

# 6



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**Sistematika i taksonomija**  
**Takson vs. taksonomska kategorija**  
**Pojam vrste**  
**Lineova binarna nomenklatura**  
**Prokariotske i eukariotske alge**  
**Carstvo gljiva**  
**Razdio lišajeva**

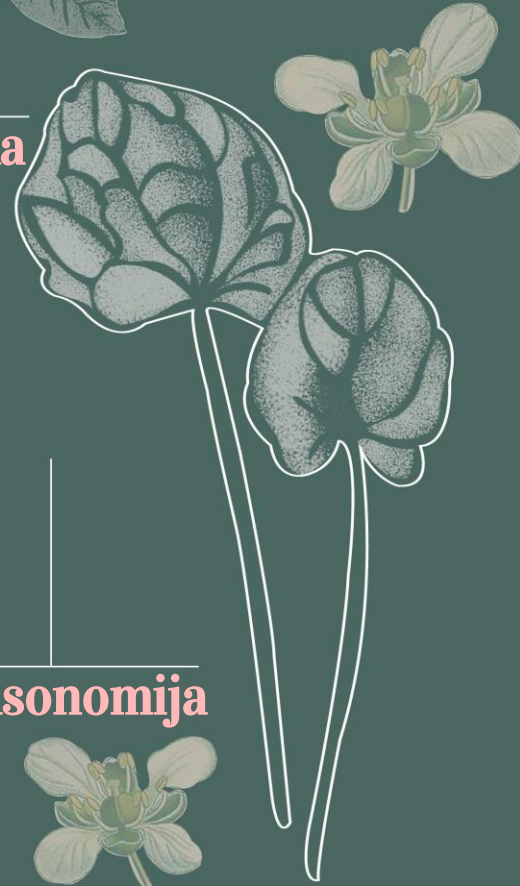
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**klasifikacija**



**sistematika**

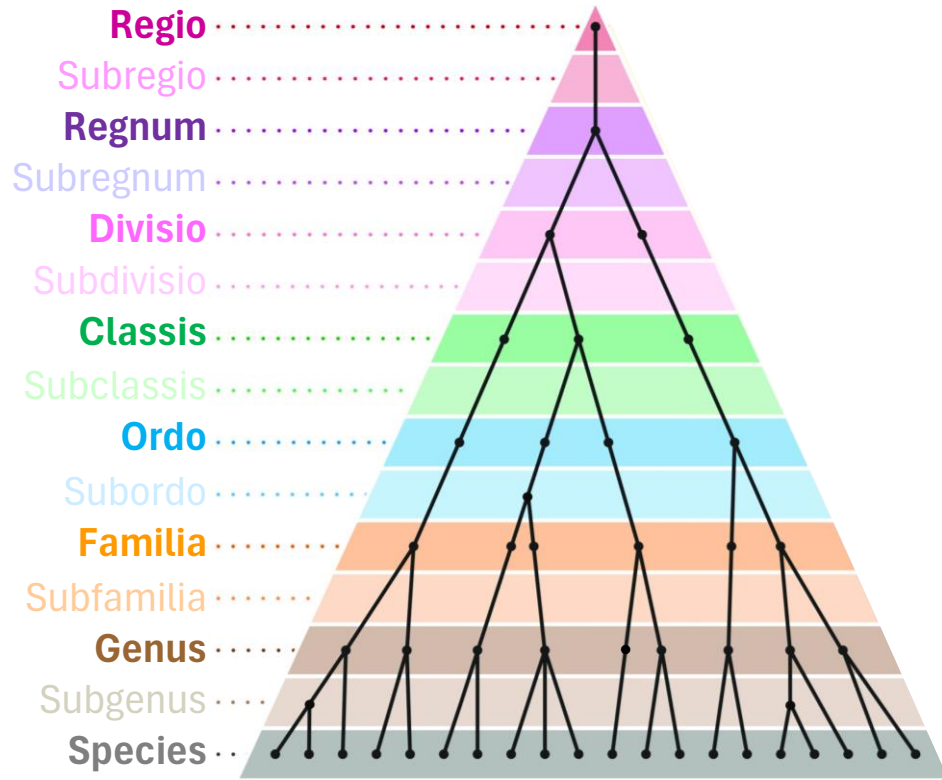


**taksonomija**

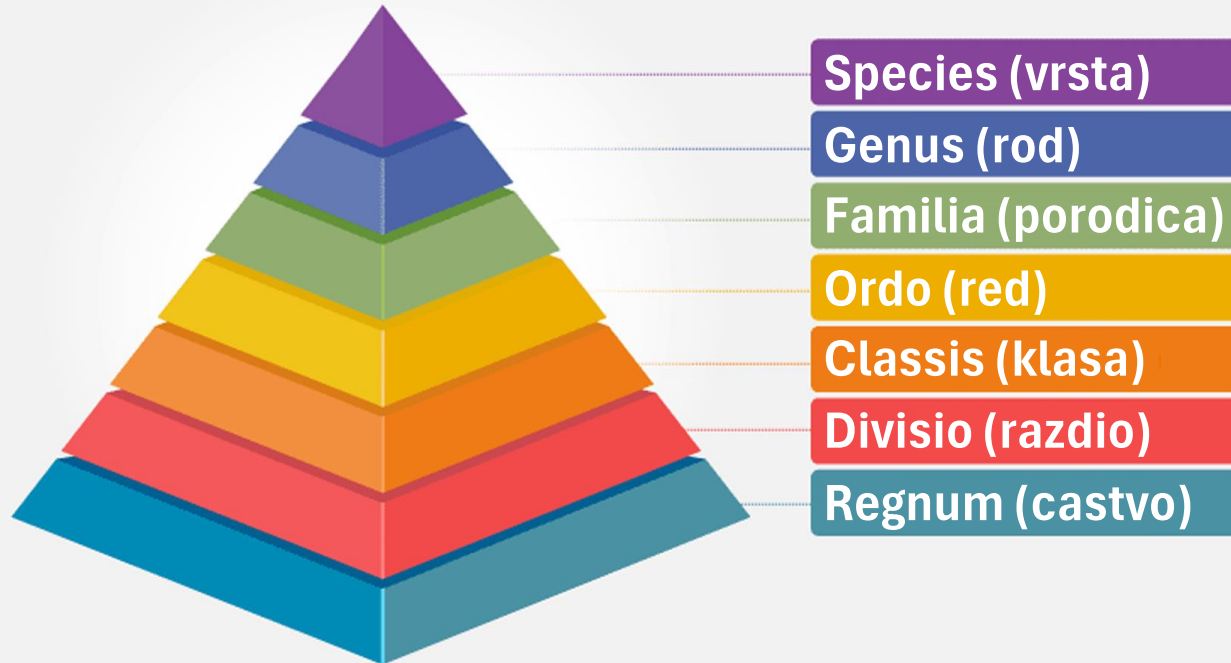
**nomenklatura**



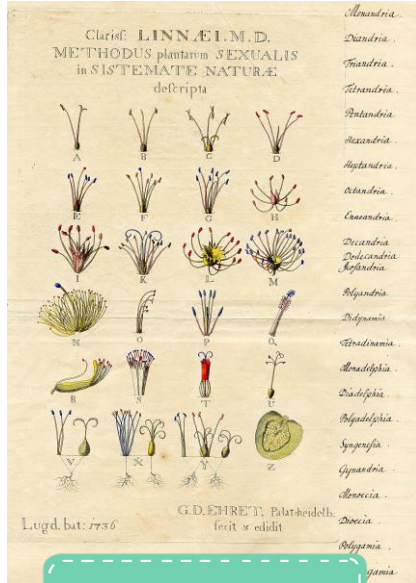
# Takson vs. taksomonska kategorija



# Osnovne taksonomske kategorije



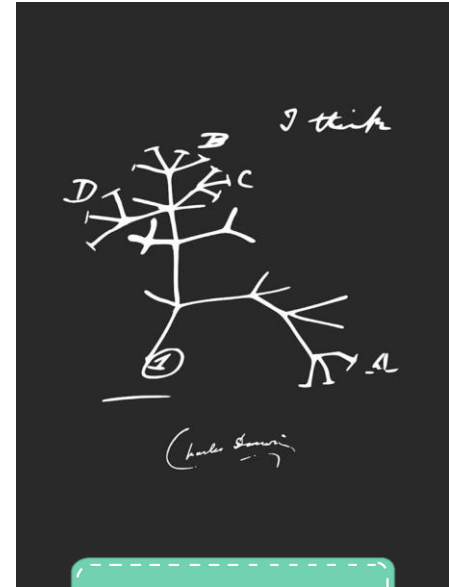
# Sistemi klasifikacije



vještački



prirodni



filogenetski



# Vještački sistemi se koriste u farmakognoziji



# Šta je vrsta?



*Geranium sanguinatum*

Plate 30  
I. Striped cranesbill  
*Geranium*

*Ribes fructu albo.*

*Ribes maior fructu rubro.*

*Ribes fructu nigro.*

*Ribes minor fructu rubro*

*Ribes vulparis fructu rubro*

Plate 14

V. White currant  
*Ribes*

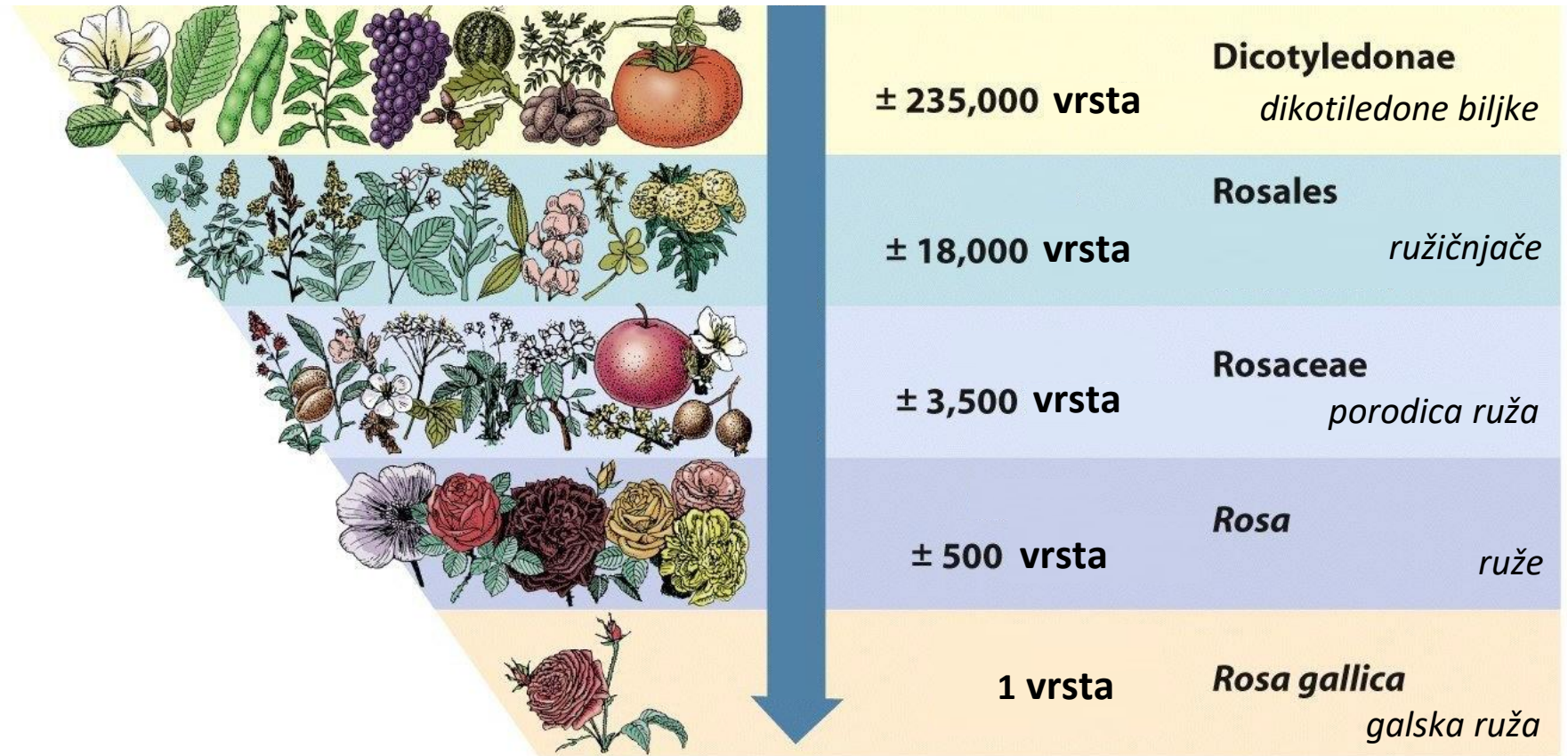
I. Alpine currant  
*Ribes*

III. Red currant  
*Ribes*

II. Common currant  
*Ribes*

*Iris simplex Polja*

# Pripadnost vrste





# Monotipski takson

**politipska porodica**  
(više od 1 roda, više vrsta)

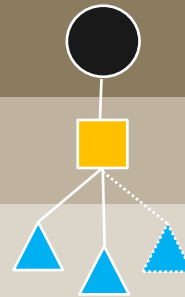
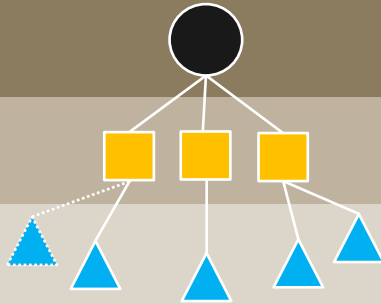
**monotipska porodica**  
(1 rod, 1 ili više vrsta)

**monospecijska porodica**  
(1 rod, 1 vrsta)

*Porodica*

*Rod*

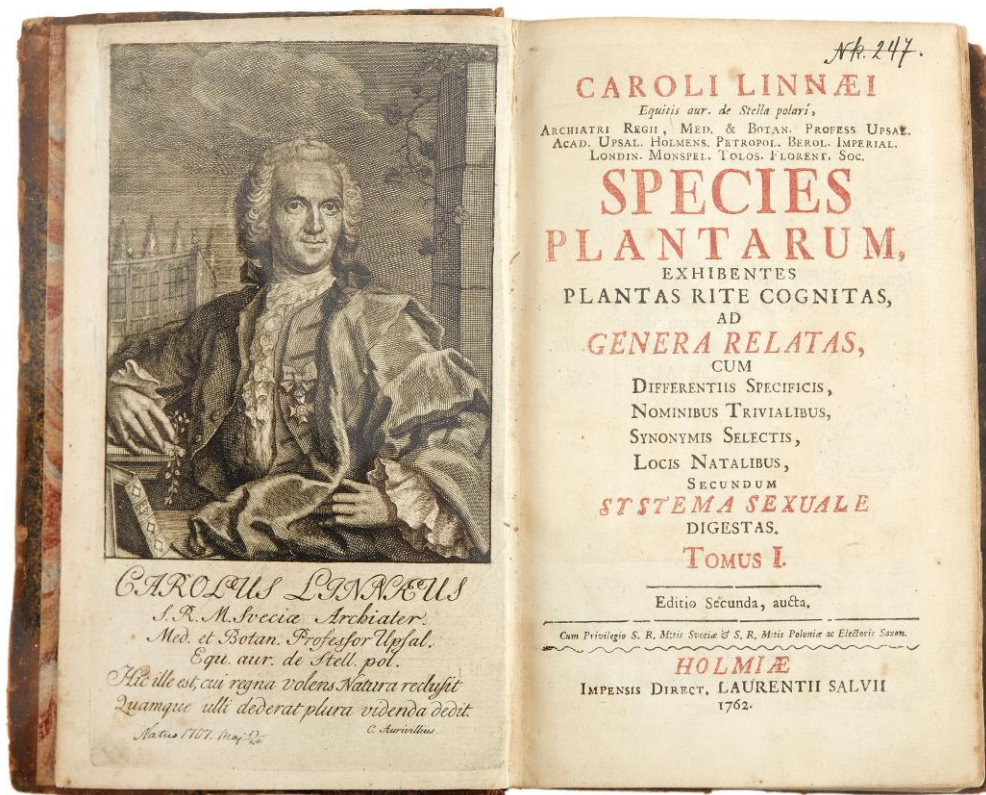
*Vrsta*



**politipski rod**  
(više od 1 vrste)

**monotipski rod**  
(1 vrsta)

# Lineova binarna nomenklatura



# Polinomijalna terminologija



*Physalis annua ramosissima,  
ramis angulosis glabris,  
foliis dentato-serratis*

*Physalis angulata*

# Ime roda i epitet vrste zajedno obrazuju binom



# Komponovanje naučnih imena





*Aster*



*Equisetum*

# Nomenklaturni tip



*Cupressus*



*Poa*

# Homonimi i sinonimi

*Vicia gigantea* Hook.  
(1831)

*Vicia gigantea* Bunge  
non Hook.  
(1835)

*Vicia nigricans* subsp. *gigantea*  
(Hook.) Lassetter & Gunn  
(1980)



*Vicia ramosissima* Franch.  
(1890)

# Nastavci za kategorije

Regnum	Plantae
Divisio	Magnoliophyta
Classis	Magnoliopsida
Ordo	Magnoliales
Familia	Magnoliaceae
Genus	<i>Magnolia</i>
Species	<i>Magnolia grandiflora</i> L.





