

**Masaryk University in Brno**

**Faculty of Sciences**

**Department of Botany a Zoology**

**Diversity of epilithic  
cyanobacteria inhabiting  
a running clear water  
in Slovakia**

**Bohuslav Uher, PhD.**

**uherius@sci.muni.cz**

# THE AIMS

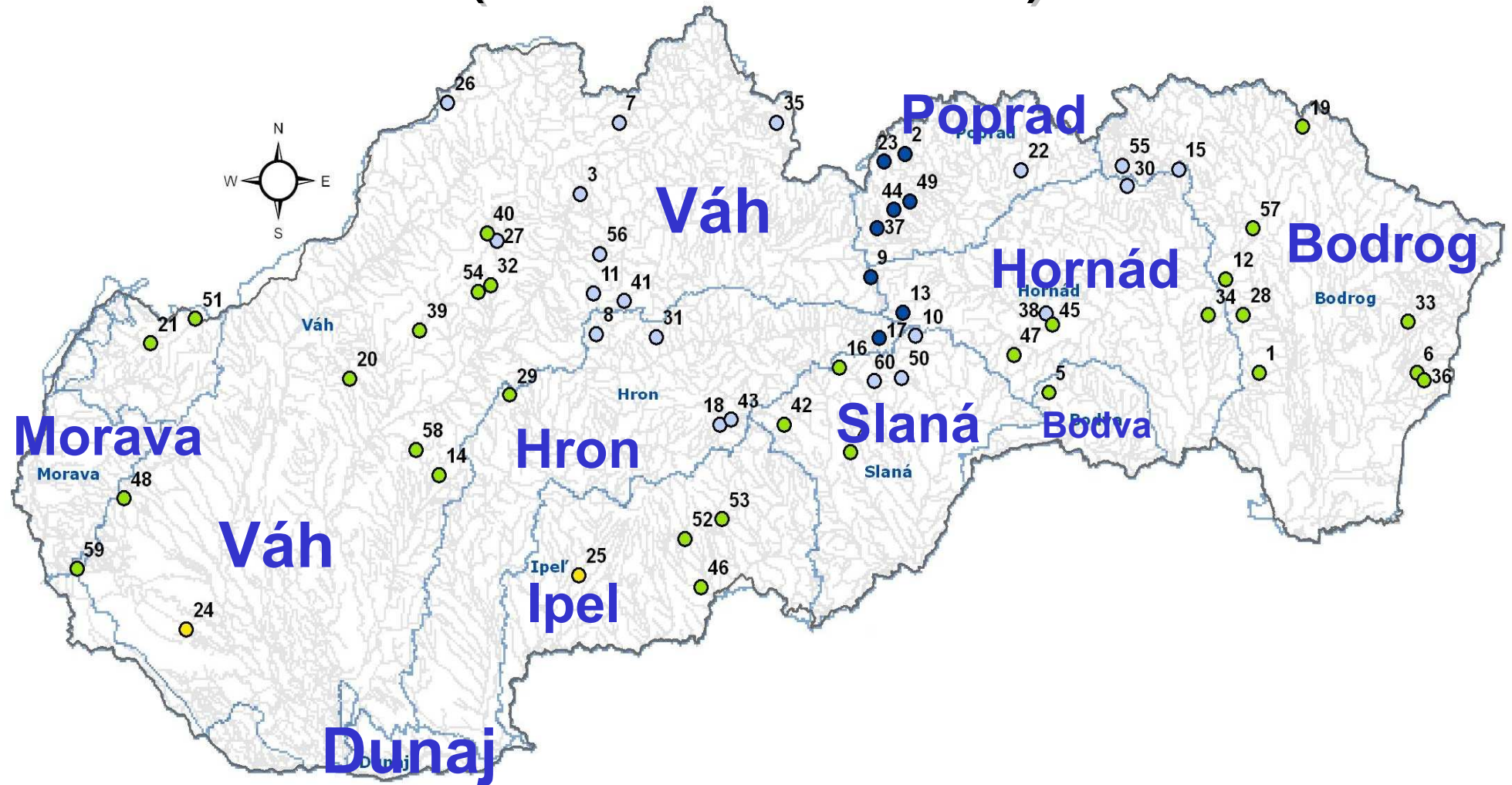
- To identify epilithic cyanobacteria in a running clear water in Slovakia
- To use cyanobacteria for monitoring clear running waters

# MATERIALS & METHODS



- 36 sampling places in Slovakia
- Scraping from submerged rocky substrata
- Determination *in vivo* (Olympus BX 51)
- Used actual literature for det. of cyanobacteria (Komárek & Anagnostidis 1989, 1998, 2005)

