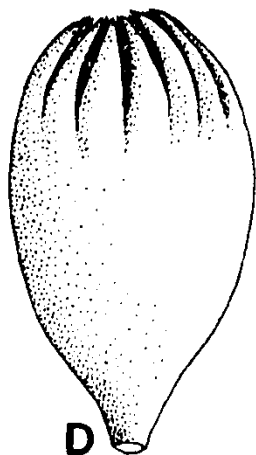
**A-** Telom sa fertilnim i sterilnim granama



**B-** Telom sa fertilnim i heterosporangijama

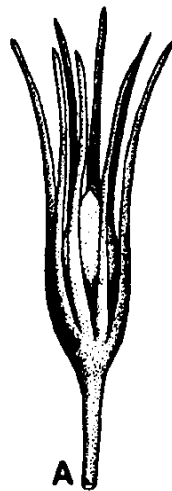


**C-** Telom sa megasporangijom okruženim sterilnim ograncima

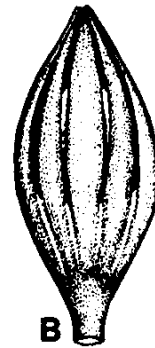


**D-** Srastanje sterilnih ogranaka koji okružuju megasporangiju

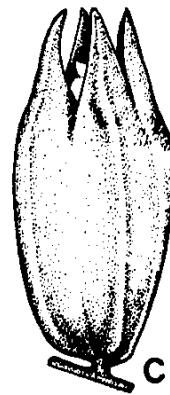
## Evolucija integumenta



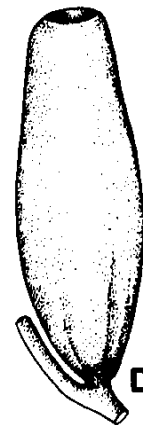
**A**



**B**



**C**



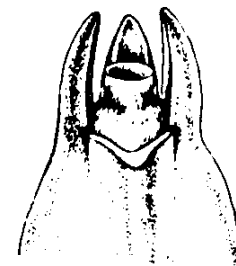
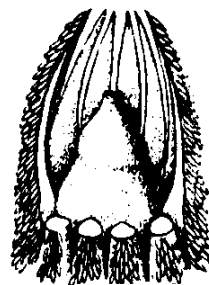
**D**

**A-** Sterilni segmenti slobodni

**B-** Segmenti djelimično srasli

**C-** segmenti većim dijelom srasli

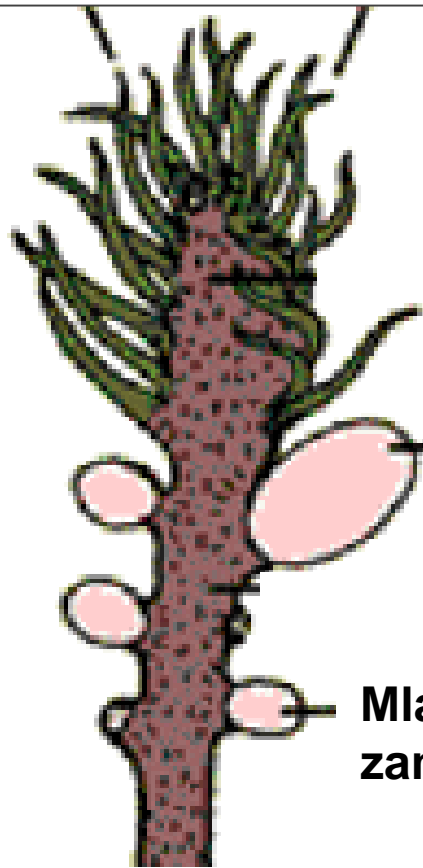
**D-** segmenti skroz srasli obodom, a na vrhu ostaje mikropila