# Mjesto biljaka u savremenim sistemima klasifikacije



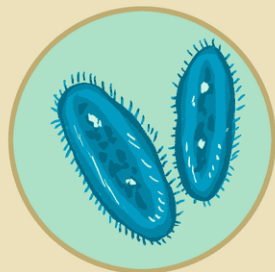
Animalia



Plantae



Fungi



Protista

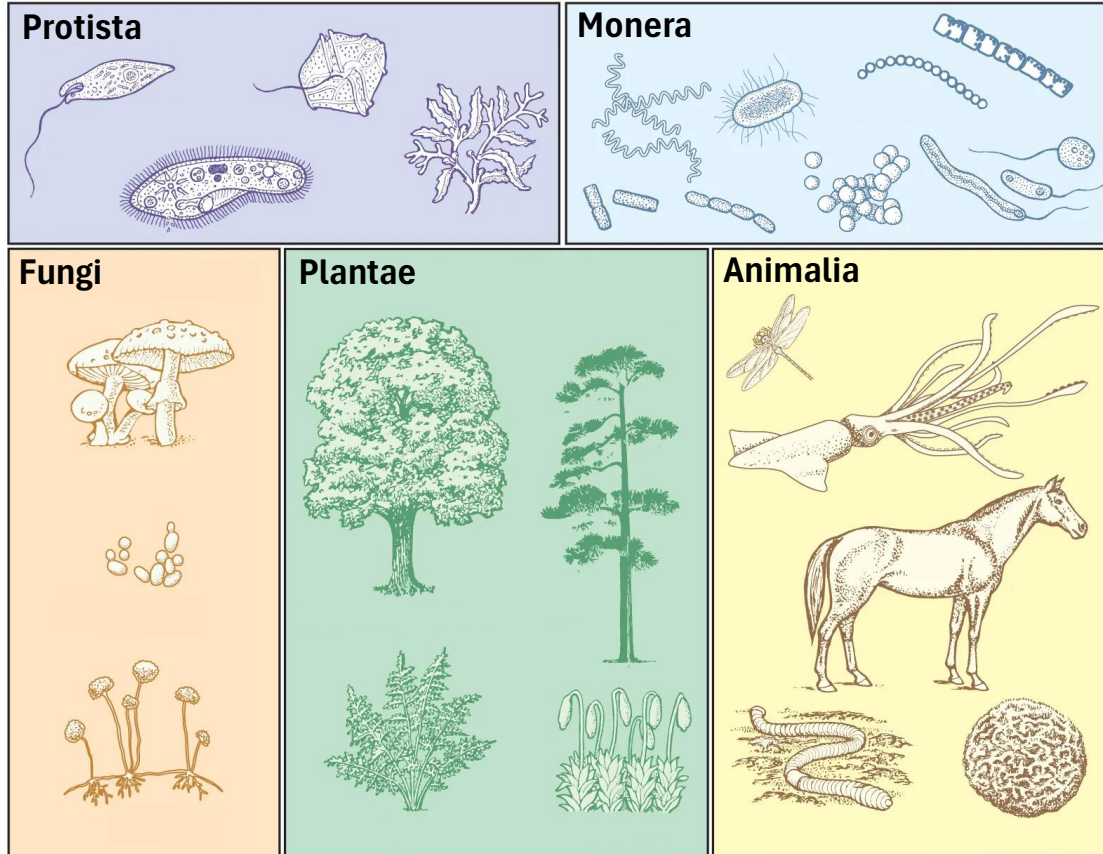


Eubacteria

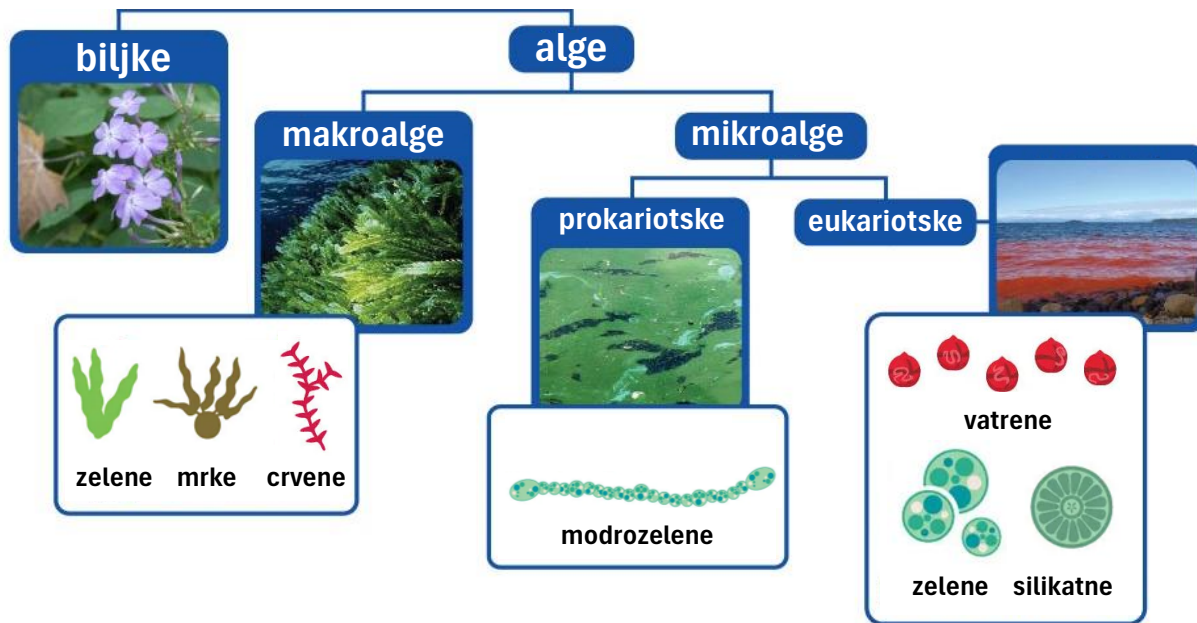


Archaeobacteria

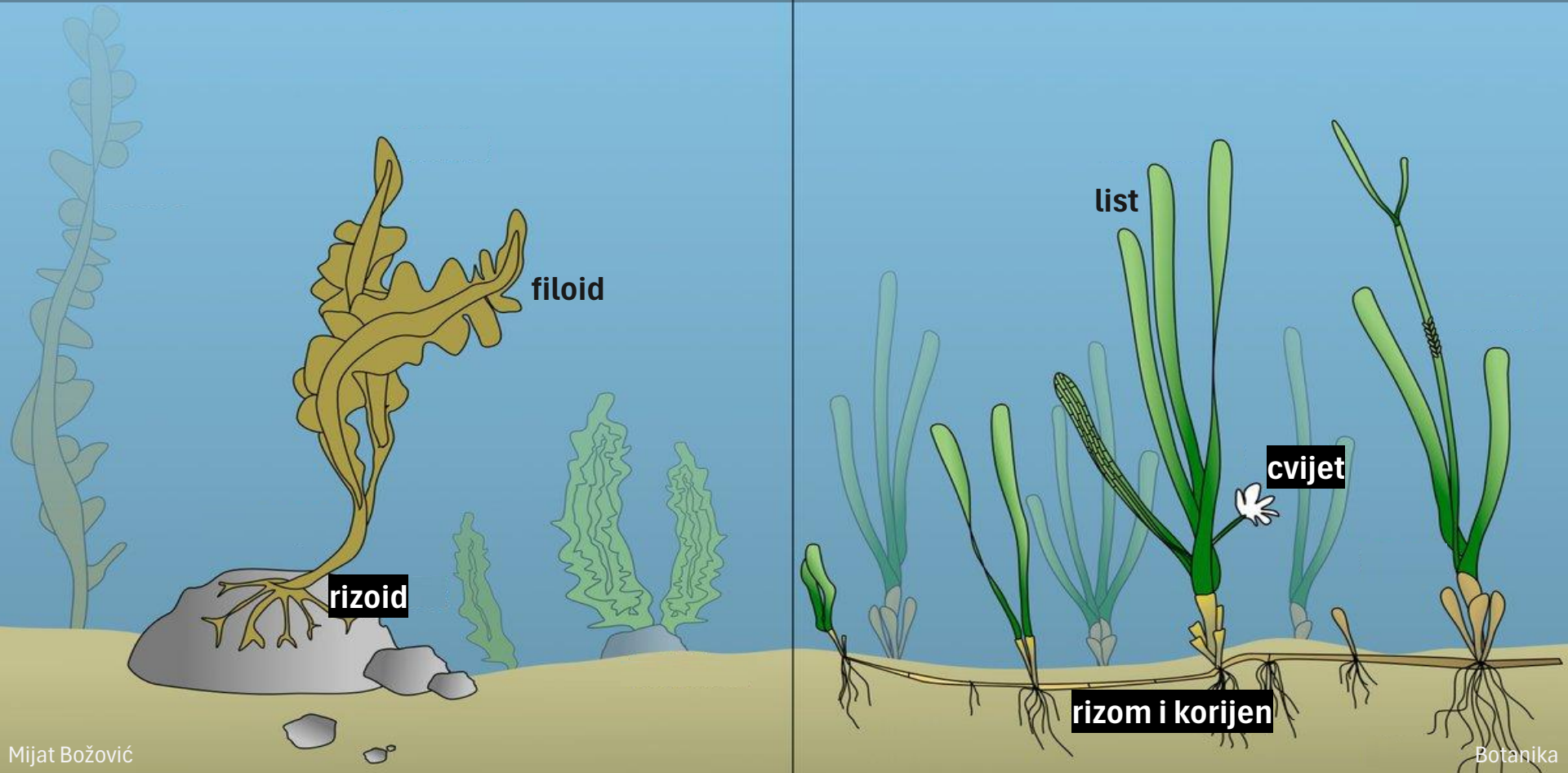
# Whittaker-ovih pet carstava



# Fotosintetički organizmi



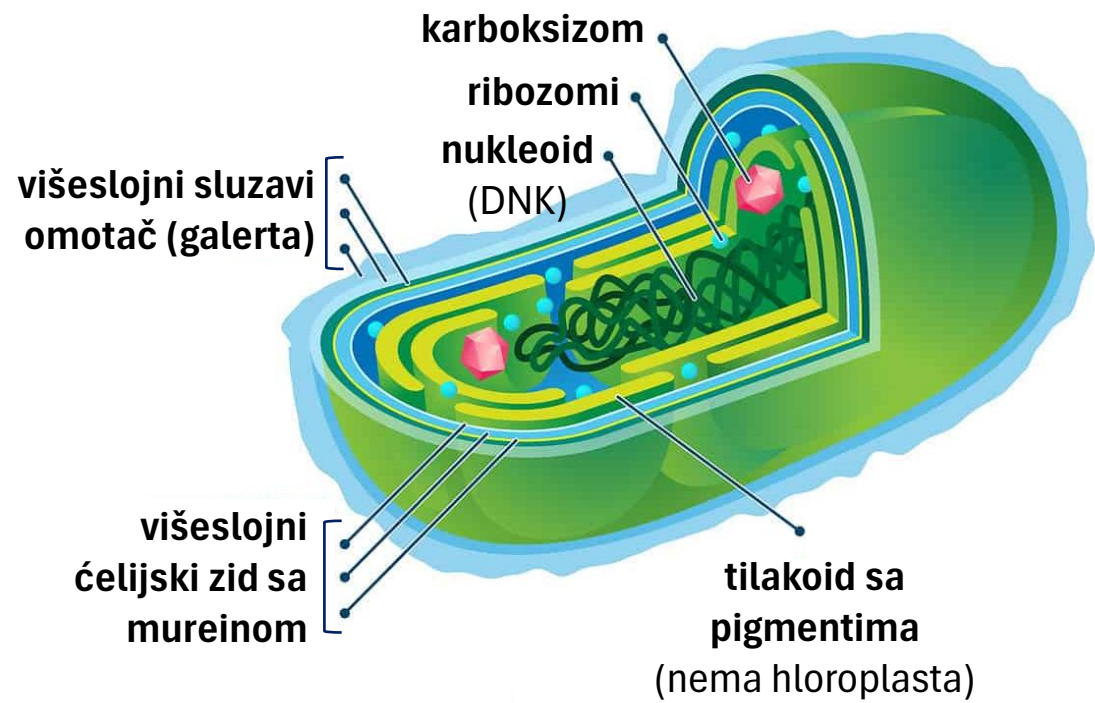
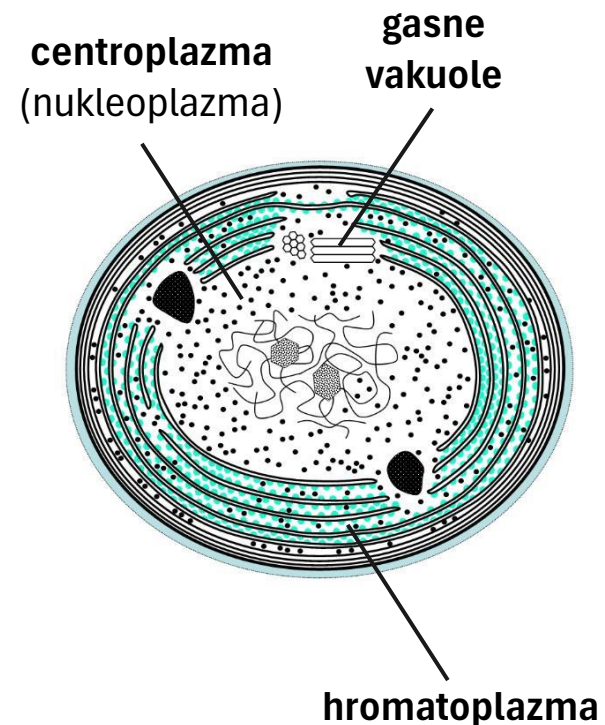
# Alga vs. biljka