# Sampling places in Slovakia (reference sites)

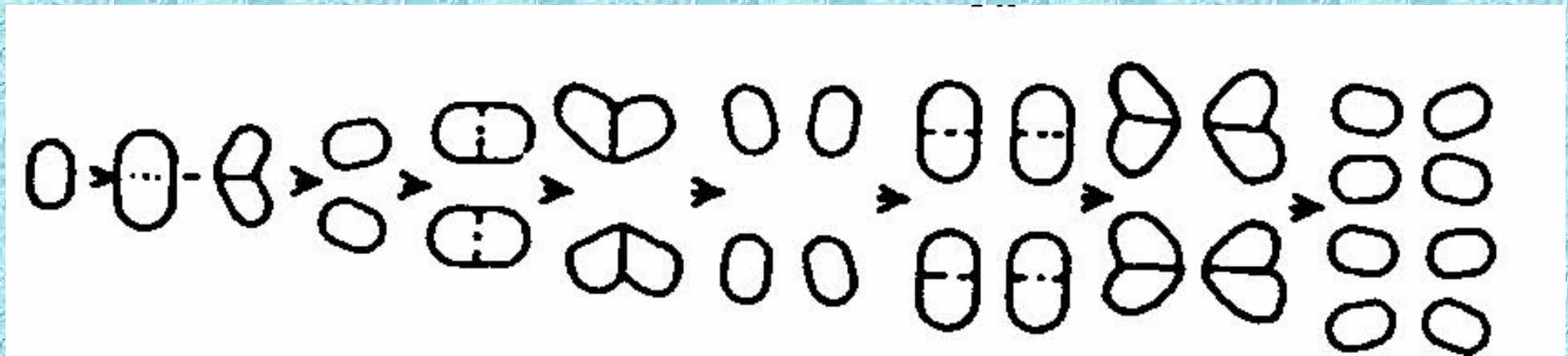


The basins of rivers

Characterization of  
cyanobacterial genera and  
families  
(diacritical features)

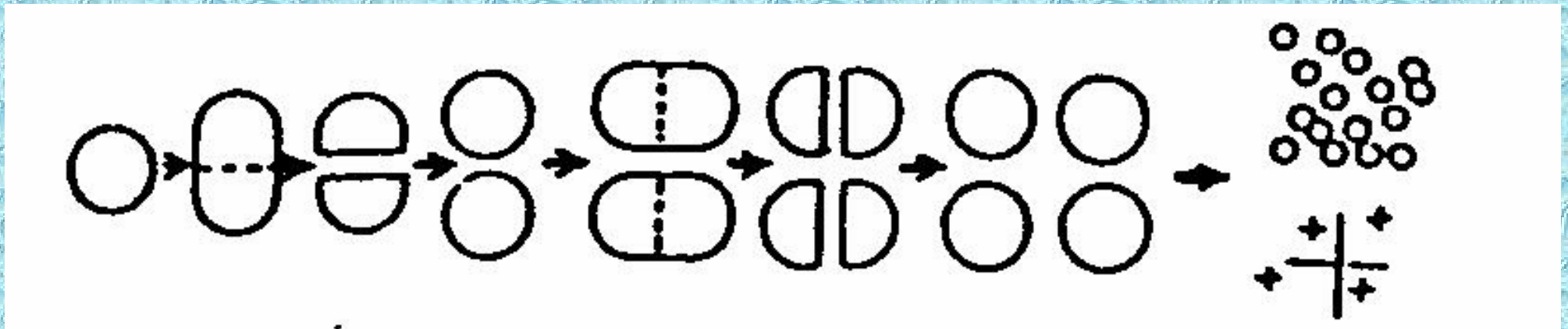
# Family Synechococcaceae

## Genus *Aphanothece*



**Scheme of cell division**

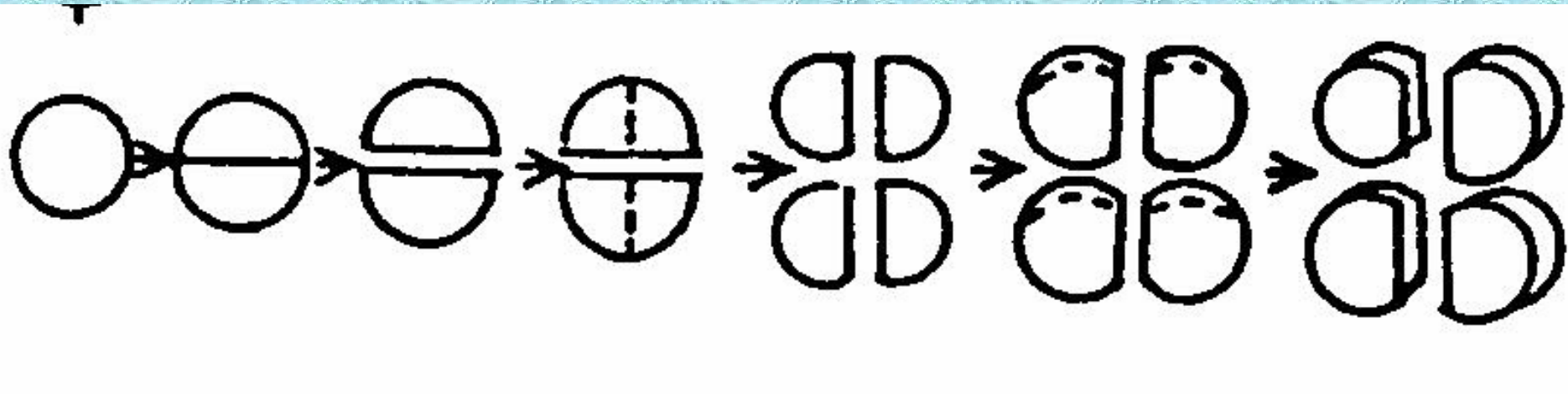
Family Merismopediaceae  
Genus *Aphanocapsa*