Tipovi polenove komore

# Cycas revoluta, izgled megasporofila i građa sjemenog zametka

Perasto usiječen megasporofil

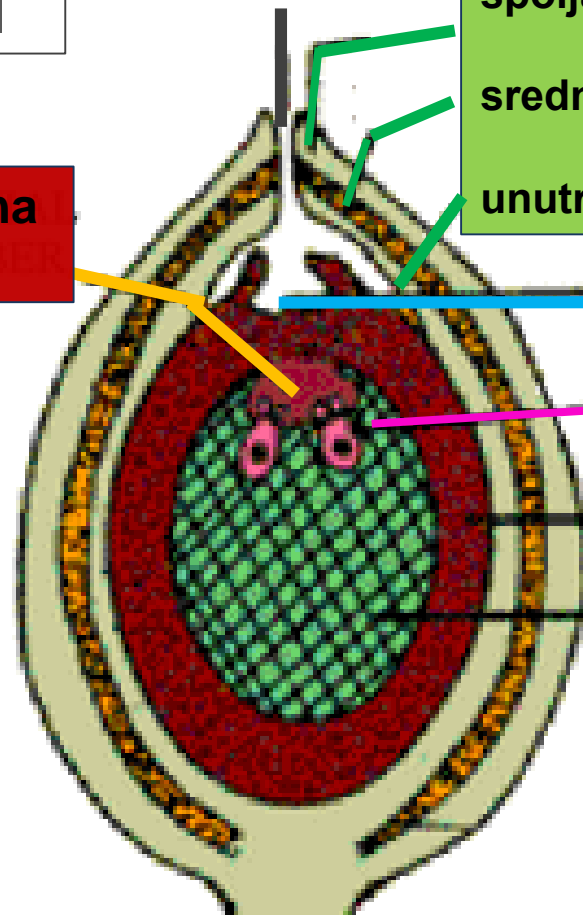


arhegonijalna komora

Oplođeno sjeme

Mladi sjemeni zametak

mikropila



spoljašnji sloj integumenta

srednjišnji sloj integumenta

unutrašnji sloj integumenta

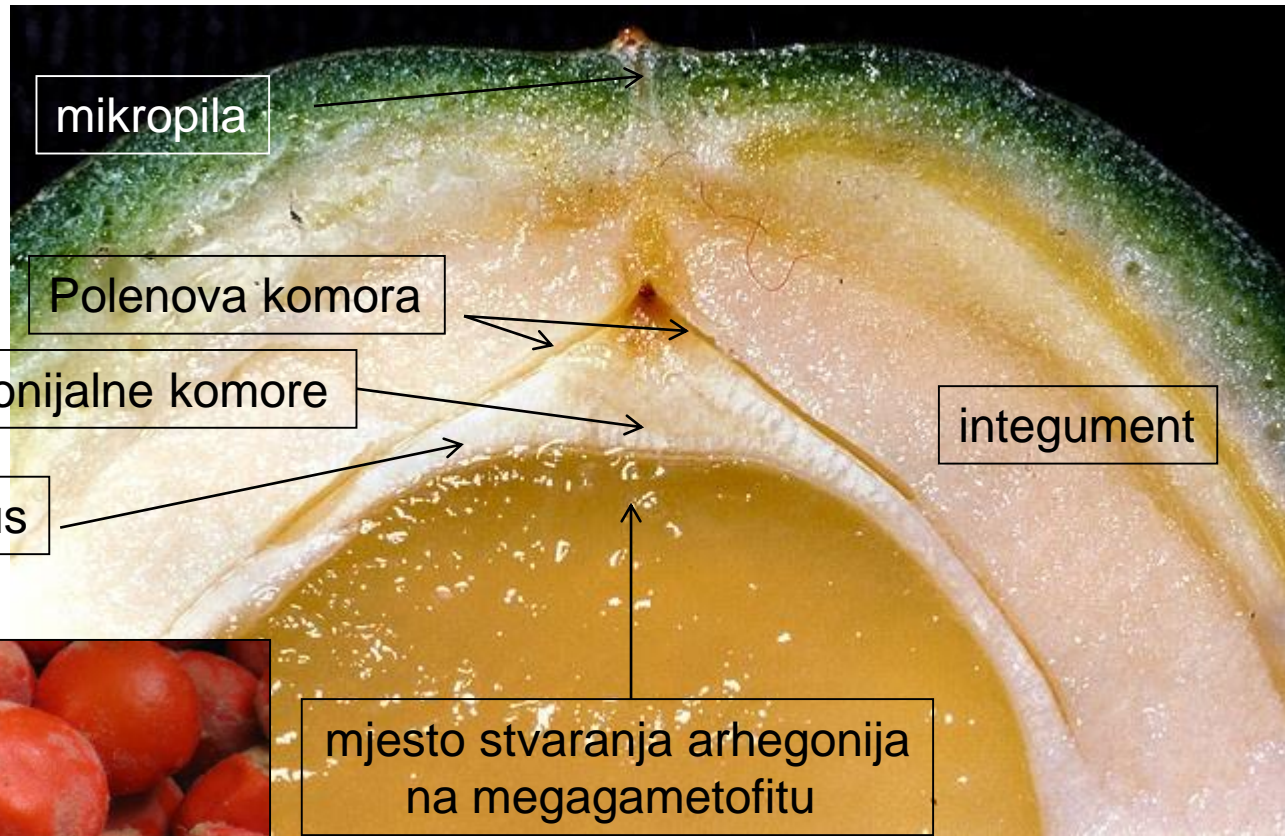