# Cyanophyta – prokariotske alge



# Građa ćelije

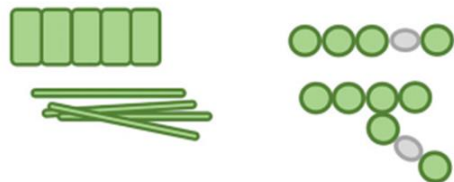


# Morfološki oblici

jednoćelijski

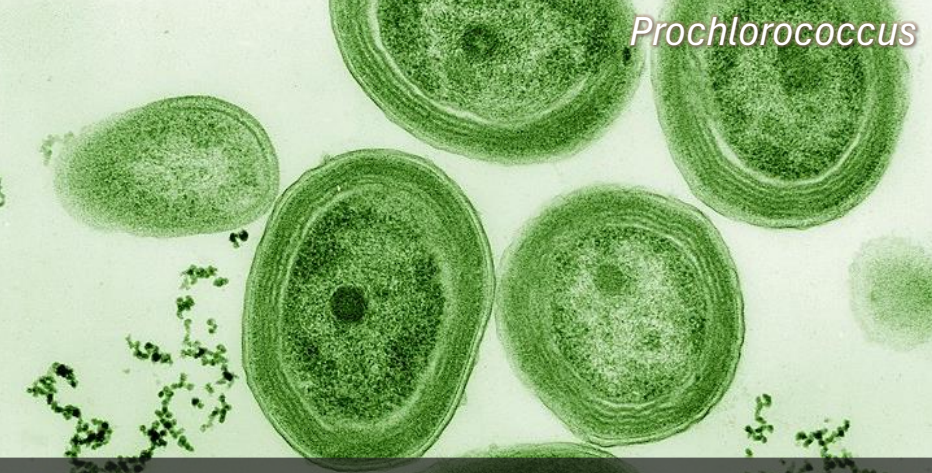


kolonijalni

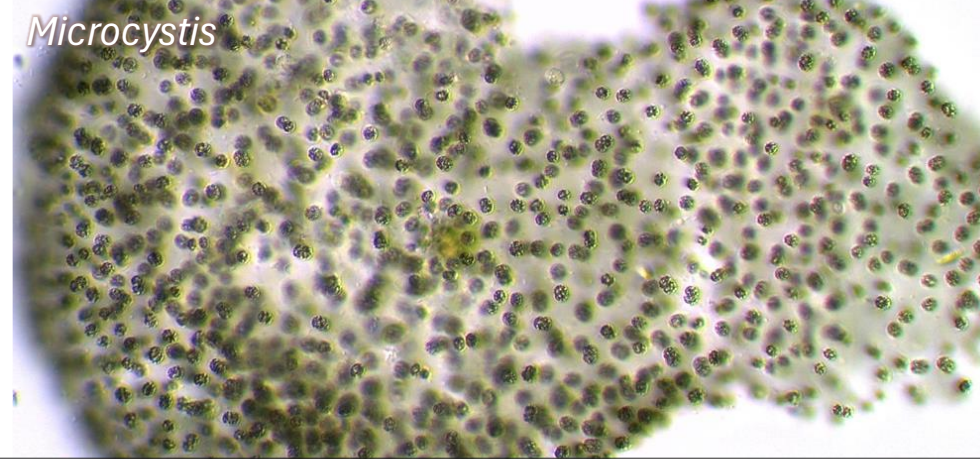


višećelijski





*Prochlorococcus*



*Microcystis*

# Jednoćelijski i kolonijalni predstavnici

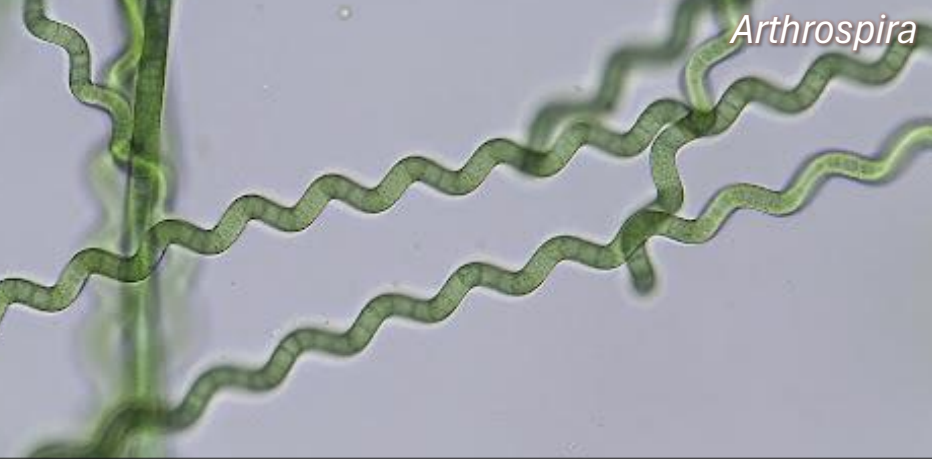


*Chroococcus*

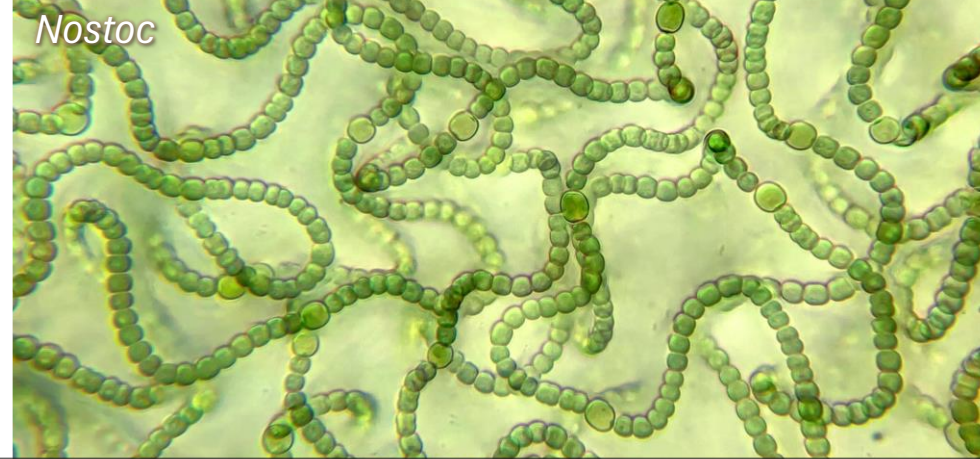


*Merismopedia*





*Arthrospira*



*Nostoc*

# Višecelijski (končasti) predstavnici

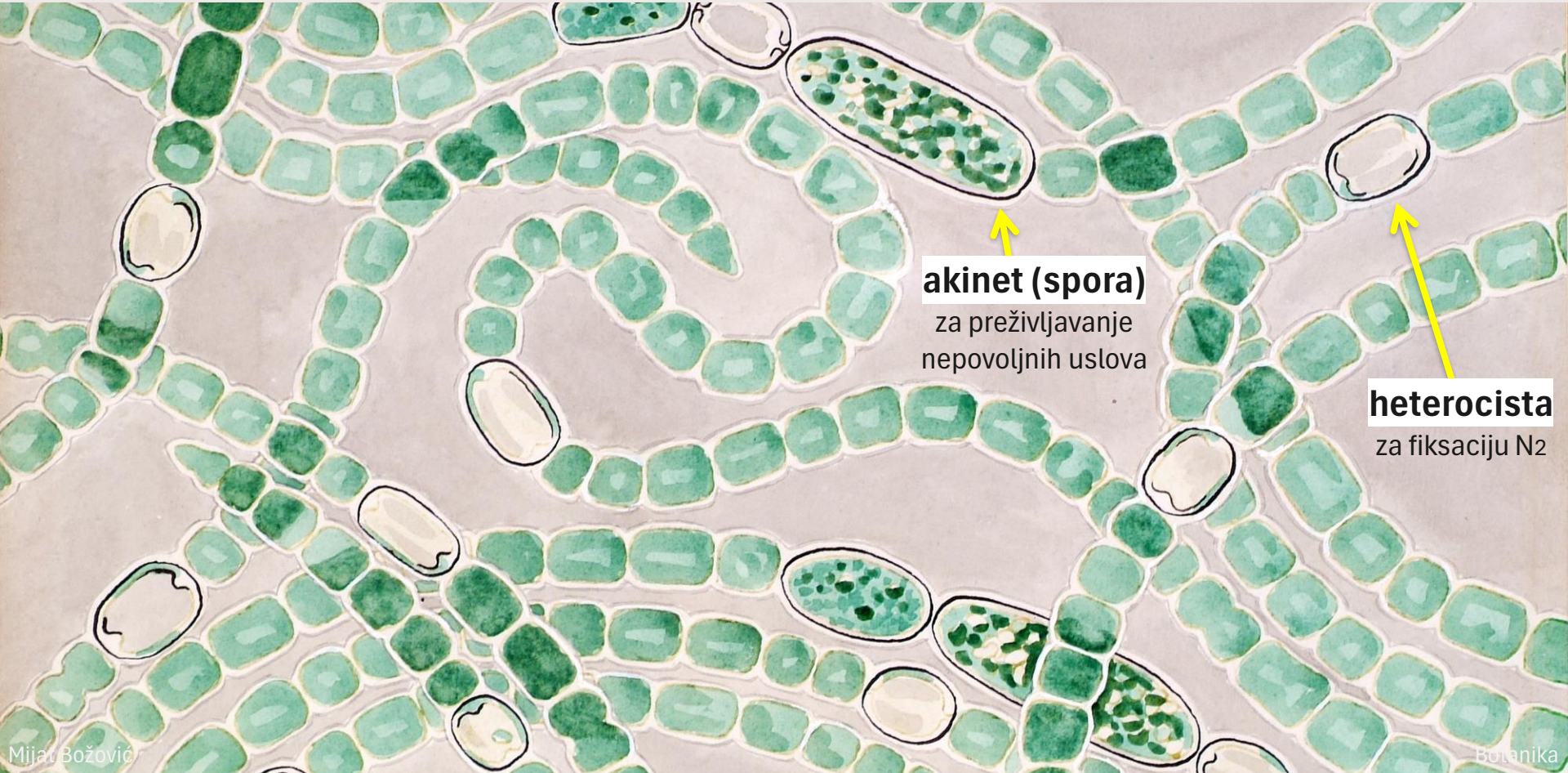


*Oscillatoria*



*Anabaena*

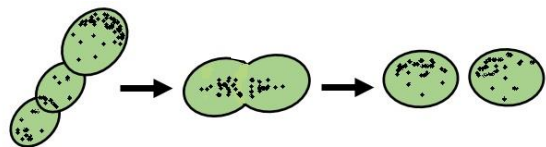
# Akineti i heterociste



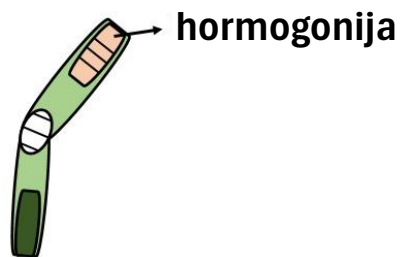
**akinet (spora)**  
za preživljavanje  
nepovoljnih uslova

**heterocista**  
za fiksaciju N<sub>2</sub>

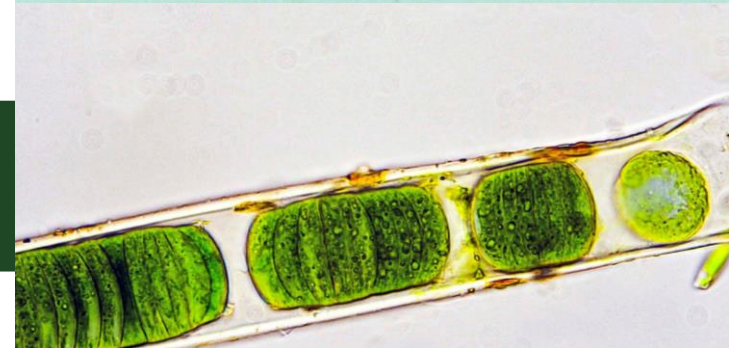
# Razmnožavaju se vegetativno



diobom ćelije



fragmentacijom  
(hormogonijama)



# Značaj modrozelenih algi



## Prehrambena industrija

kao hrana (tengu-hljeb) i suplement (spirulina)



## Zdravlje ljudi

kao izvor sekundarnih metabolita sa antibiotskim dejstvom i različitih organskih kiselina i proteina



## Poljoprivreda i zaštita životne sredine

azotofiksatori (prirodna fertilizacija), prečišćavanje voda, bioindikatori



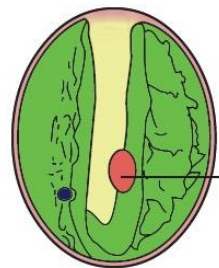
## Ekološki značaj

pionirski organizmi, otpornost na ekstremne uslove, uzrokuju cvjetanje vode, simbioza (fotobionti u lišajevima)

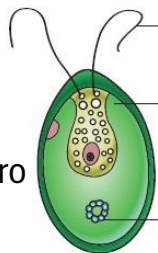
# Eukariotske alge



# Talus: vegetativno tijelo alge



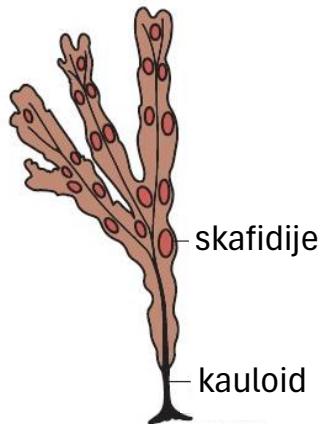
jedro



bič

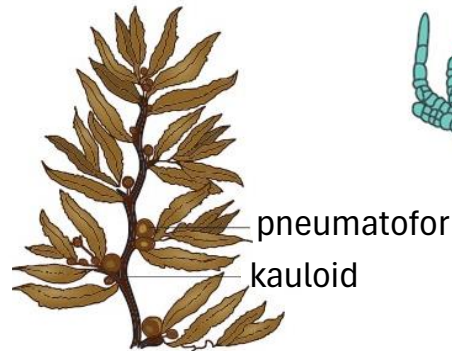
hloroplast

pirenoid



skafidije

kauloid

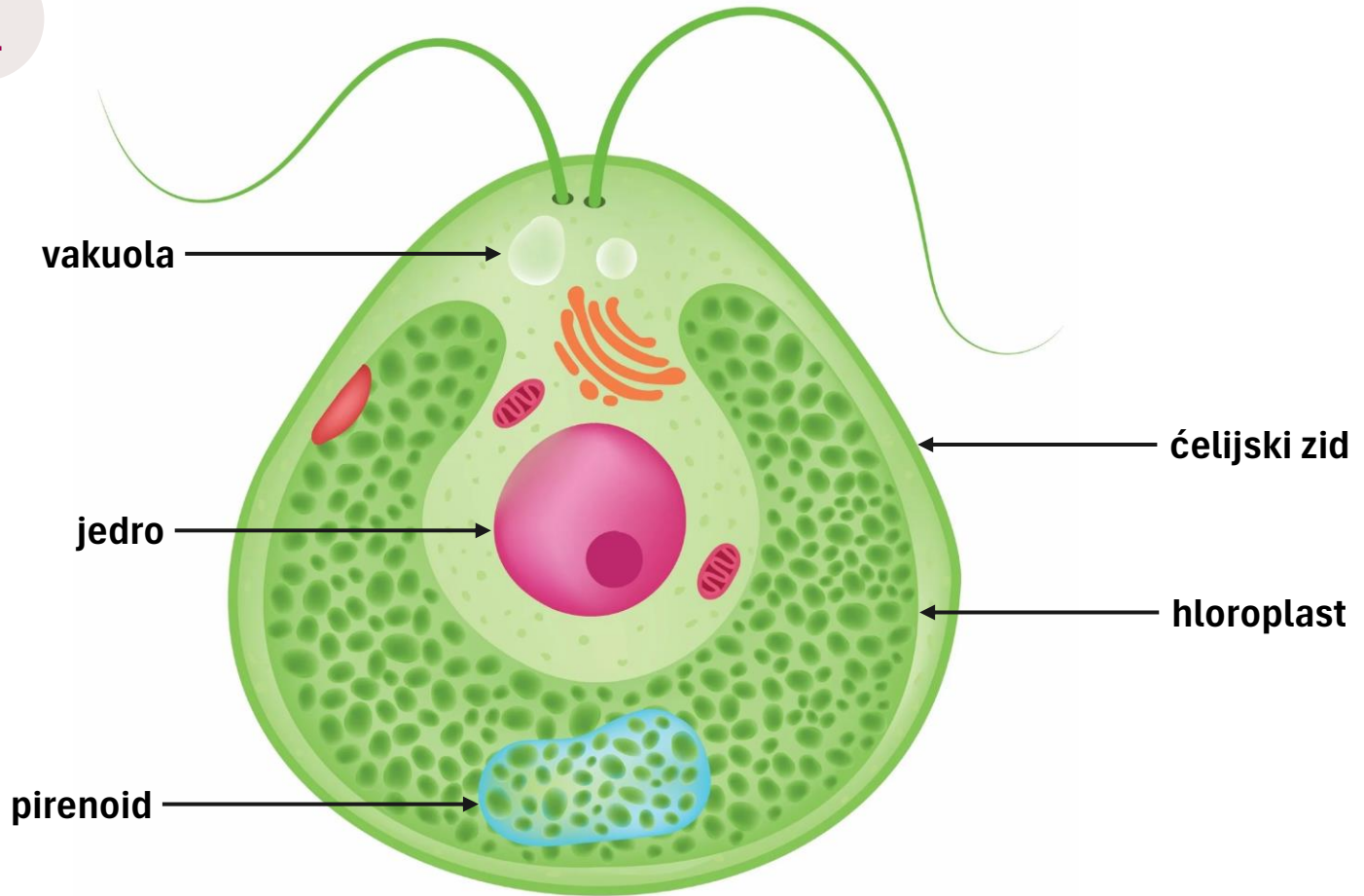


pneumatofor

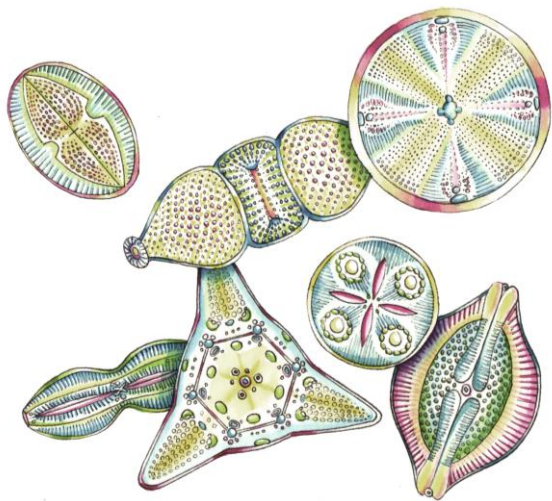
kauloid



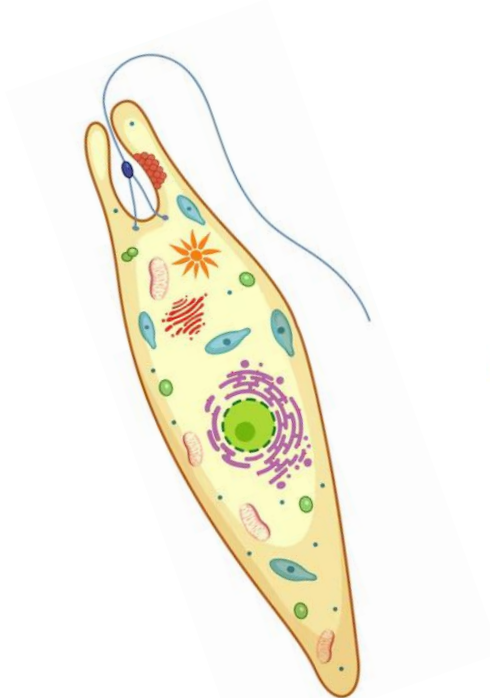
# Ćelija algi



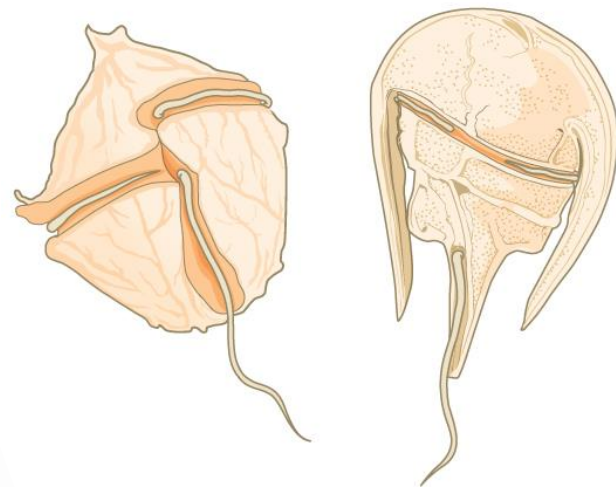
# Pelikula i teka



silikatni pancir (teka)  
kod Bacillariophyta



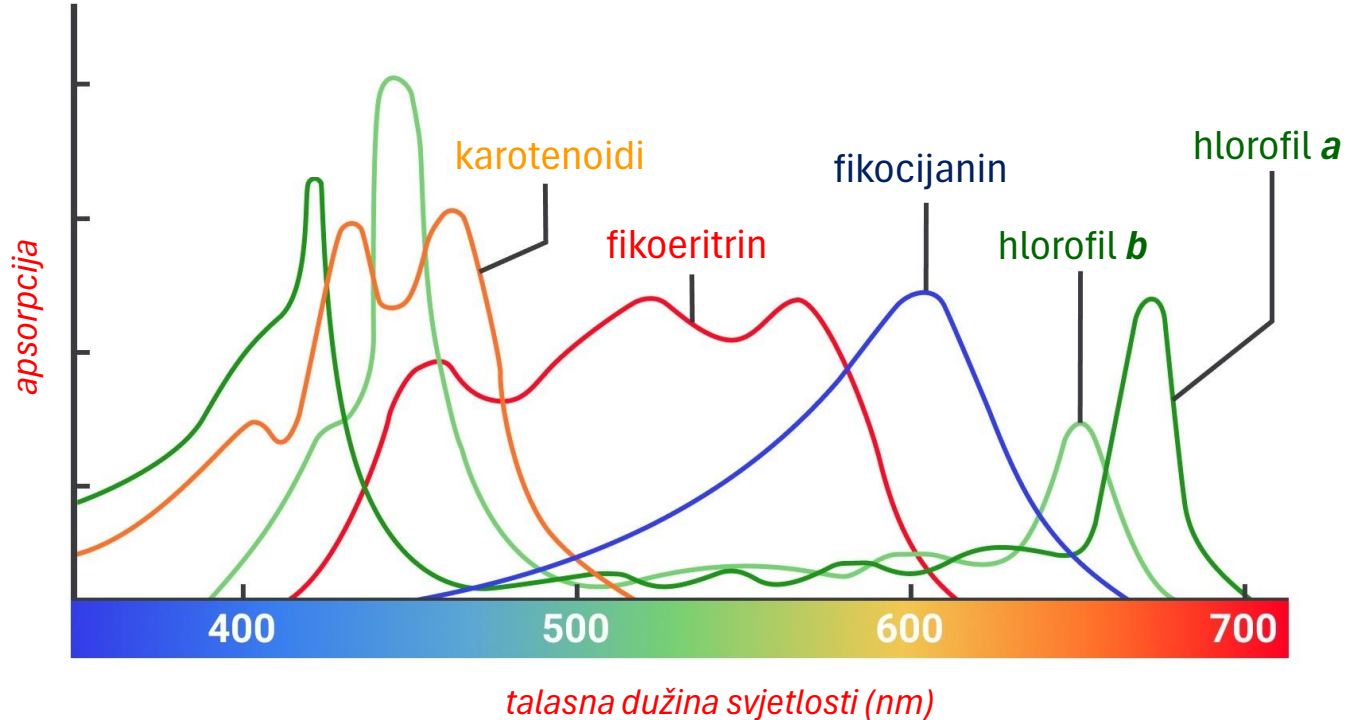
elastični omotač (pelikula)  
kod Euglenophyta



celulozni pancir (teka)  
kod Pyrophyta



# Ishrana algi: zeleni i pomoćni pigmenti

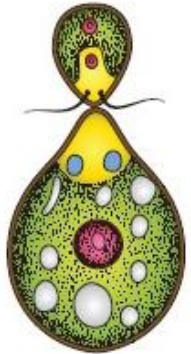
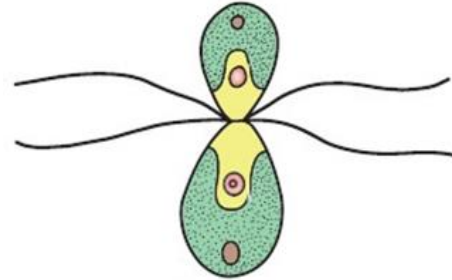
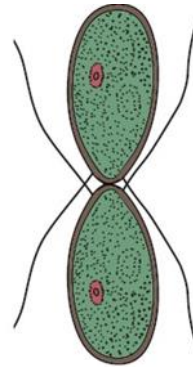
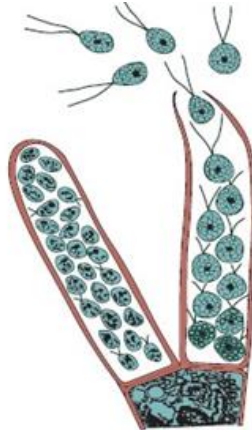
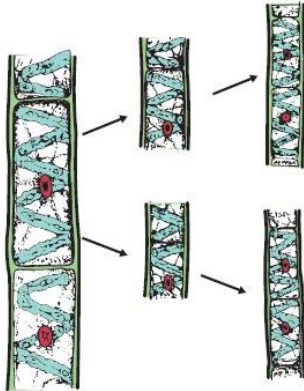
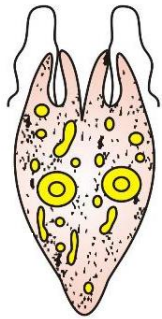