**Scheme of cell division**

# Family Entophysalidaceae

## Genus *Chlorogloea*

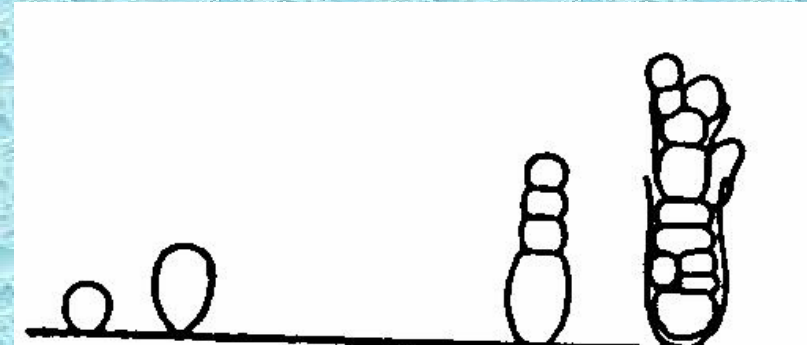
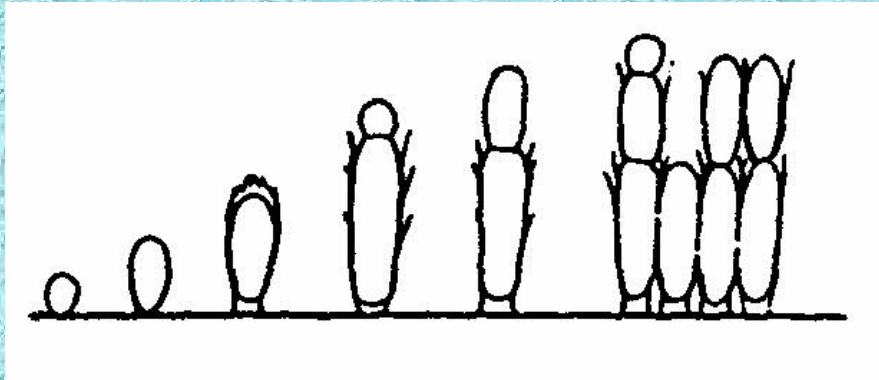
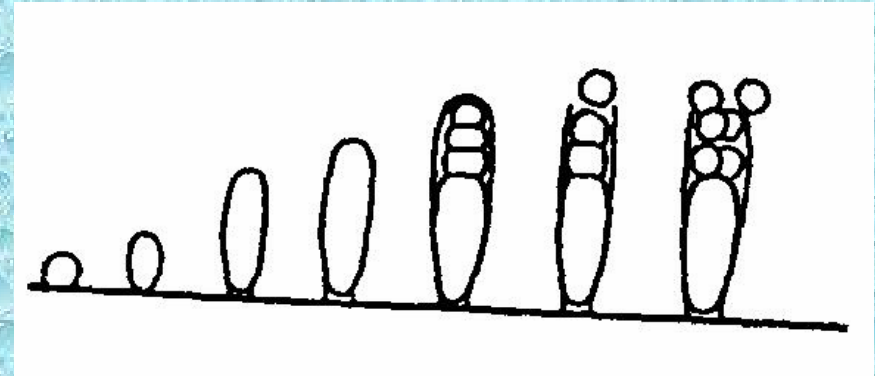
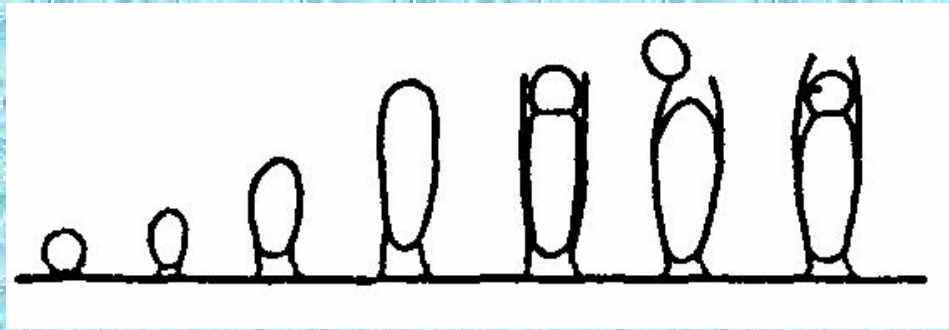