polenova komora

arhegonija

nucelus

endosperm

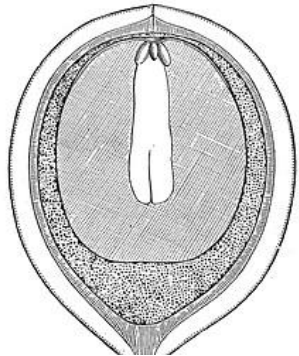
Građa sjemenog zametka



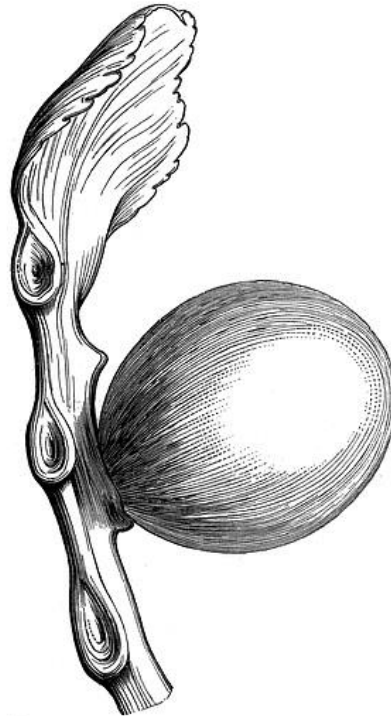
# Cycas revoluta, habitus, izgled mega- i mikrosporofila



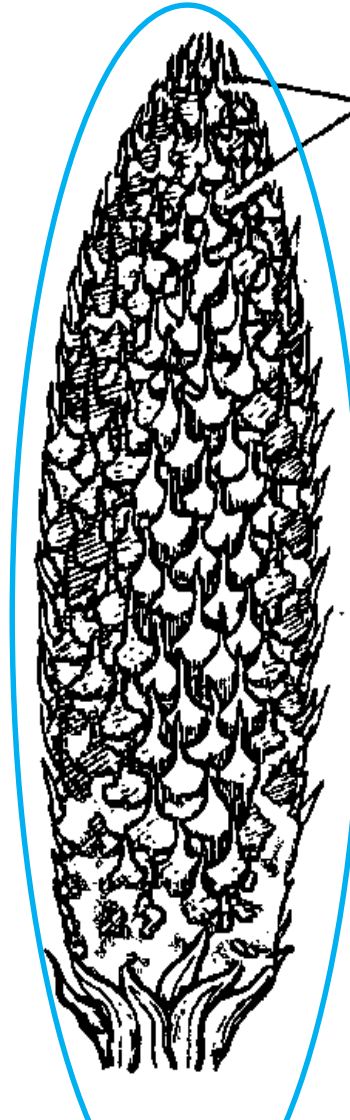
*Cycas circinalis.*



Sjemeni zametak



Megasporofil sa sjemenim zametkom  
(megasporofili nisu u strobilusima!)