# Razmnožavanje algi

vegetativno

bespolno  
(sporama)

polno



*mitoza*

*fragmentacija*

*zoospore*

*izogamija*

*anizogamija*

*oogamija*

# Klasifikacija algi



**Pyrrhophyta**



**Euglenophyta**



**Charophyta**



**Phaeophyta**



**Chrysophyta**



**Rhodophyta**



**Chlorophyta**



**Xanthophyta**



**Bacillariophyta**

# Chlorophyta





## Osobine zelenih algi

01

### **talus**

jednoćelijske, kolonijalne,  
sifonalne, višecelijske

02

### **razmnožavanje**

vegetativno, bespolno (zoosporama) i  
polno (izogamija, anizogamija, oogamija)

03

### **pigmenti**

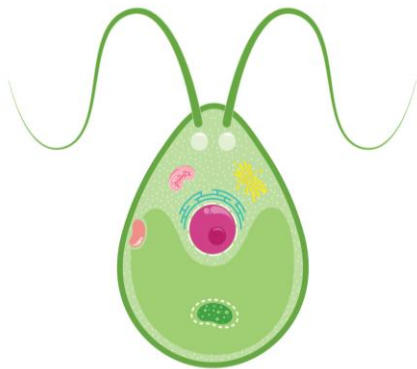
hlorofili a i b (dominiraju),  
karotenoidi

04

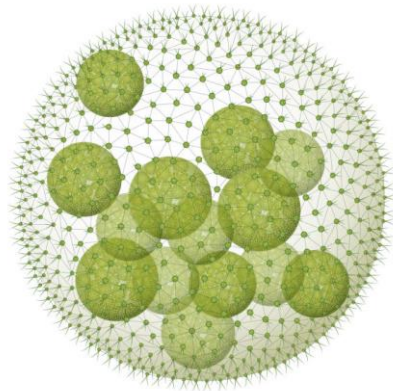
### **način života**

bentosne, planktonske, epifitske

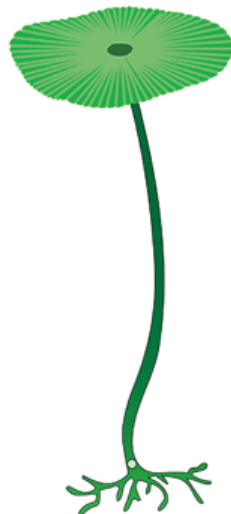
# Morfološki oblici



jednoćelijski



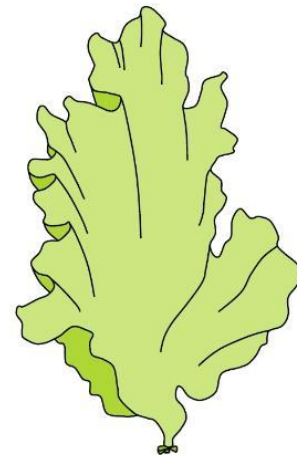
kolonijalni



sifonalni



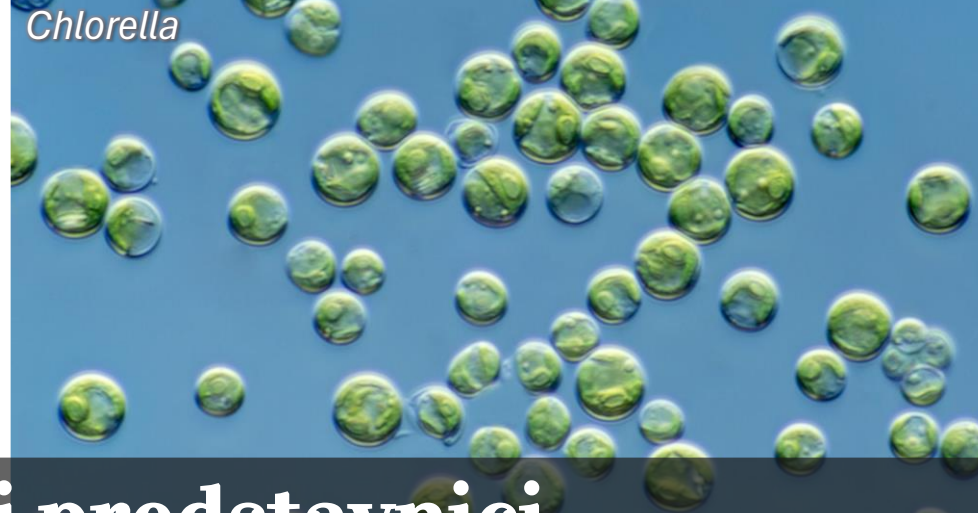
višećelijski



*Chlamydomonas*



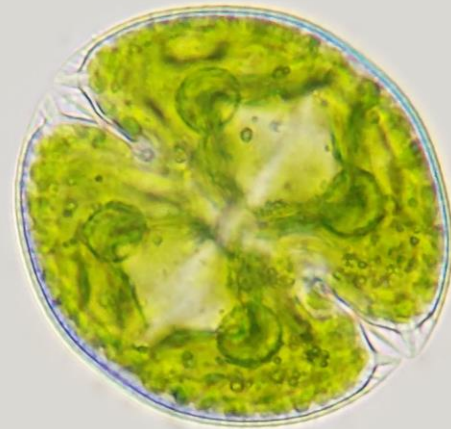
*Chlorella*



# Jednoćelijski predstavnici

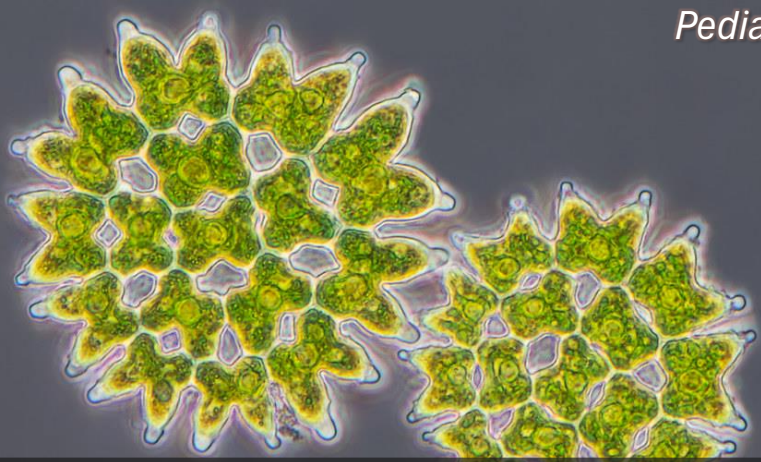


*Closterium*

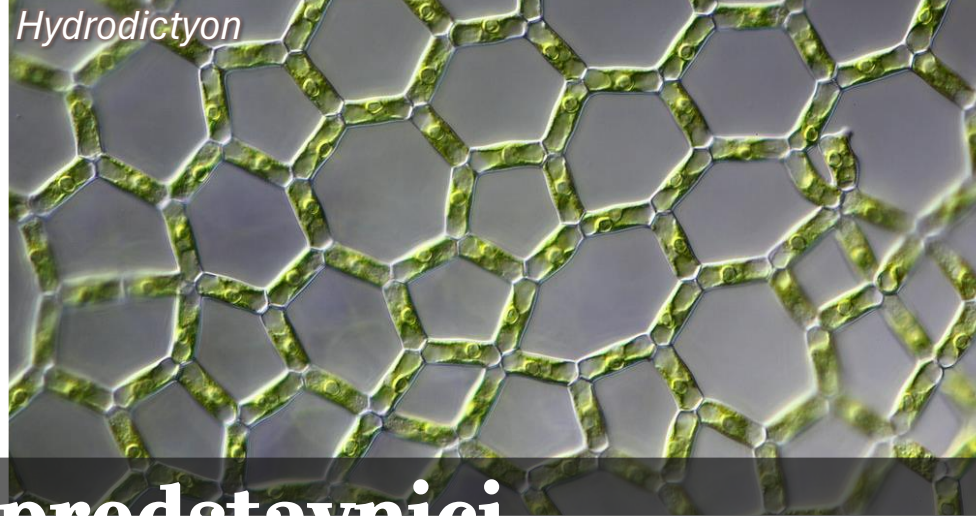


*Cosmarium*

*Pediastrum*



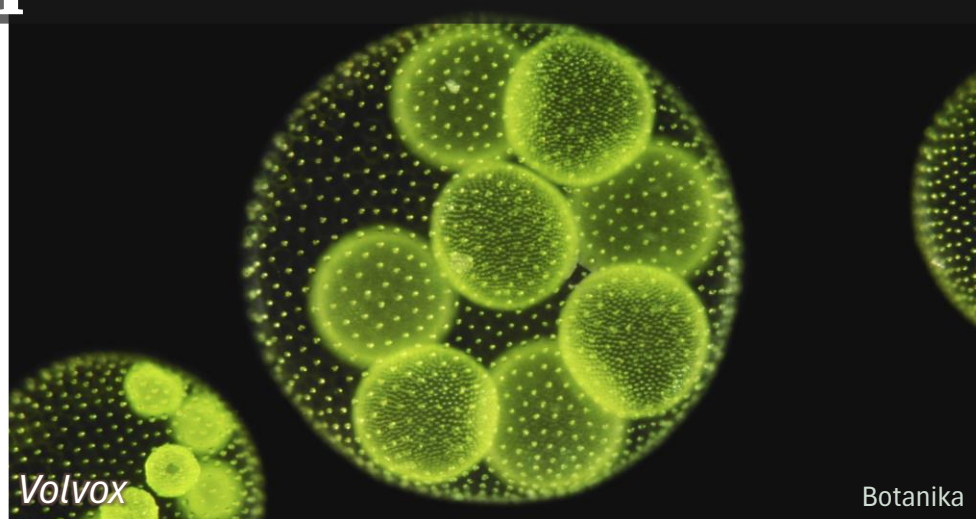
*Hydrodictyon*



# Kolonijalni predstavnici

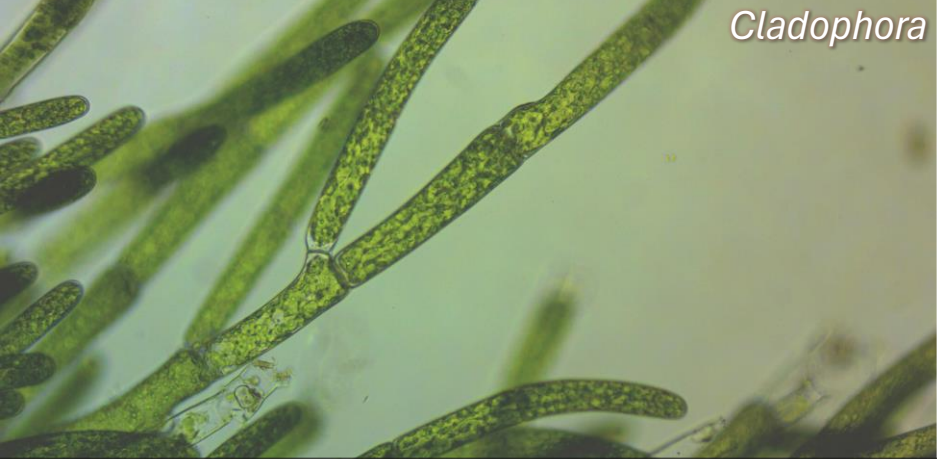


*Scenedesmus*



*Volvox*





*Cladophora*



*Caulerpa*

# Sifonalni predstavnici



*Acetabularia*



*Halimeda*



*Ulva*



*Zygnema*

# Višćelijski predstavnici



*Ulotrix*



*Spirogyra*

# Phaeophyta





## Osobine mrkih algi

01

### **talus**

višećelijski (kormoidna građa)

02

### **razmnožavanje**

vegetativno, bespolno (zoosporama)  
i polno (izogamija, anizogamija,  
oogamija)

03

### **pigmenti**

hlorofili a i c,  
karotenoidi (fukoksantin)

04

### **način života**

bentosne (isključivo morske)

# Kormoidni talus



*Macrocystis*



*Fucus*



*Alaria*



*Sargassum*



*Sargassum*



*Laminaria*

## Predstavnicu mrkih algi



*Fucus*



*Padina*

# Značaj algi



## Izvor hrane

izvor ugljenih hidrata, soli, vitamina i mikroelemenata (kombu)



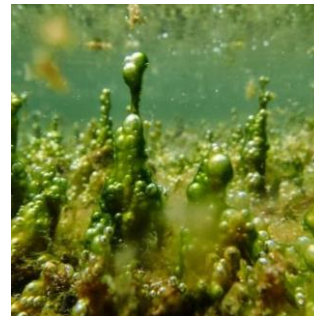
## U industriji

polisaharidi agar i karagen (od crvenih algi) i algin (od mrkih algi)



## U farmaciji i kozmetici

agar i karagen, izvor joda (mrke alge), anti-age (*Padina pavonica*)



## Ekološki značaj

glavni producenti u vodenoj sredini

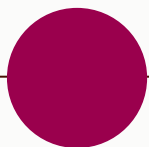
# Carstvo Fungi/Mycota





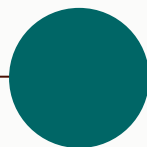
# Osobine gljiva

sličnosti sa  
biljkama



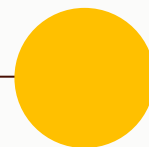
imaju **ćelijski zid**;  
**nepokretne** su;  
apsorpcija preko  
uvećane površine;  
**neograničen** rast

posebne  
specifičnosti



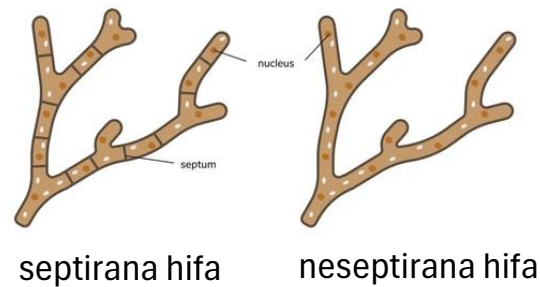
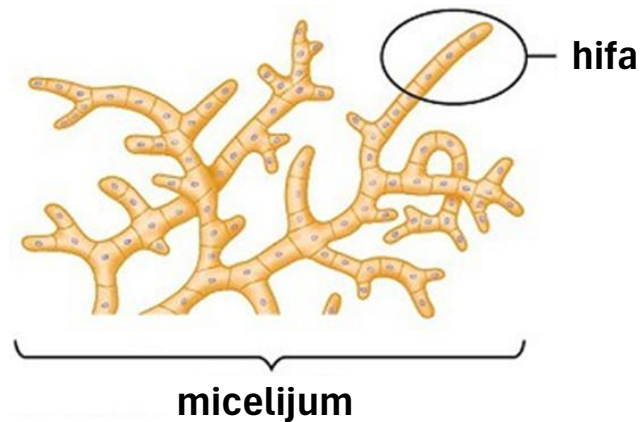
**hitin** u  
ćelijskom zidu;  
**dikarionska** faza  
u ciklusu razviću

sličnosti sa  
životinjama



**heterotrofna**  
ishrana;  
**glikogen** i **masti**  
kao rezervne  
materije;  
pigment **melanin**

# Micelijum: vegetativno tijelo gljive



# Heterotrofna ishrana

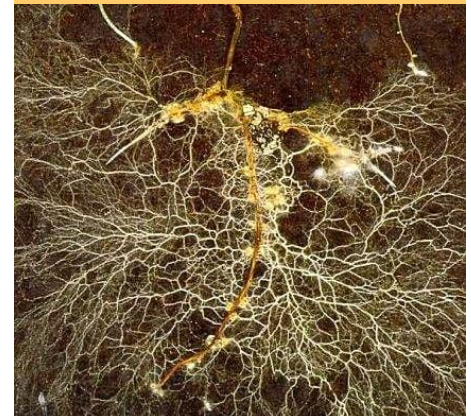
saprofiti



paraziti



simbionti



# Razmnožavanje

**vegetativno**

**fragmentacijom  
micelijuma i pupljenjem**

*pupljenje kvasca i  
pseudomicelijum;  
sklerocije i strome u  
nepovoljnim uslovima*