**Scheme of cell division**



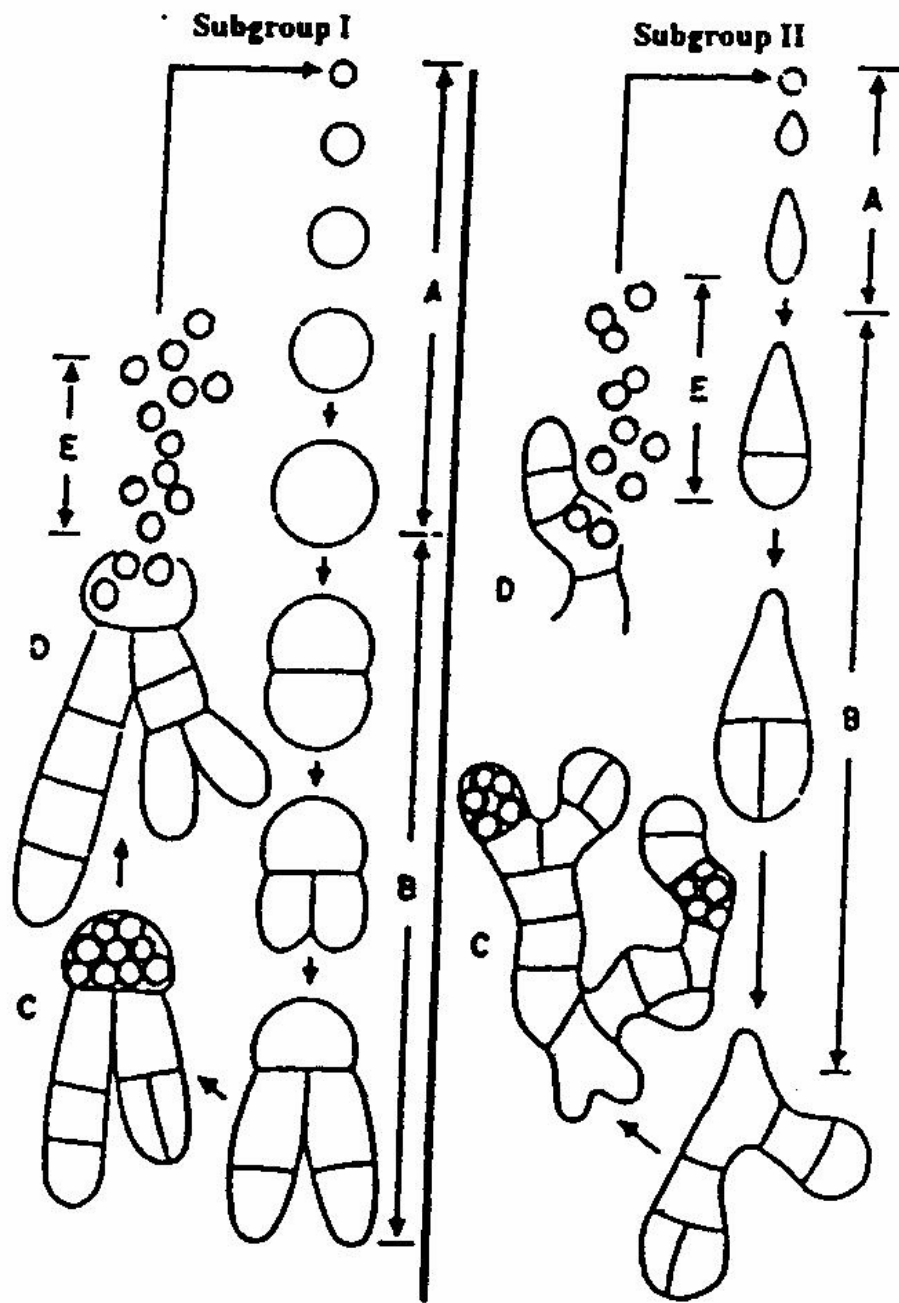
# Family Chamaesiphonaceae

## Genus *Chamaesiphon*



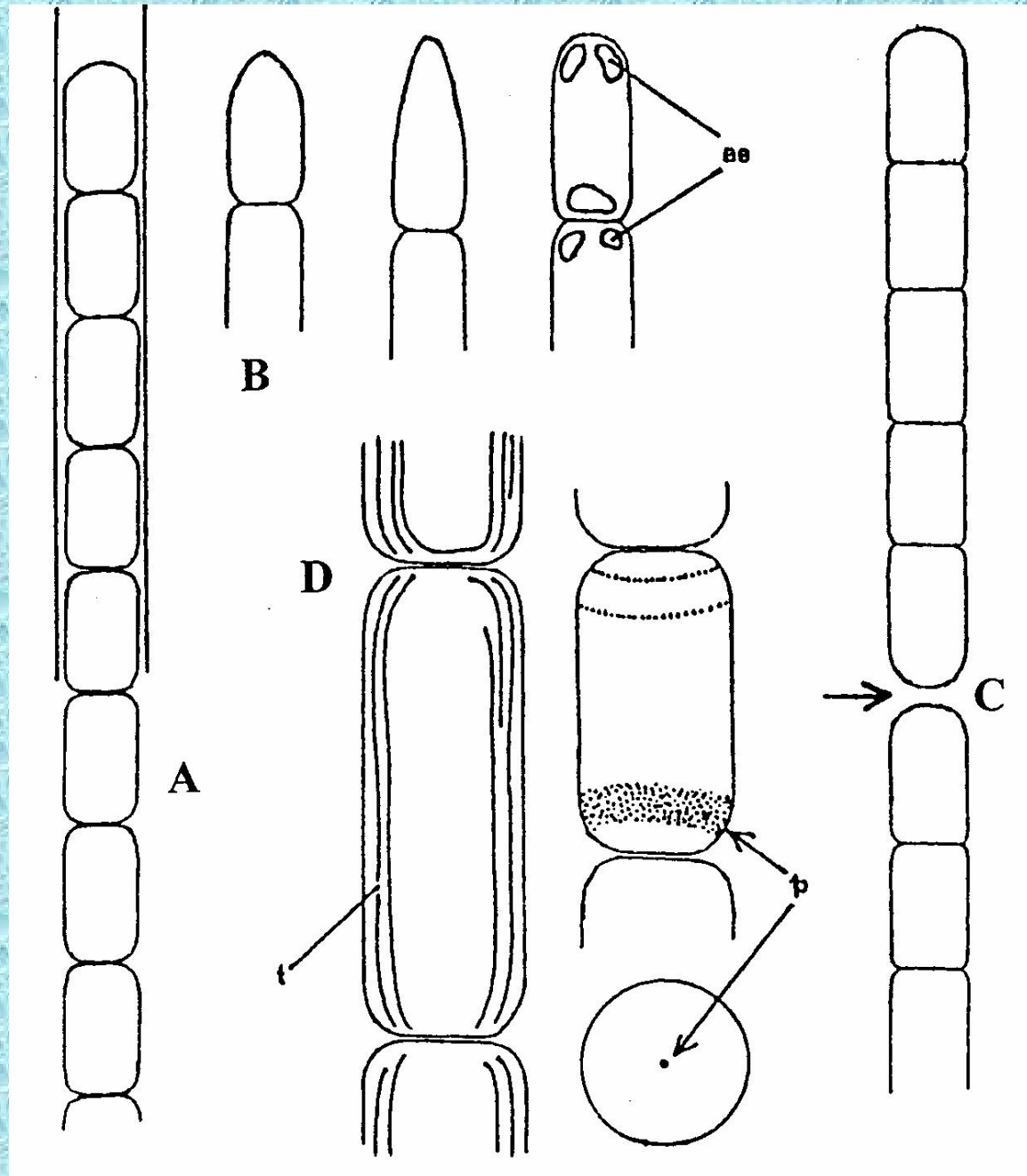
**Scheme of cell division**

Family  
*Hyellaceae*  
Genus  