Muški strobilus cikasa

Mikrosporofili

Mikrosporangije  
(polenove kese)  
na mikrosporofilu



# Cycas spp.-cikas

megasporofil



muška jedinka

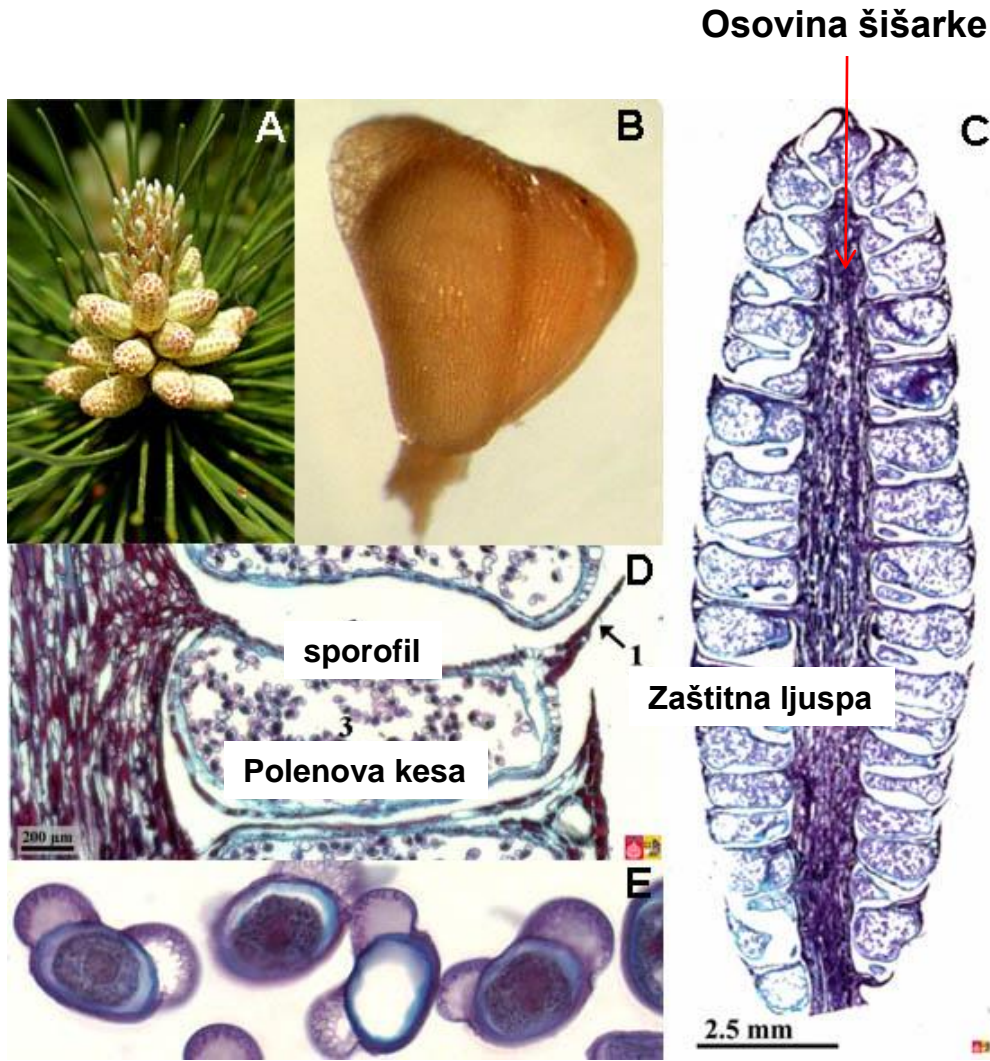


ženska jedinka





# Grada šišarki bora (Pinus sp.)



A, C - muška šišarka  
B, D- mikrosporofil i polenova keska  
E- polenova zrna



# Ginkgooidae

Sjemeni zametak



ženska jedinka



muška jedinka



# Gnetidae

Dihazijalni strobilusi.

Ovojni listići nalik perijantu cvjetnica.

Dvojno oplođenje.

Dugačka mikropilarna cijev.

Prisustvo traheja u ksilemu.

Naspraman raspored listova.

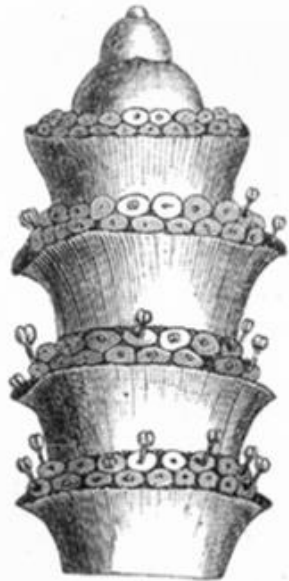
Odsustvo smonih kanala.