**bespolno**

**obrazovanjem  
spora**

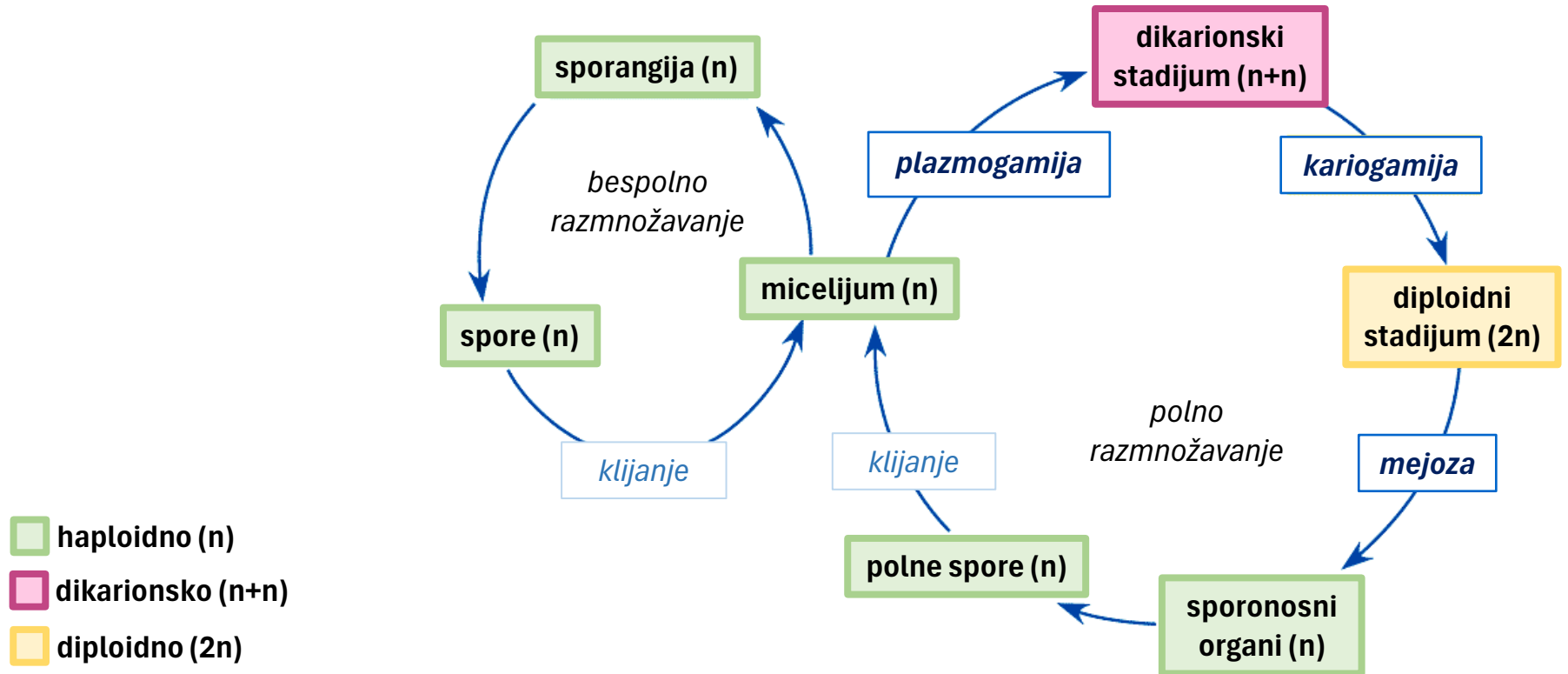
*endogene (sporangiospore)  
i egzogene spore (konidije)*

**polno**

**gametogamija,  
gemetangiogamija,  
somatogamija**

*uvijek se dešava  
plazmogamija,  
kariogamija i mejoza*

# Životni ciklus

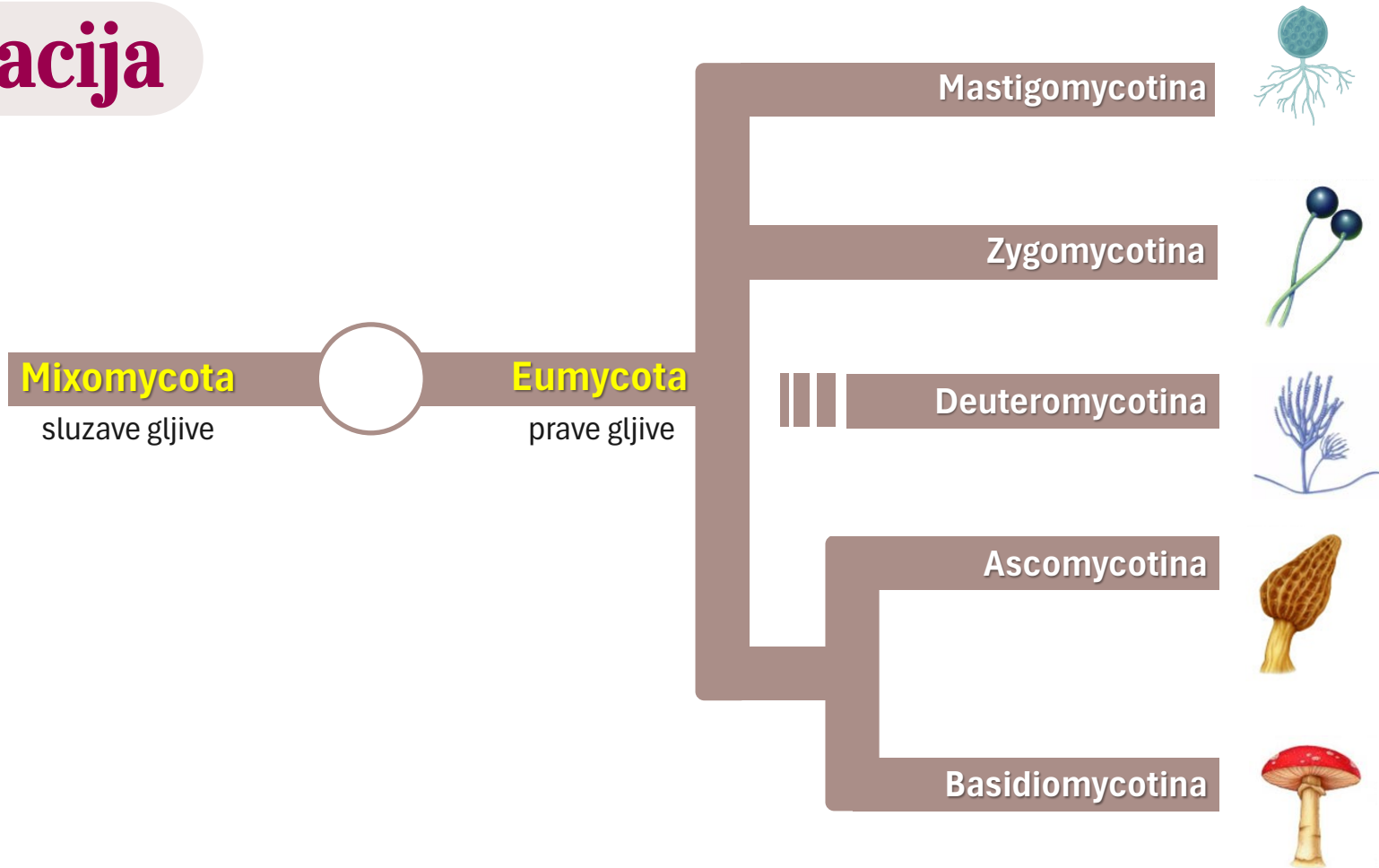


# Nastavci za kategorije

Regnum	Fungi
Divisio	Eu <b>mycota</b>
Subdivisio	Basidi <b>mycotina</b>
Classis	Hymeno <b>mycetes</b>
Ordo	Agarica <b>les</b>
Familia	Amanita <b>aceae</b>
Genus	<i>Amanita</i>
Species	<i>Amanita muscaria</i>



# Klasifikacija



# Zygomycotina

A detailed microscopic image showing a dense network of fine, white, thread-like hyphae. Interspersed among these hyphae are numerous small, dark, spherical spores. The background is blurred, showing some brown organic matter and green plant parts, suggesting a natural or laboratory setting where the fungus is growing.





## Osobine zigomikota

01

### **talus**

neseptirani haploidni micelijum  
(neseptirane hife)

02

### **razmnožavanje**

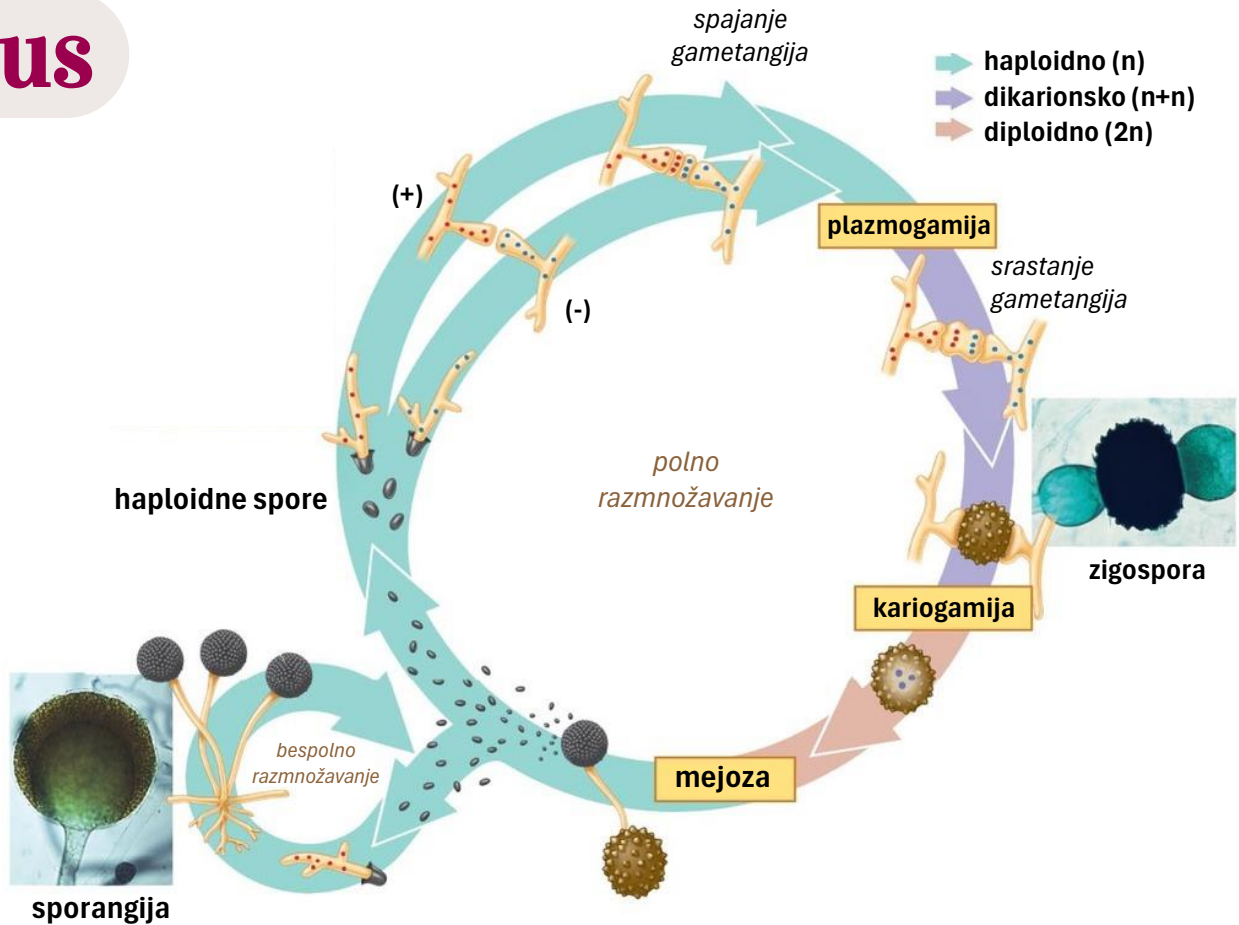
polno (zigogamija) i  
bespolno (endogenim sporama)