*Pleurocapsa*



**Scheme of cell division**

# Family Pseudanabaenaceae



# Family Phormidiaceae

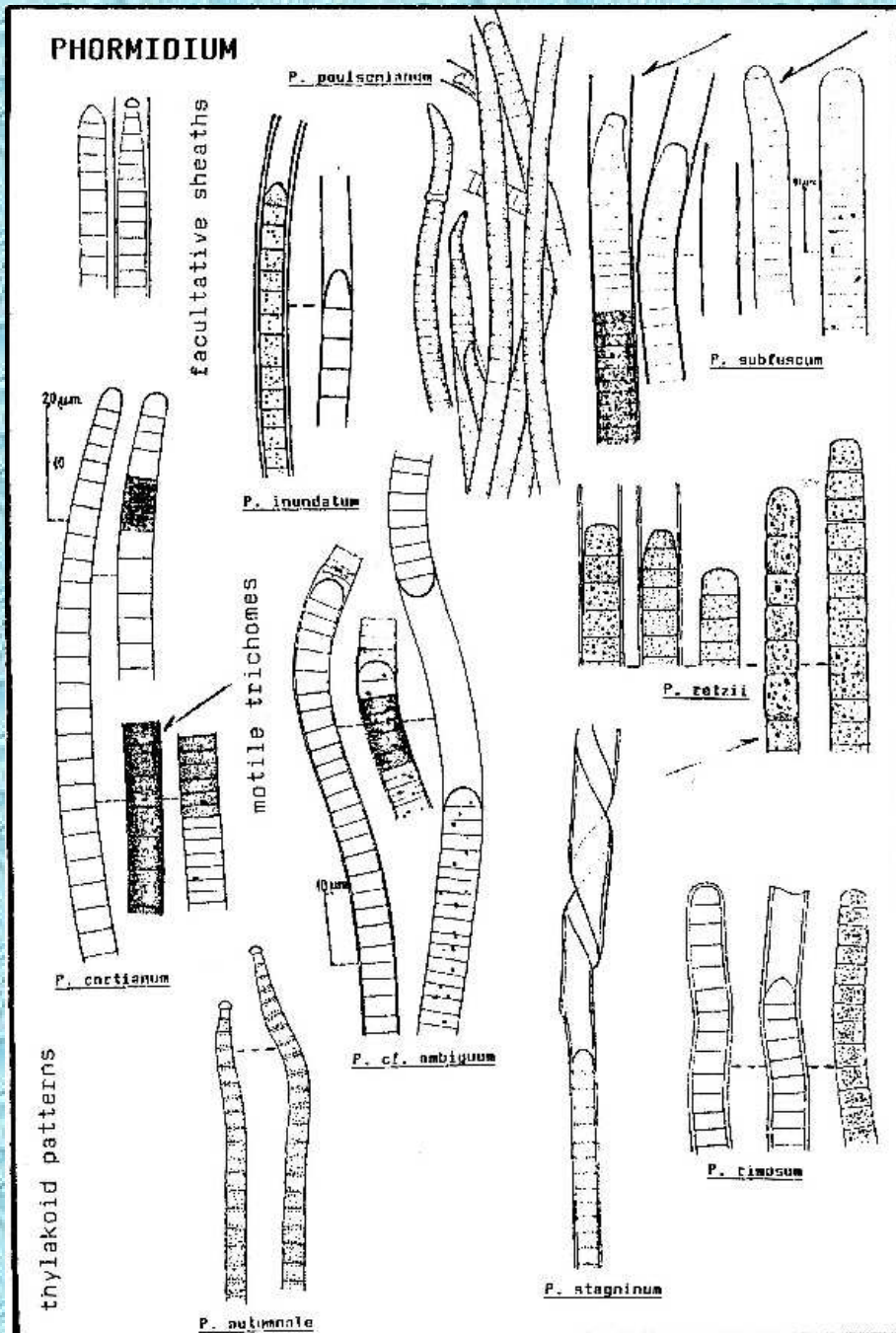
Trichomes 4-14  $\mu\text{m}$  wide

Facultative sheaths

Hormogonia by necridic  
cells