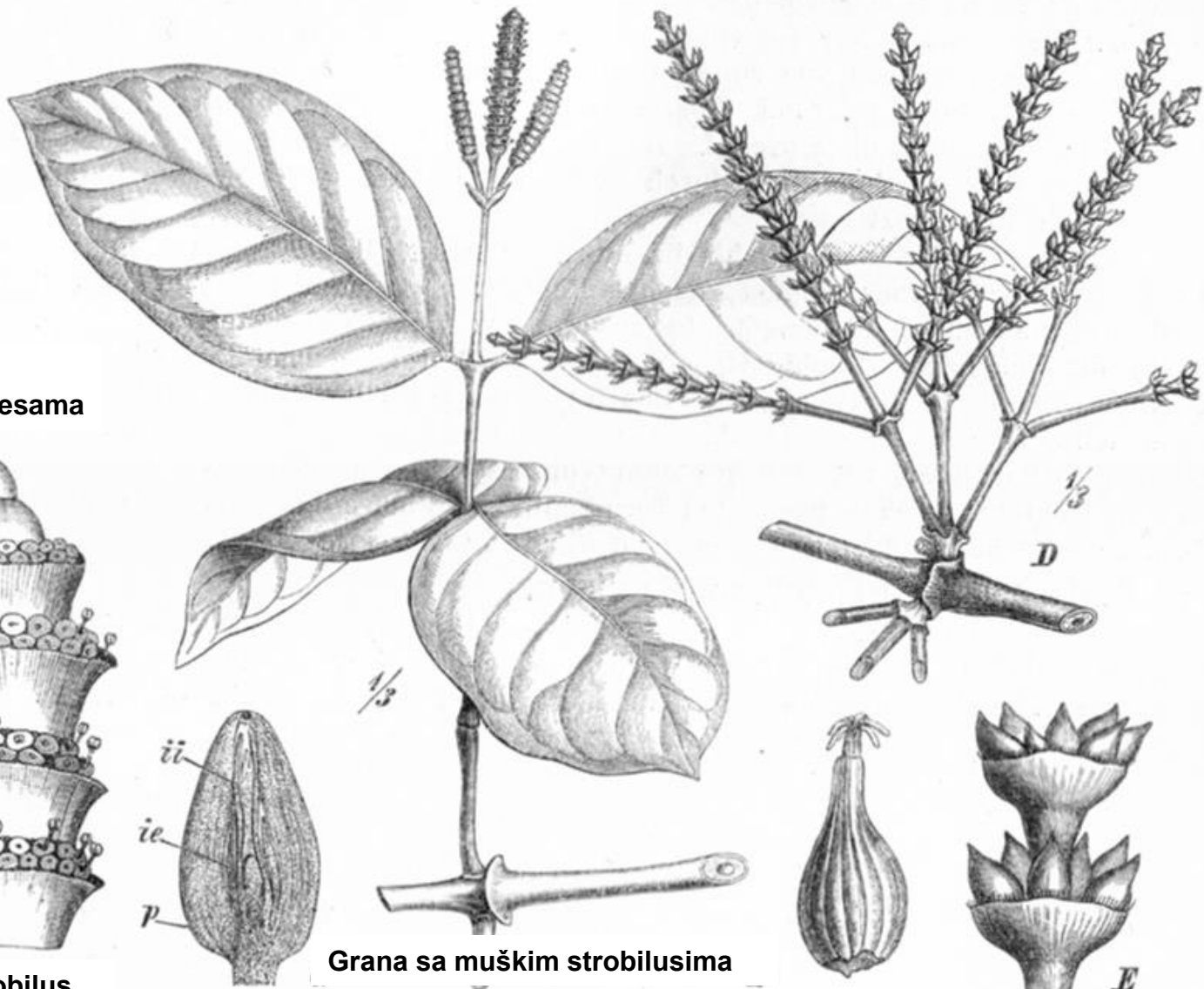
Grana sa ženskim strobilusima



Androfor sa  
Polenovim kesama



Muški strobilus



Grana sa muškim strobilusima

Sjemeni zametak

Ženski strobilus sa  
sjemenim zamecima

Gnetum sp.

# Welwitschia mirabilis

Muška jedinka



Ženski strobilus

# Pinidae

O. Pinales

Fam. Pinaceae

Fam. Cupressaceae

Fam. Taxodiaceae (nisuativne u fl. CG)

Fam. Cephalotaxaceae (nisuativne u fl. CG)

Fam. Podocarpaceae (nisuativne u fl. CG)

Fam. Araucariaceae (nisuativne u fl. CG)

Fam. Sciadopityaceae (nisuativne u fl. CG)

O. Taxales

Fam. Taxaceae

- Fam. Taxodiaceae- močvarni čempresi.