03

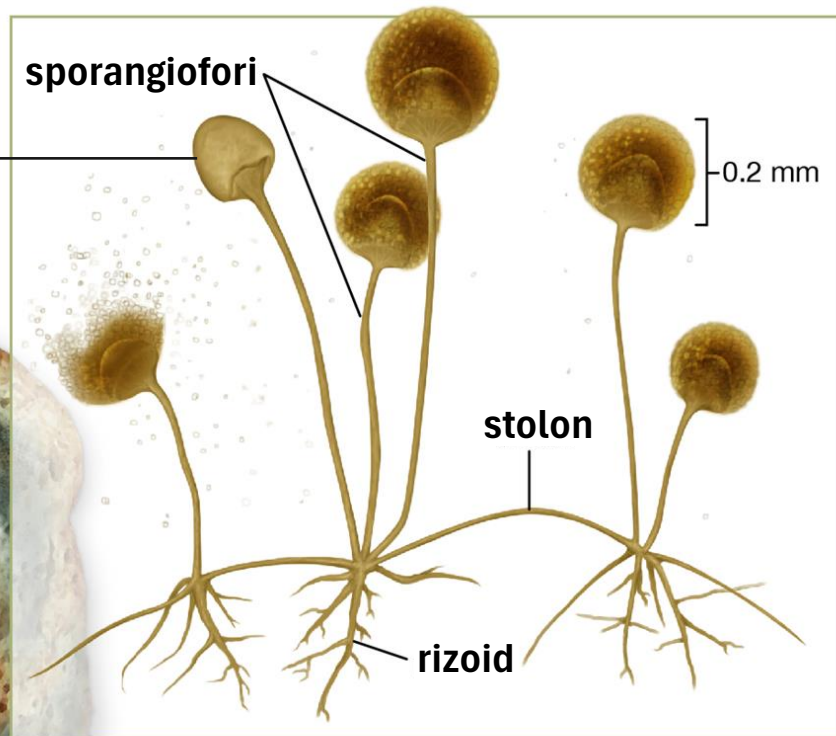
### **način života**

saprofitski i parazitski

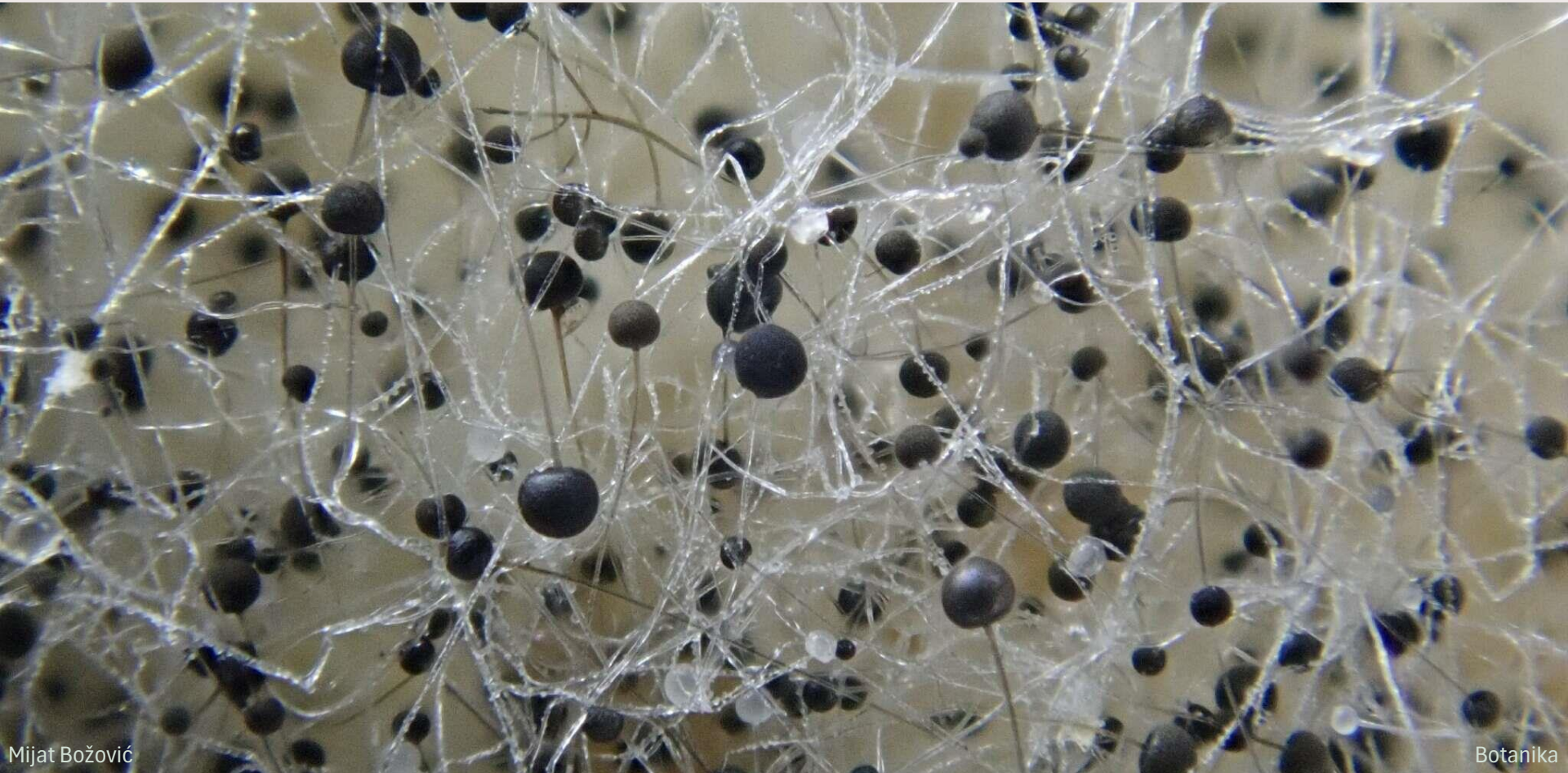
# Životni ciklus



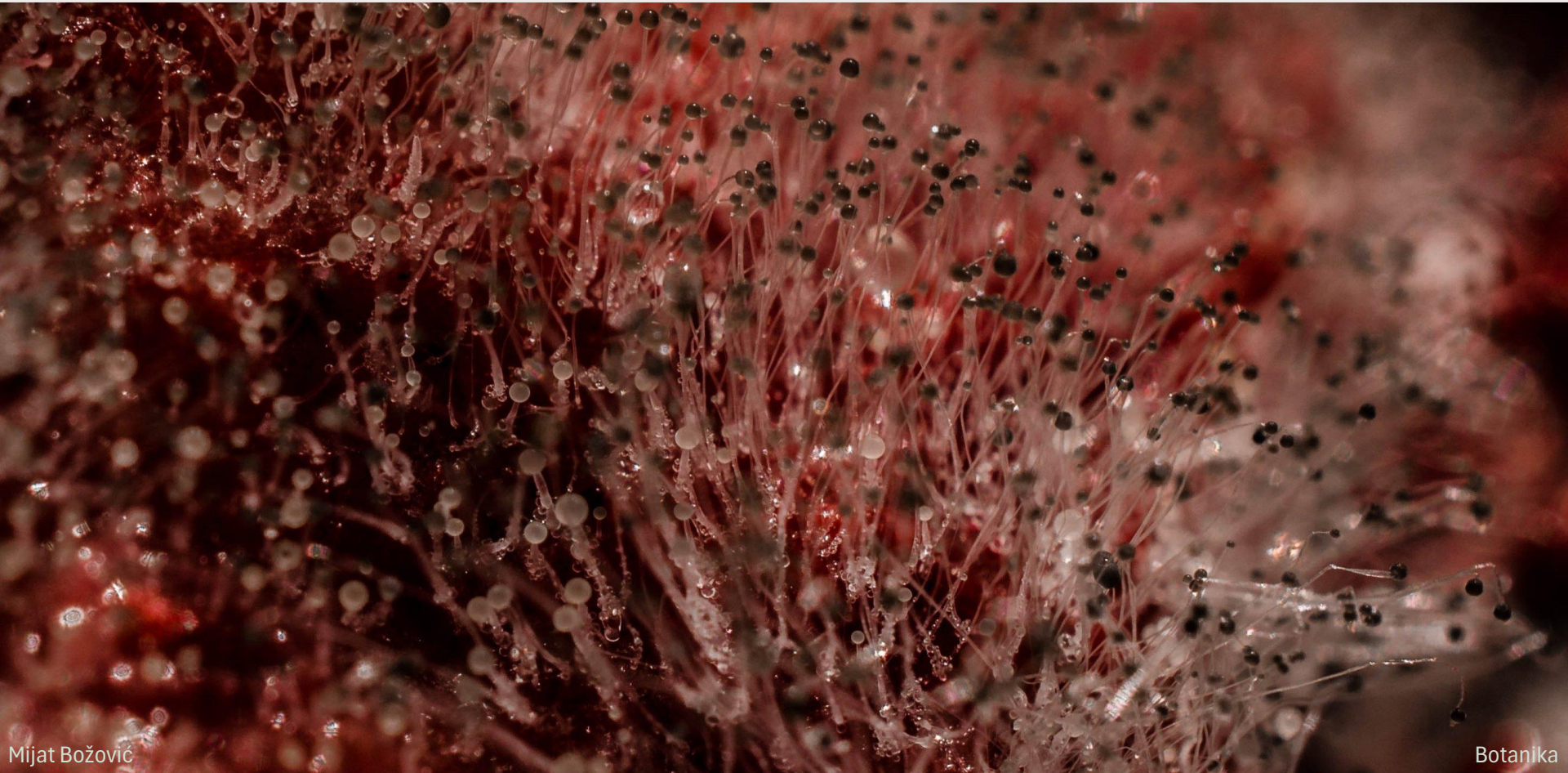
# Sporonosni organ za obrazovanje endogenih spora



# *Rhizopus stolonifer*

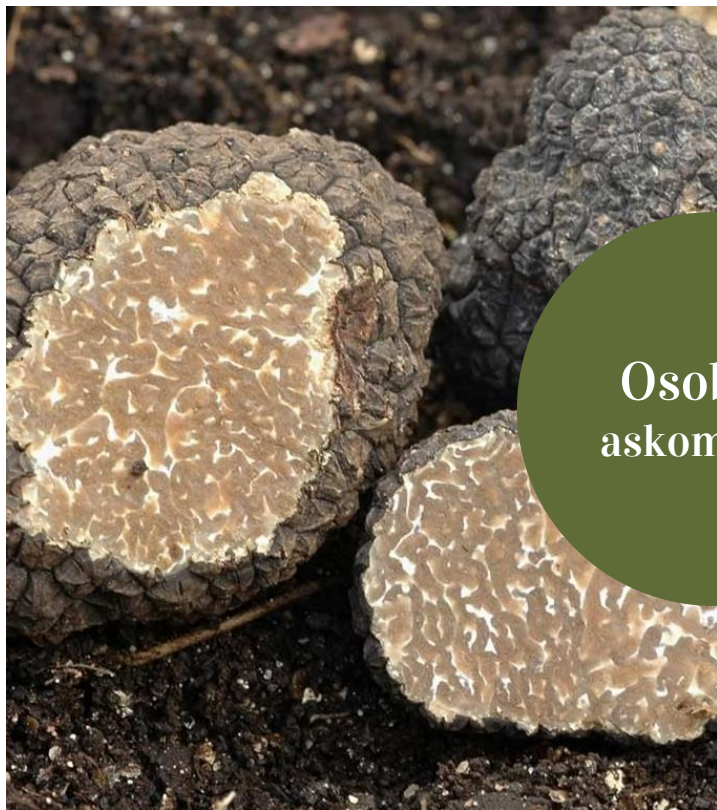


# *Mucor mucedo*



# Ascomycotina





## Osobine askomikota

01

### **talus**

septirani haploidni micelijum

02

### **razmnožavanje**

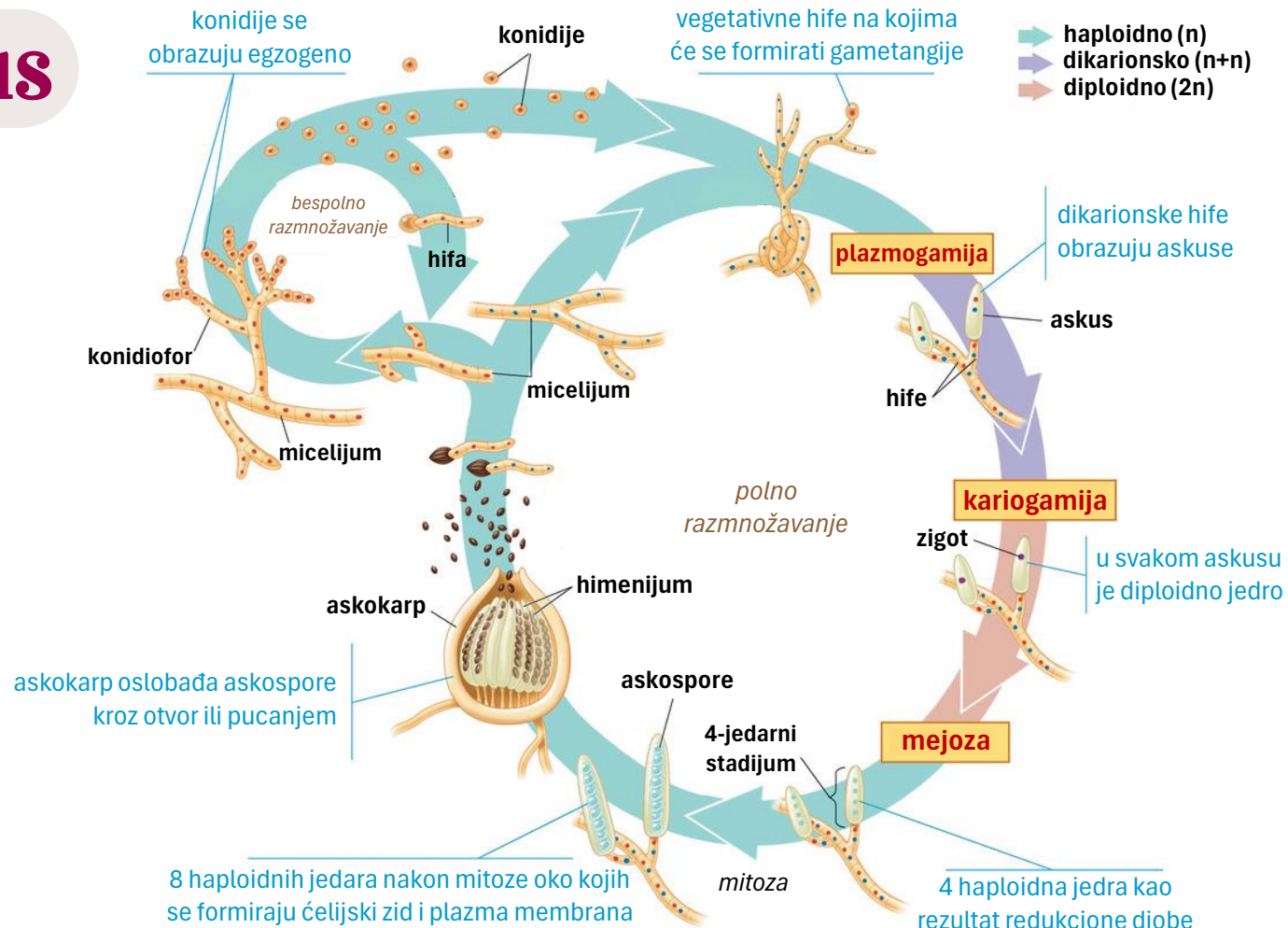
polno (gametangiogamija: askusi sa endogenim askosporama) i bespolno (konidijama)

03

### **način života**

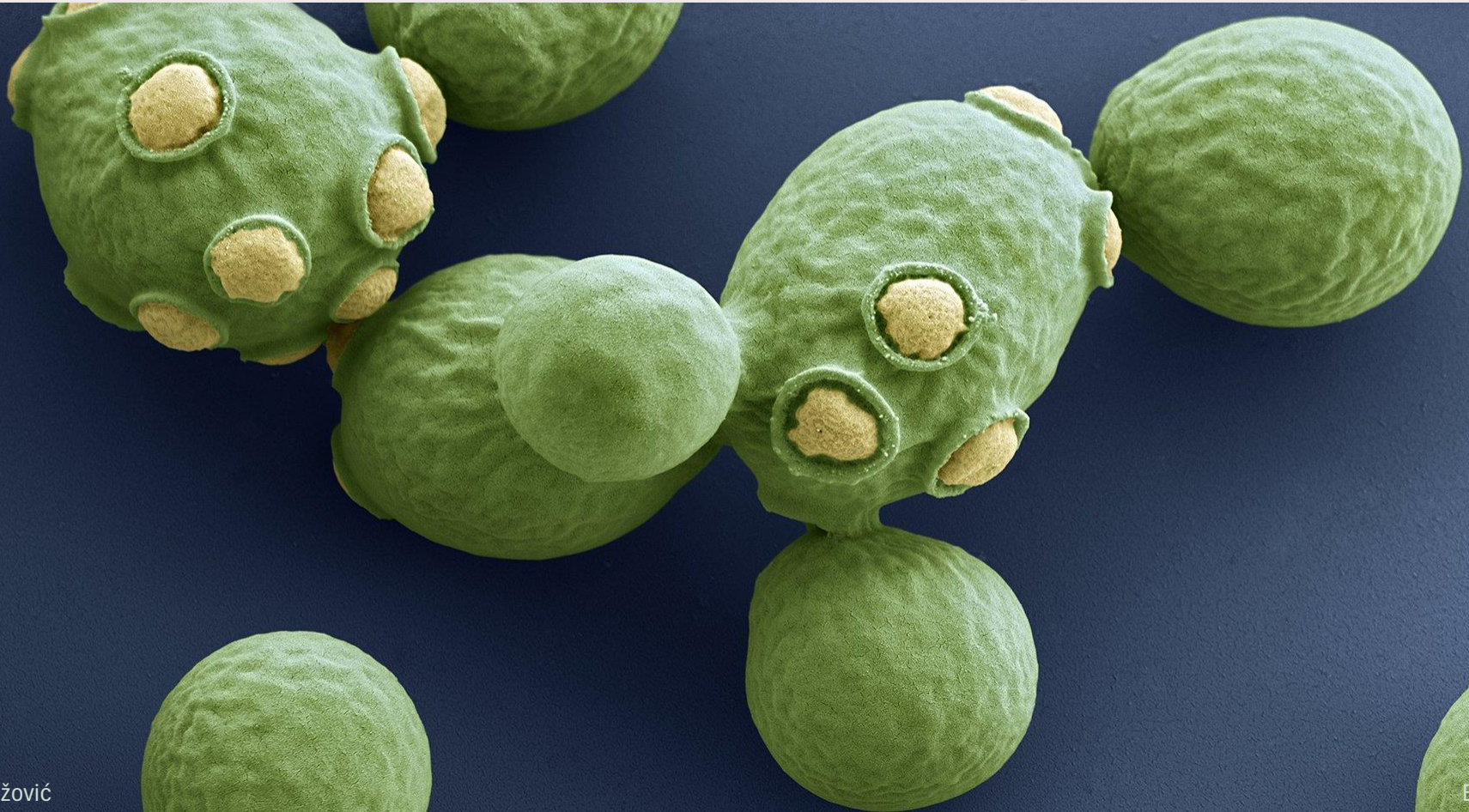
saprofitski i parazitski

# Životni ciklus





# *Saccharomyces cerevisiae*



# *Candida albicans*



# *Claviceps purpurea*



sklerocija gljive koja  
sadrži ergot alkaloide

# Basidiomycotina





## Osobine bazidiomikota

01

### **talus**

septirani haploidni micelijum

02

### **razmnožavanje**

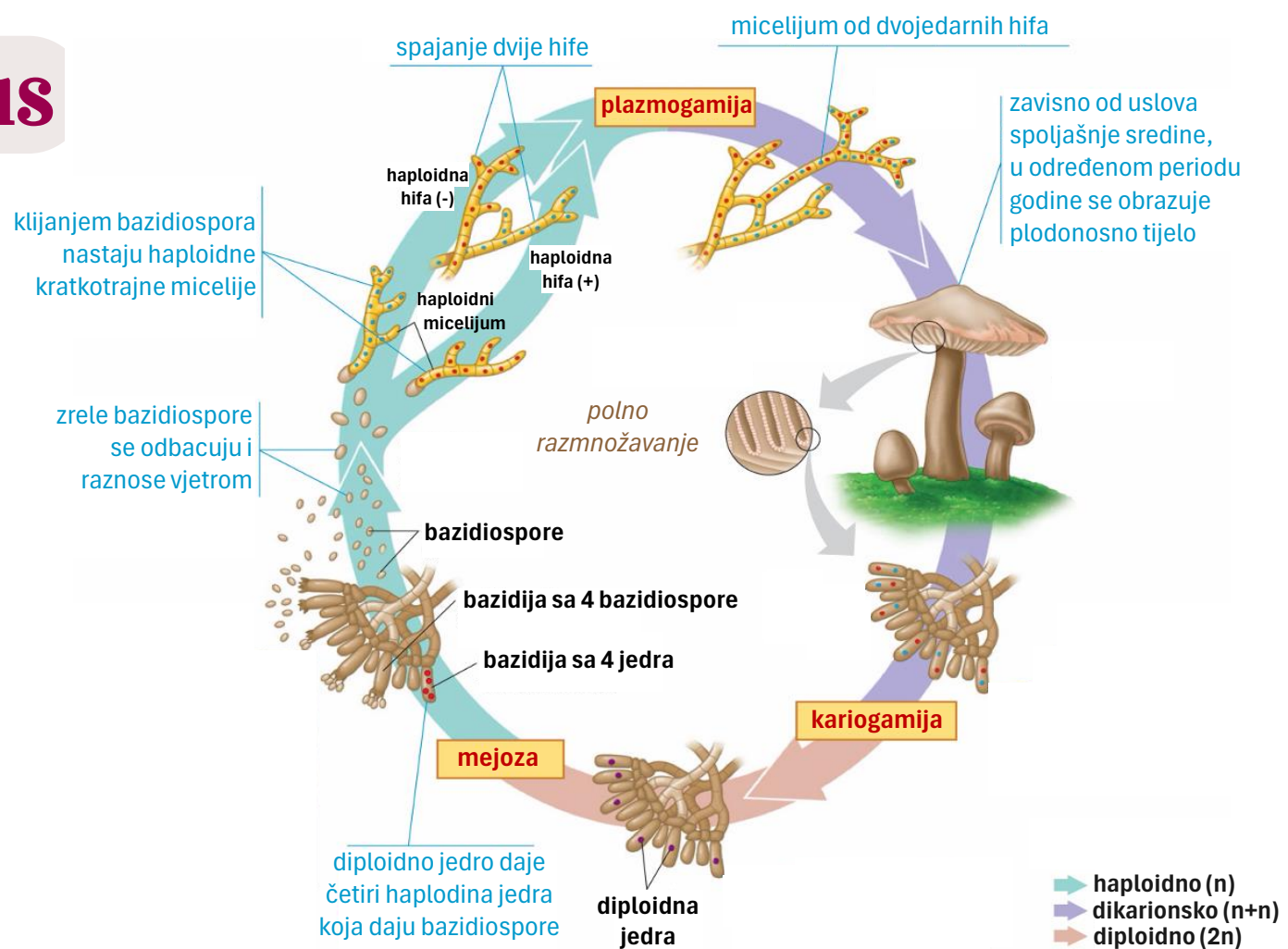
polno (somatogamija: bazidije sa egzogenim bazidiosporama) i bespolno (konidijama)