Cells grow in original size  
before next division

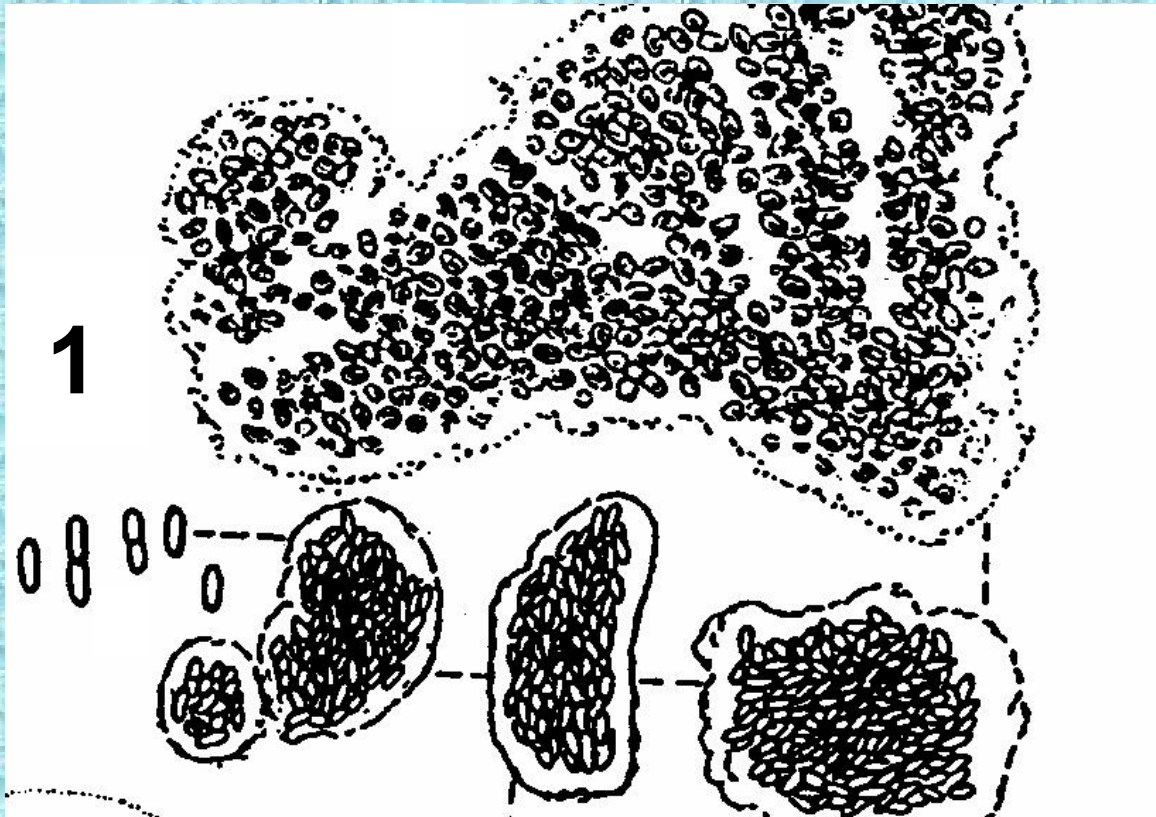
Radial position of  
thylakoids



From: Setaia ex Reitter (1932), different authors ex Kondratova (1963) and Staurandt (1964), Emdenk (1956, 1975).