Rodovi: Taxodium (Sjeverna Amerika),  
Metasequoia (Kina), Saquoia (Siera Nevada),  
Cryptomeria (Kina, Japan), Sciadopitys  
(Japan), Athrotaxis (Tasmanija), Cunninghamia  
(Kina)

- Fam. Cepalotaxaceae

Amentotaxus (Azija), Cephalotaxus (istočna  
Azija), Torreya (Azija, Sjeverna Amerika),

- Fam. Sciadopityaceae

Sciadopytis (Japan)

- Fam. Podocarpaceae

Podocarpus (Južna hemisfera)

- Fam: Araucariaceae

Araucaria (Čile i Patagonija)



A world map showing the distribution of gymnosperms. The Northern Hemisphere is highlighted in a light green color, and the Southern Hemisphere is highlighted in a light yellow color. The map shows the distribution of gymnosperms in the Northern Hemisphere (Taxodiaceae, Pinaceae, Cupressaceae, Cephalotaxaceae) and the Southern Hemisphere (Araucariaceae, Podocarpaceae).

**Sjeverna hemisfera:** Taxodiaceae, Pinaceae,  
Cupressaceae, Cephalotaxaceae

**Južna hemisfera:** Araucariaceae,  
Podocarpaceae

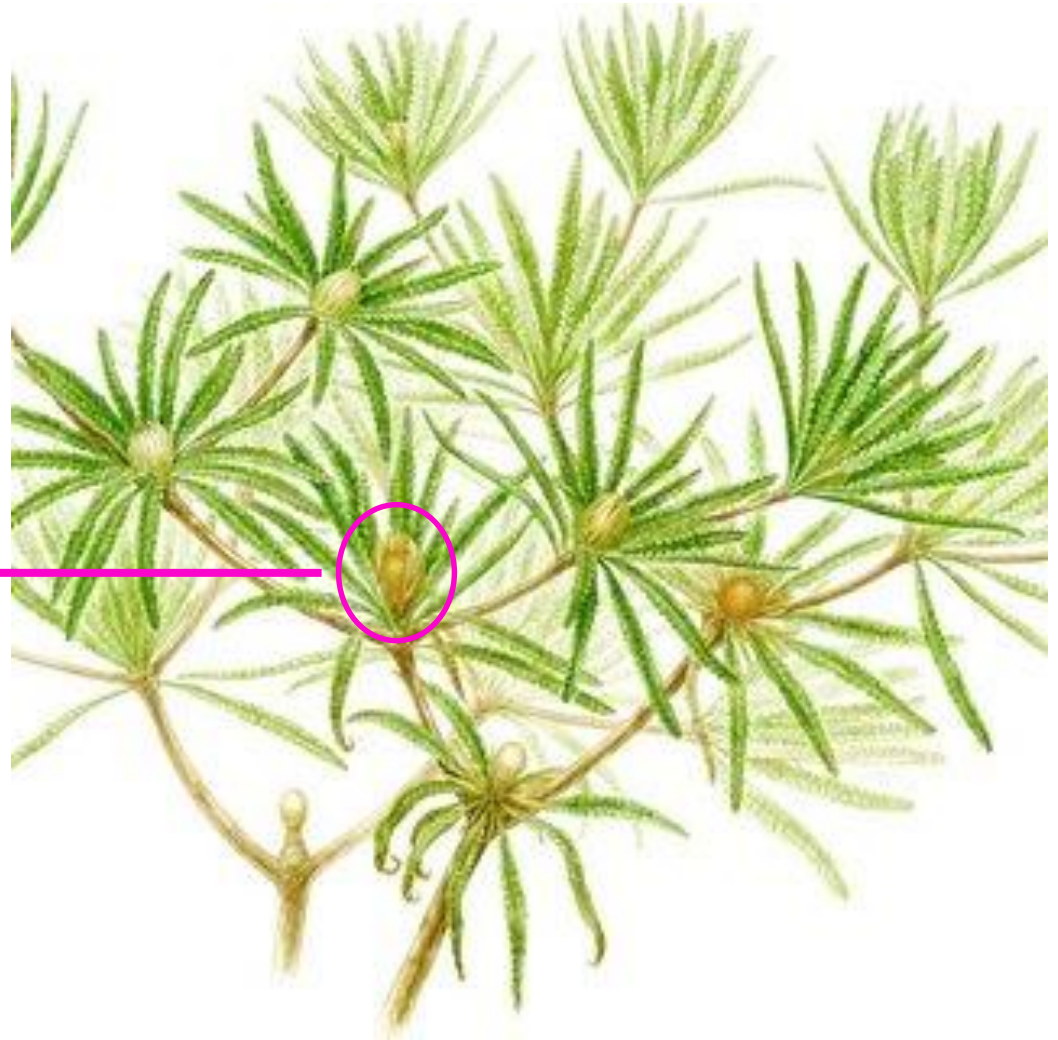
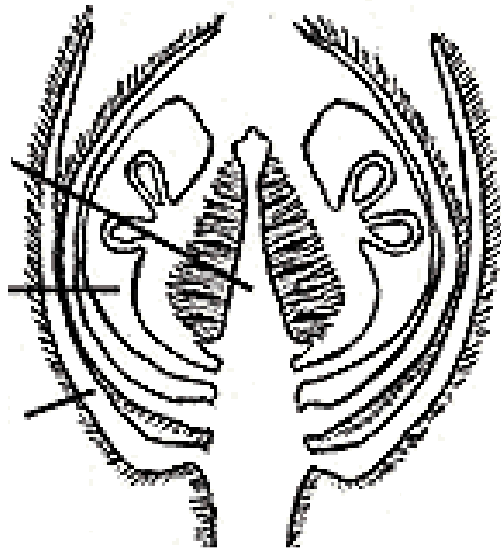
# Bennettitae (izumrle biljke)