03

### **način života**

saprofitski i parazitski

# Životni ciklus



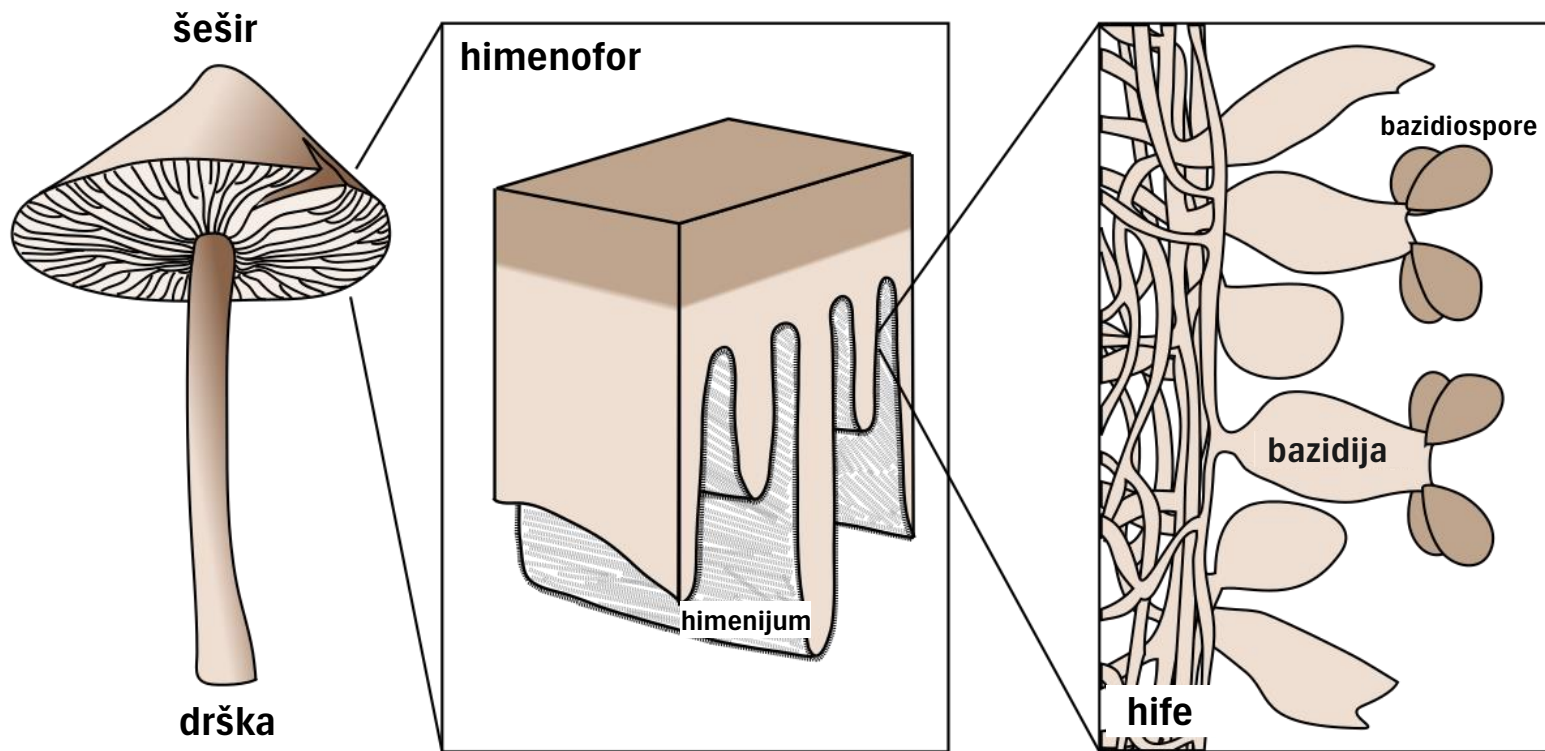
# Pečurke se javljaju isključivo kod bazidiomikota



micelijum

plodonosno tijelo

# Himenofor i himenijum







# Oblici himenofora



# *Boletus edulis*



# *Boletus satanus*



# *Amanita muscaria*



# *Ganoderma lucidum*



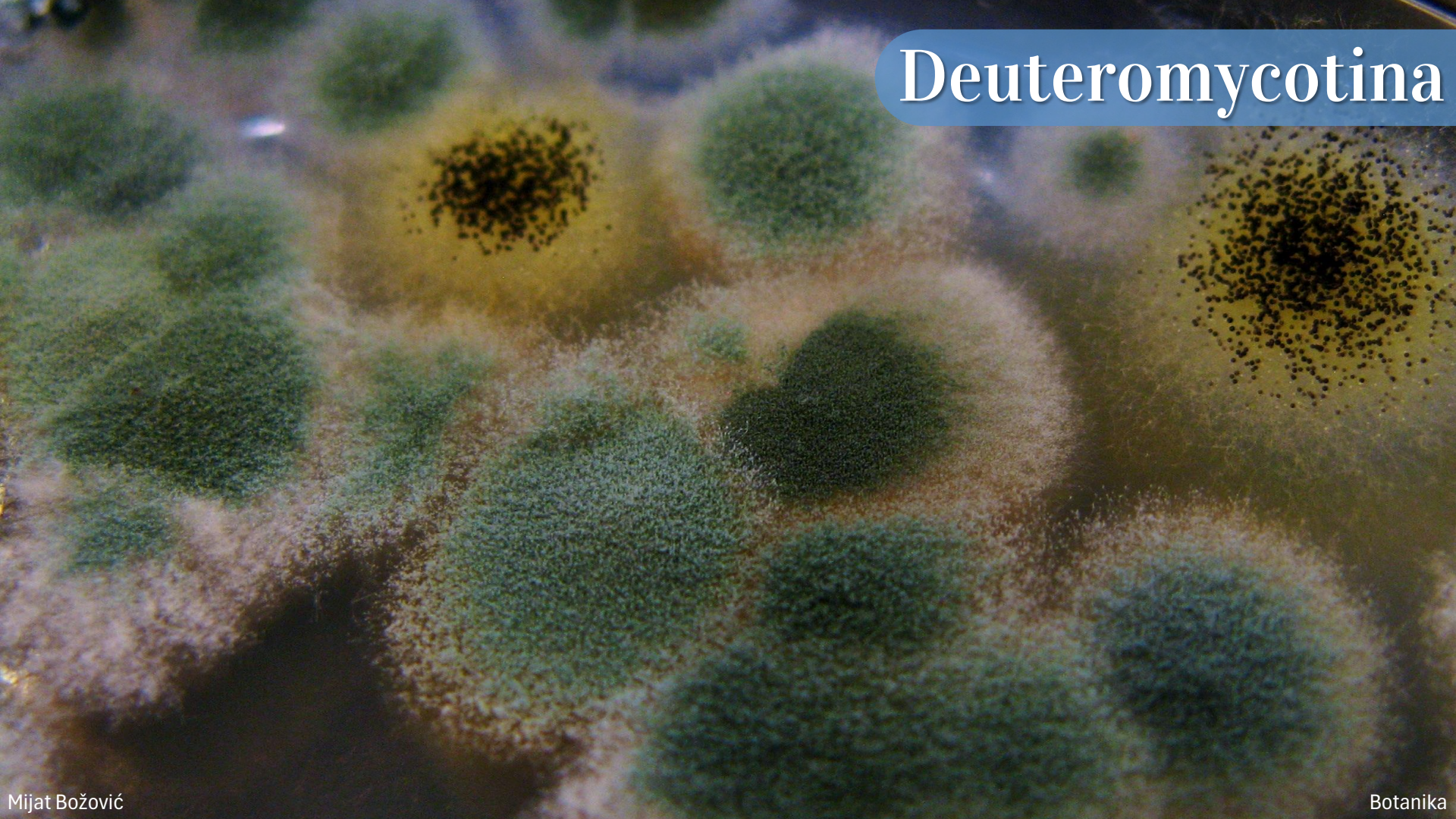
# *Agaricus campestris*



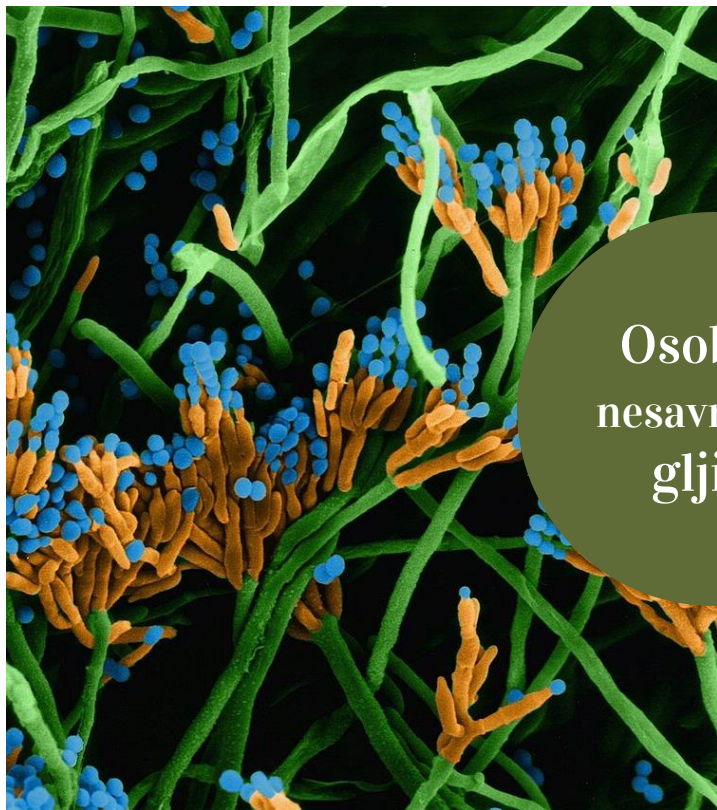
# *Psilocybe semilanceata*



# Deuteromycotina







## Osobine nesavršenih gljiva

01

### **talus**

septirani haploidni micelijum

02

### **razmnožavanje**

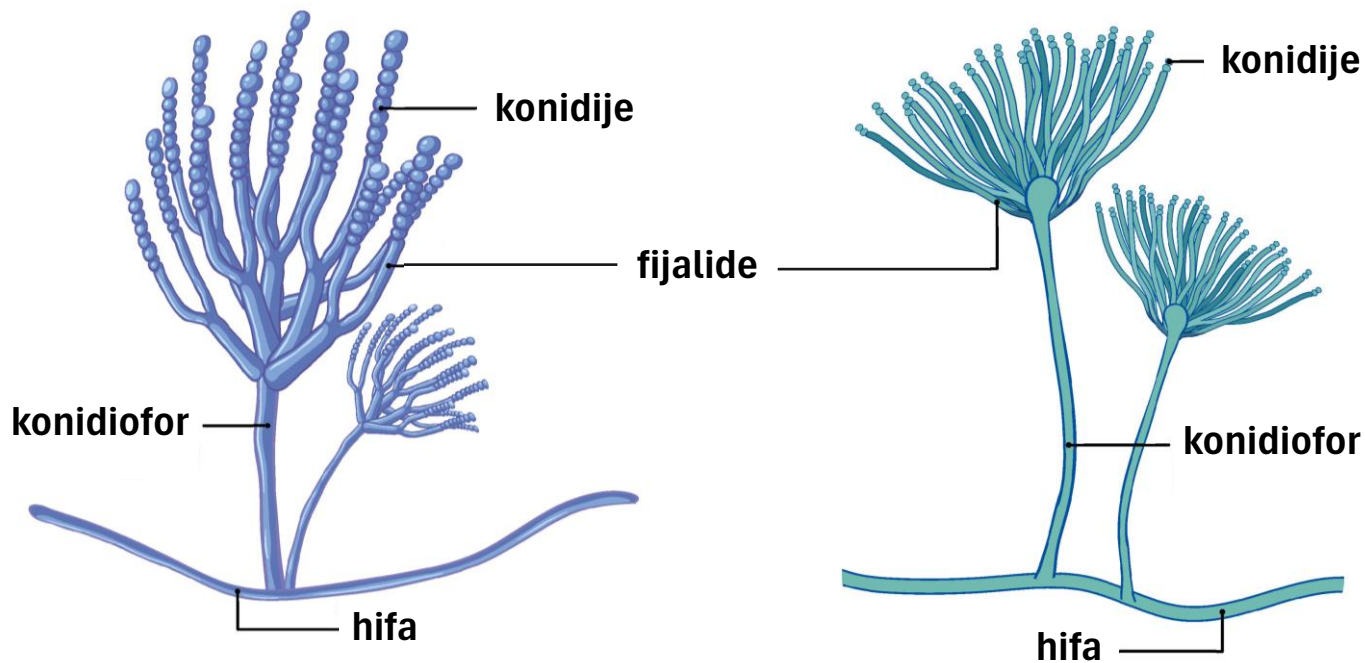
isključivo bespolno (konidijama koje nastaju na konidioforima) i vegetativno (fragmentacijom)

03

### **način života**

saprofitski i parazitski

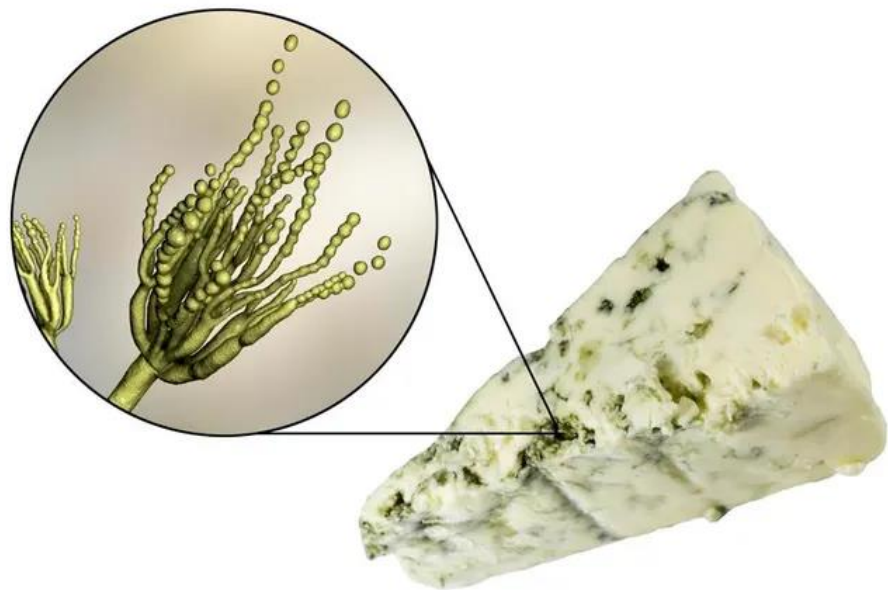
# Konidijski aparati za obrazovanje egzogenih spora



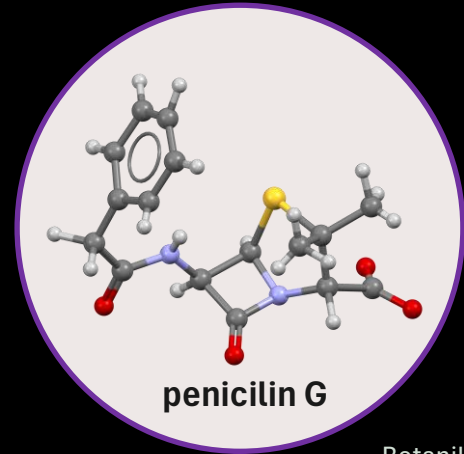
# *Penicillium* vrste kao uzročnici kvarenja voća



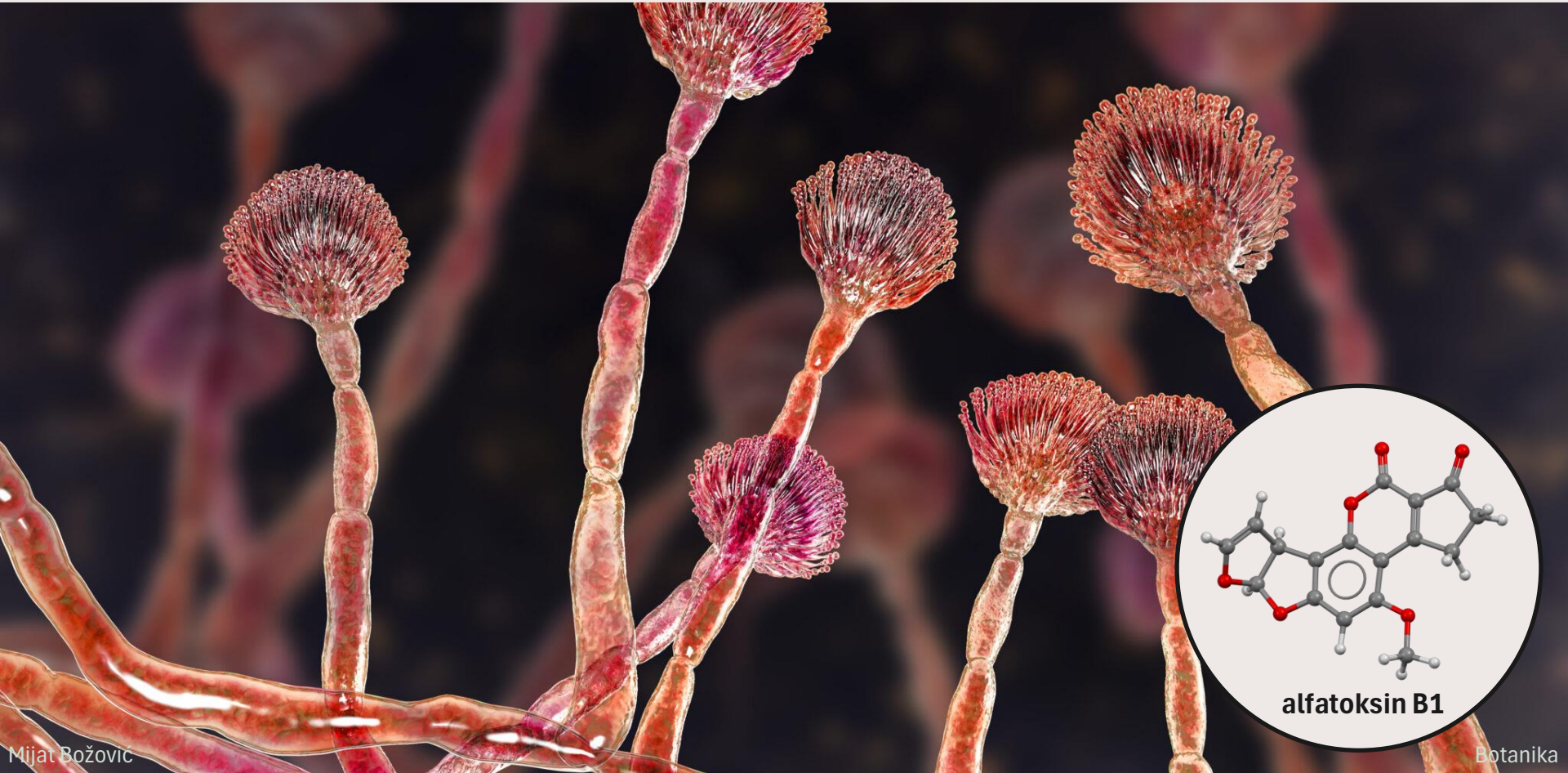
# *Penicillium* vrste se koriste u proizvodnji sireva