# **RESULTS & DISCUSSION**

# 1. *Aphanothece floccosa* (Zalessky) Cronberg et Komárek



## Description:

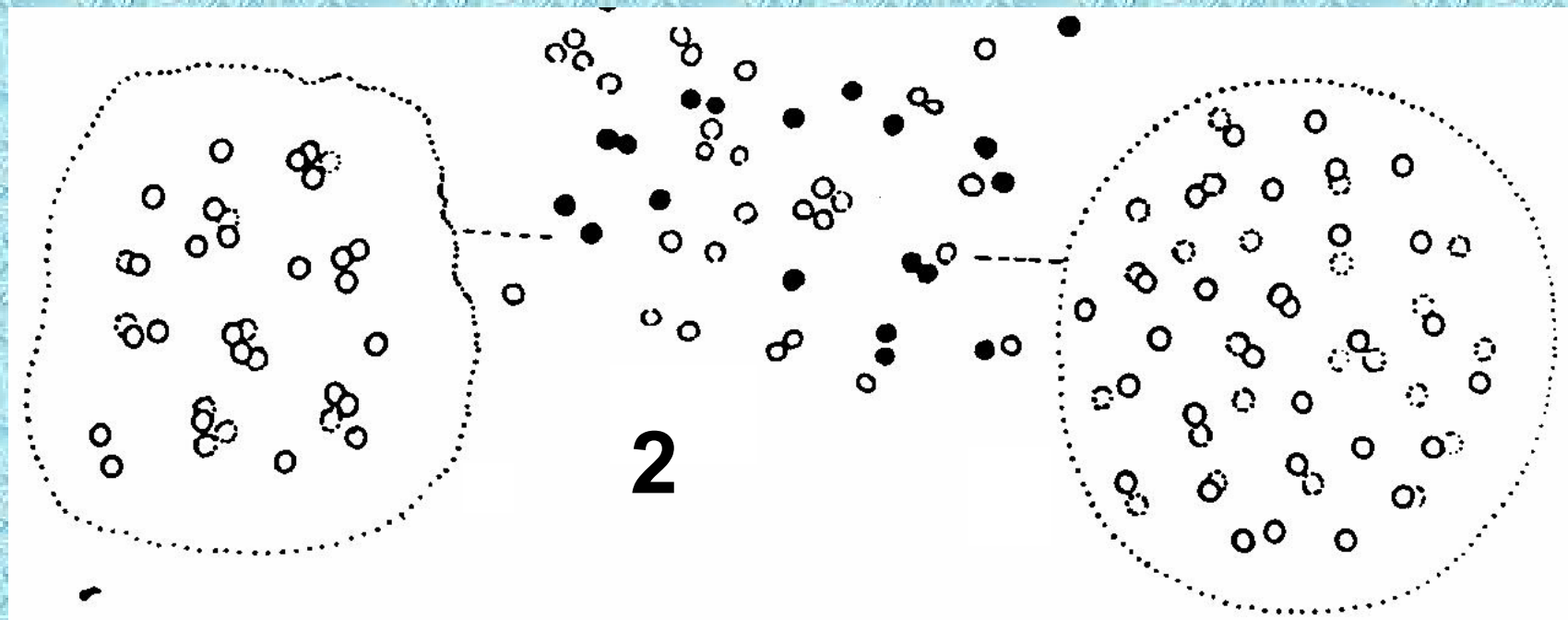
Clearly visible limited slime, not structured

Cells very densely aggregated in microscopic colonies

Cells thin, rod-shaped, (2)3-5 x 1-1.5  $\mu\text{m}$  (l x w)

Locality: 22

## 2. *Aphanocapsa fonticola* Hansgirg



### **Description:**

**Microscopic colonies with delimited mucilage**

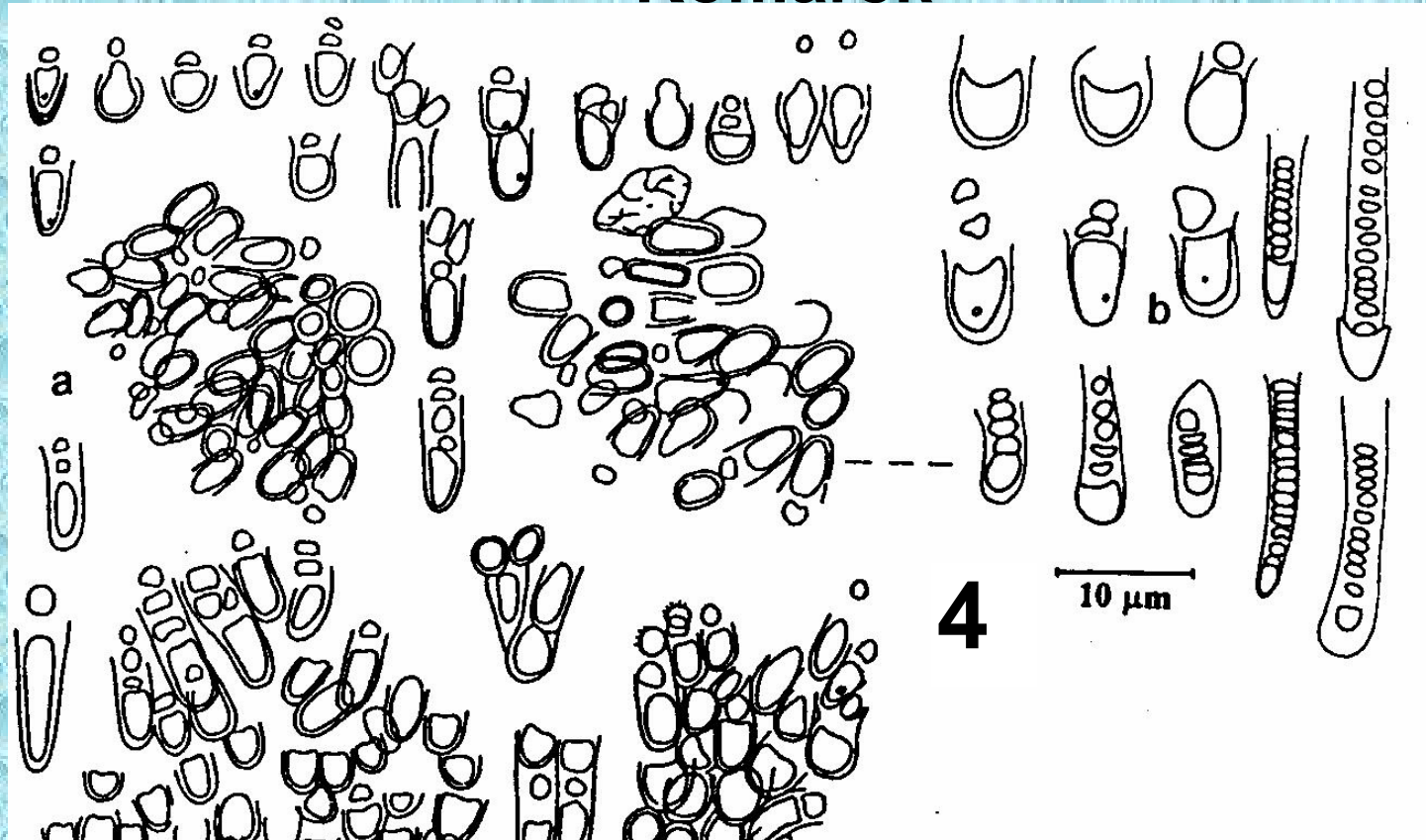
**Cells spherical, elongate before division, blue-green, 2.5 - 3  $\mu\text{m}$  in diameter**