Reproduktivne strukture  
zaodjenute ovojnim  
listovima, često dvopolne!

Sjemena  
loža  
(konusno  
izdignuta)

Sočni  
mikro-  
Sporofil

Ovojni  
listovi

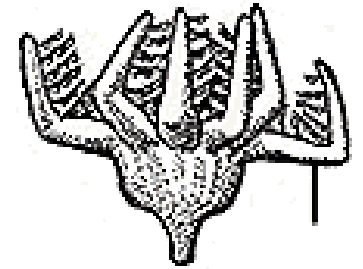
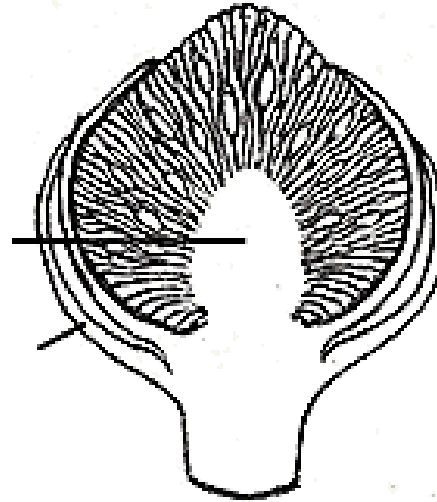


*Williamsonella sp.*



Sjemena  
loža

Ovojni  
listovi



Mikro-  
Sporofili sa  
sinangijama

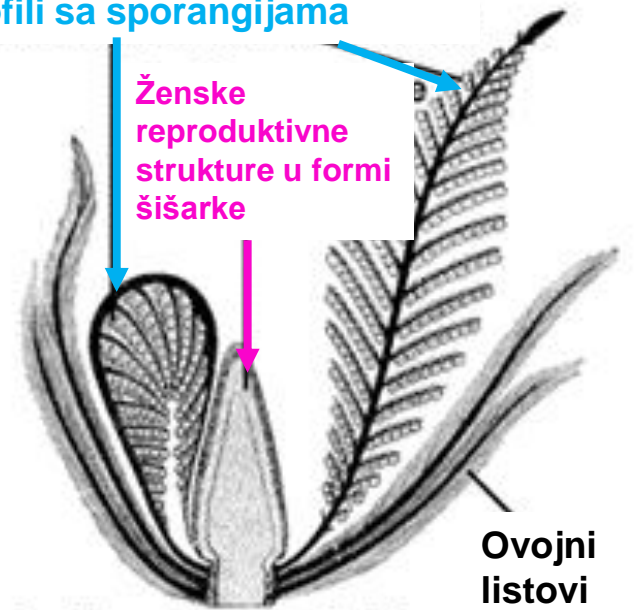
*Williamsonia sp.*



*Cycadeoidea*

Muške reproduktivne strukture  
Mikrosporofili sa sporangijama

Ženske  
reproduktivne  
strukture u formi  
šišarke



Ovojni  
listovi