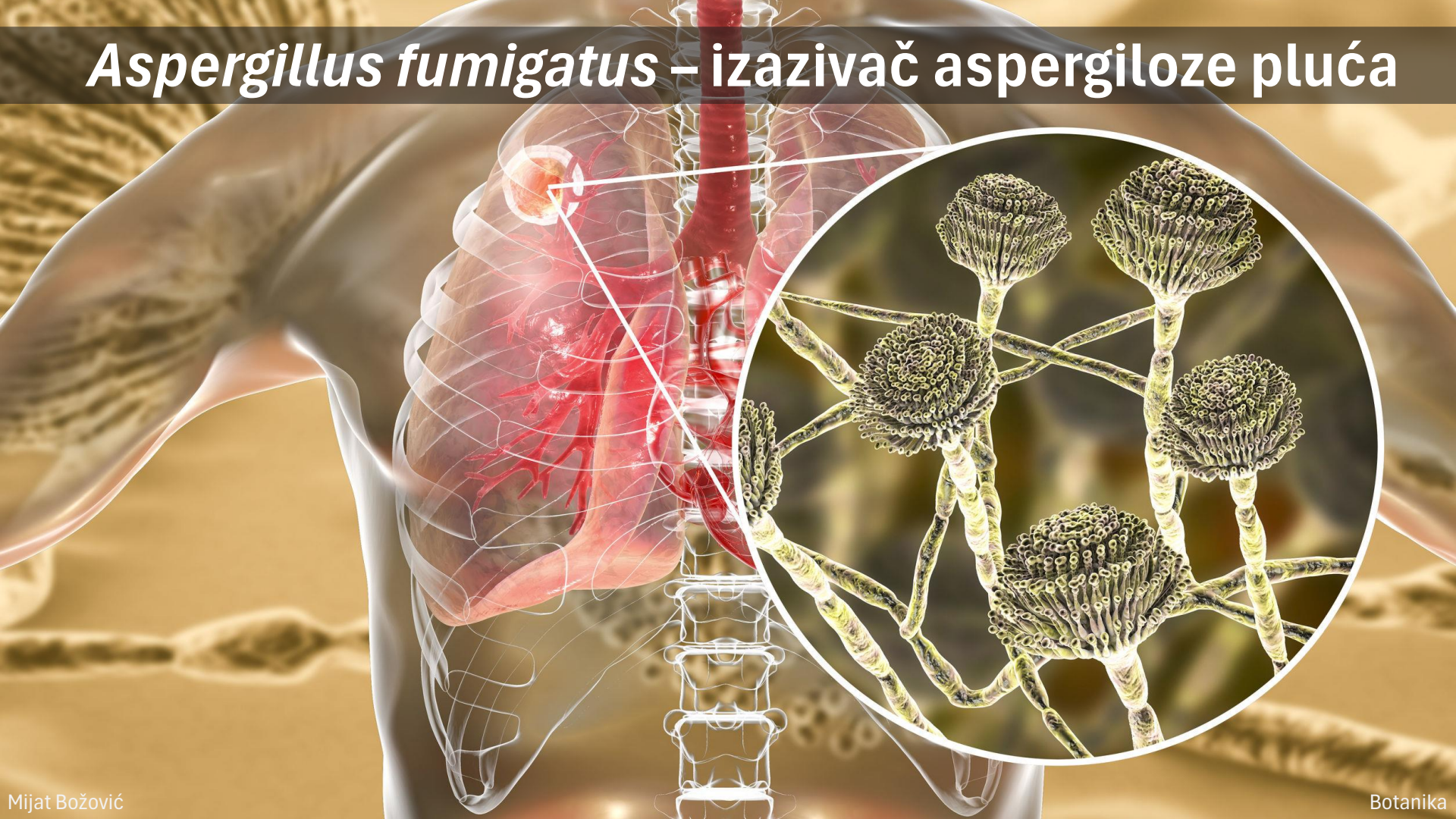
# *Penicillium chrysogenum*



# *Aspergillus flavus*



# *Aspergillus fumigatus* – izazivač aspergiloze pluća

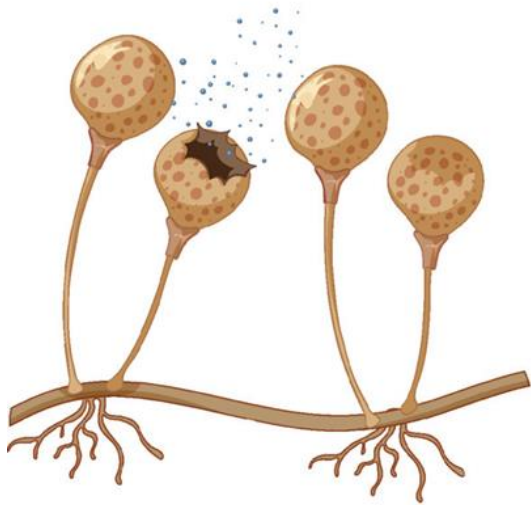


# *Aspergillus* vrste kao uzročnici kvarenja hrane

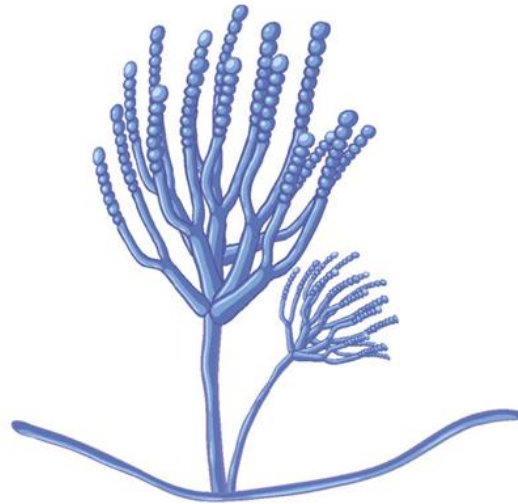




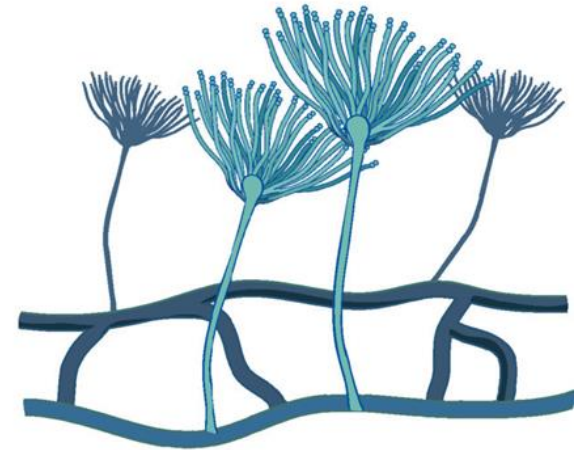
# Buđi (plijesni) su taksonomski raznoliki



*Mucor*



*Penicillium*



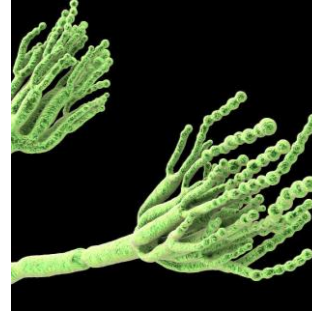
*Aspergillus*

# Značaj gljiva



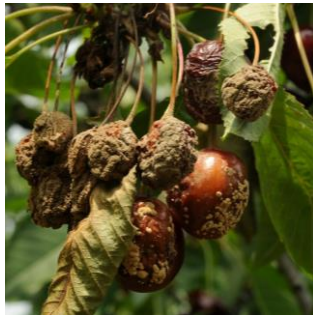
## Prehrambena industrija

kao hrana (pečurke), u proizvodnji hrane i alkoholnih pića (kvasci), uzročnici kvarenja hrane (plijesni)



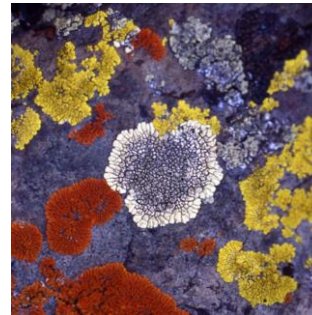
## Zdravlje ljudi

kao izvor biološki aktivnih materija (antibiotici, alkaloidi), uzročnici bolesti (mikoze) i trovanja (mikotoksikoze), izvori alergena



## Poljoprivreda

paraziti biljaka (fitopatogene gljive) i životinja (mikoze)



## Ekološki značaj

razlagači (kruženje materije i C-ciklus), kao simbionti (lišajevi, mikoriza)

# Lichenes/Lichenophyta





## Osobine lišajeva

01

### **taksonomski status**

razdio u okviru carstva Fungi

02

### **talus**

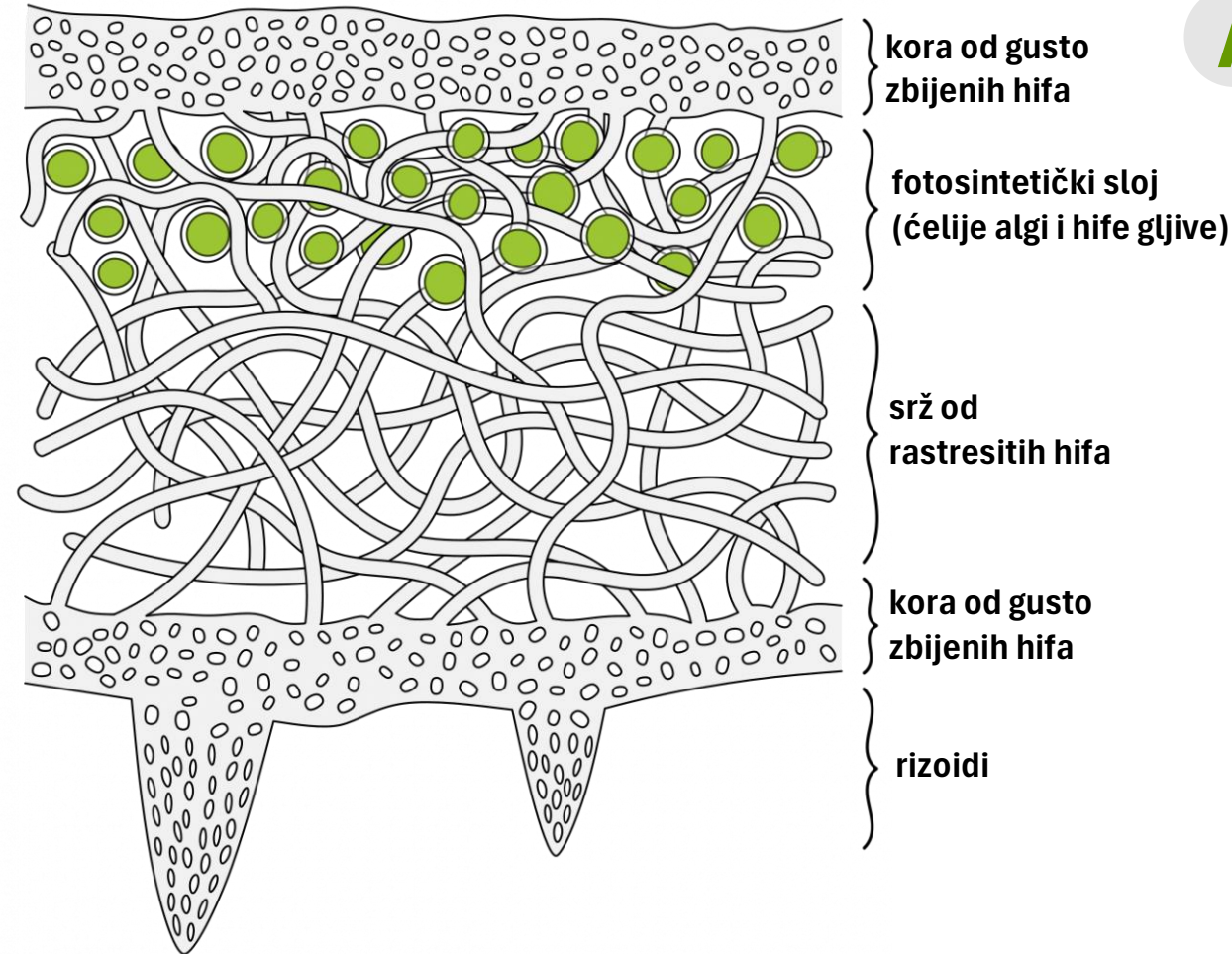
simbioza alge i gljive (mutualistički odnos); talus je entitet sam za sebe

03

### **razmnožavanje**

najčešće vegetativno (fragmentima, soredijama), polno i bespolno (na gljivi i algi svojstvene načine)

# Anatomska građa



fotobiont

mikobiont

# Morfološki oblici



***korast***



***listast***



***žbunast***

# *Graphis scripta*



*Lobaria pulmonaria*





# *Usnea barbata*



*Evernia prunastri*



***Cetraria islandica***



*Letharia vulpina*



# *Xanthoria parietina*

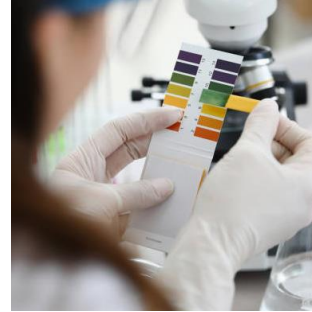


# Značaj lišajeva



## Izvor hrane

za ljude i životinje: npr.  
islandski lišaj, irvasov lišaj



## U industriji

za dobijanje boja  
(lakmus papir)



## U farmaciji i kozmetici

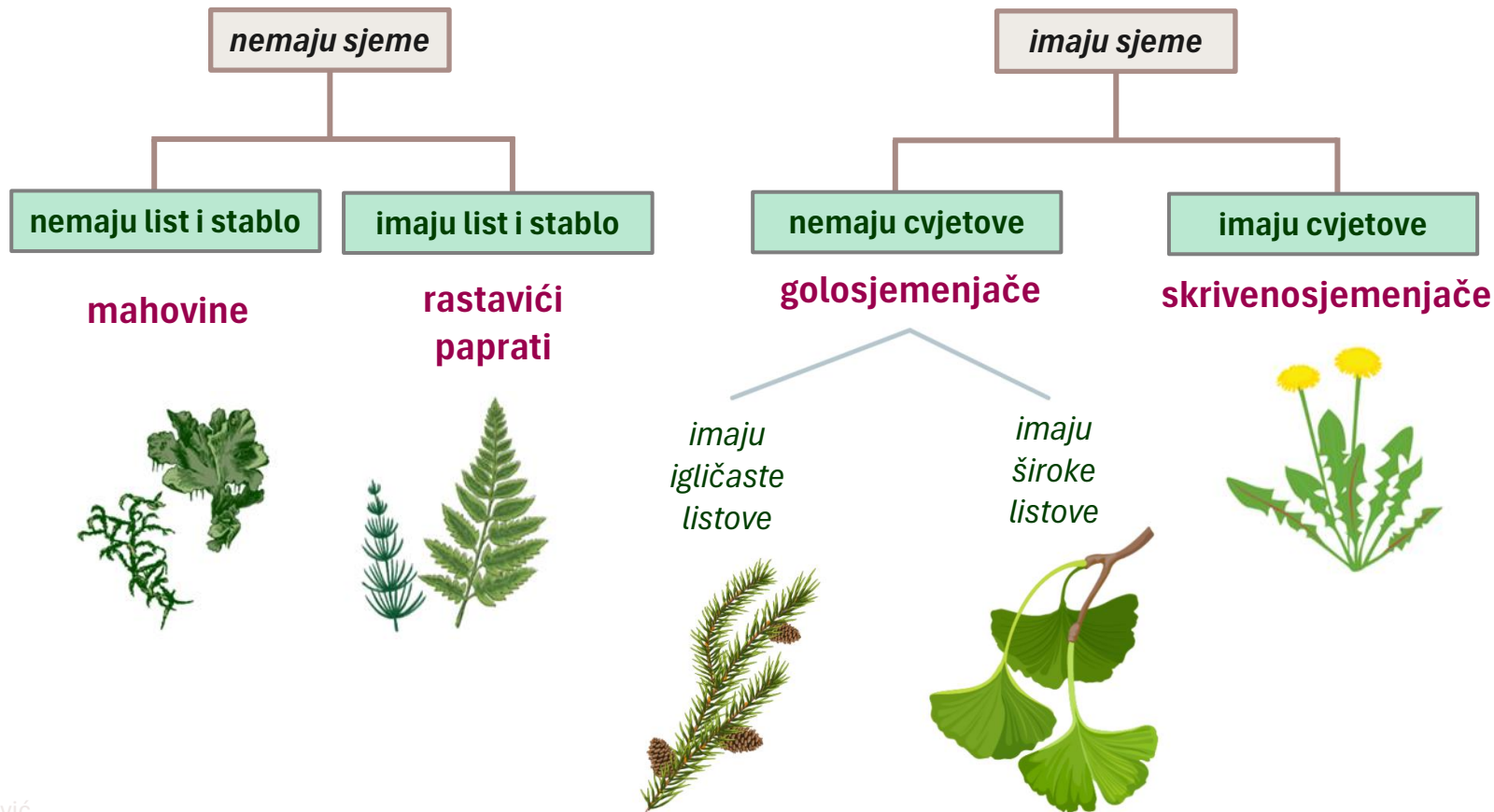
lišajske kiseline (antibiotik),  
fenoli i polisaharidi



## Ekološki značaj

pionirske vrste, bioindikatori

# Kopnene biljke





# Vaskularne biljke





Botanika

Mijat BOŽOVIĆ

# Pitanja?