**Locality: 16**





## 4. *Stichosiphon pseudopolymorphus* (Fritsch) Komárek



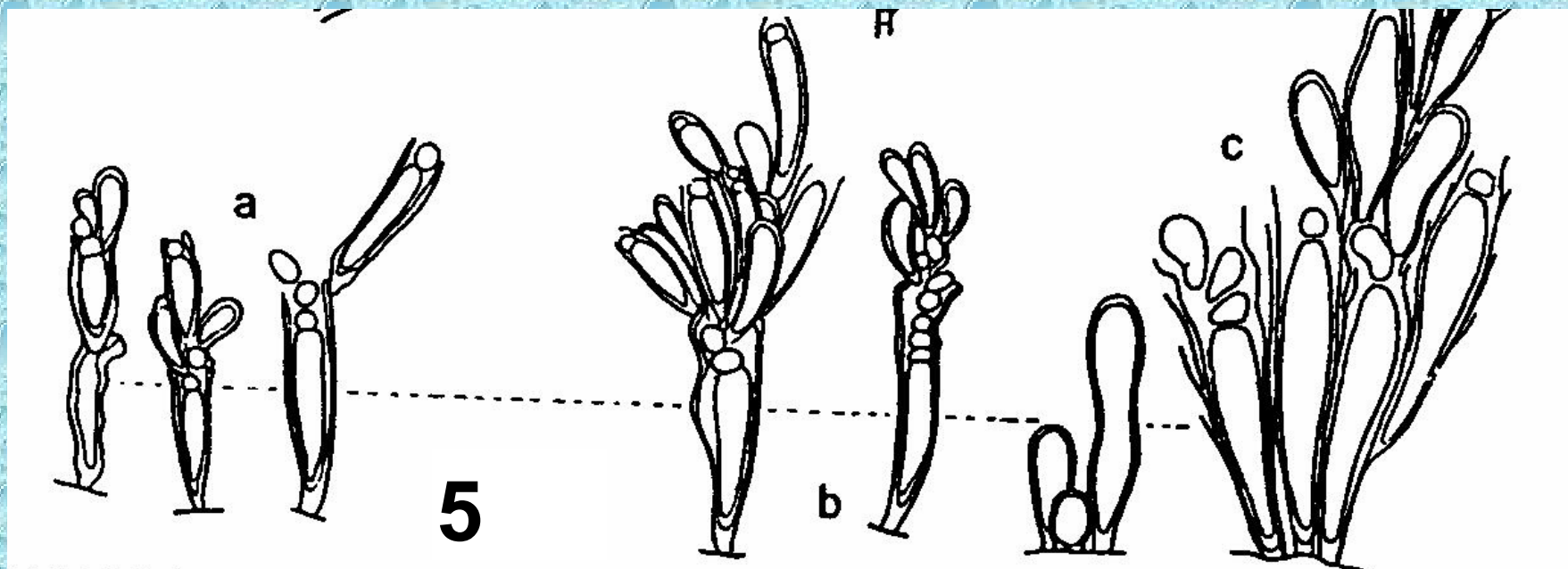
### Description:

Micro- or macroscopic colonies visible as brownish spots on the surface

Cells individual or in short rows, basal cells ellipsoidal, exocytes spherical, subspherical, (5)8-10 × (2.5)5-8 μm

Locality: 33

## 5. *Chamaesiphon carpaticus* Starmach



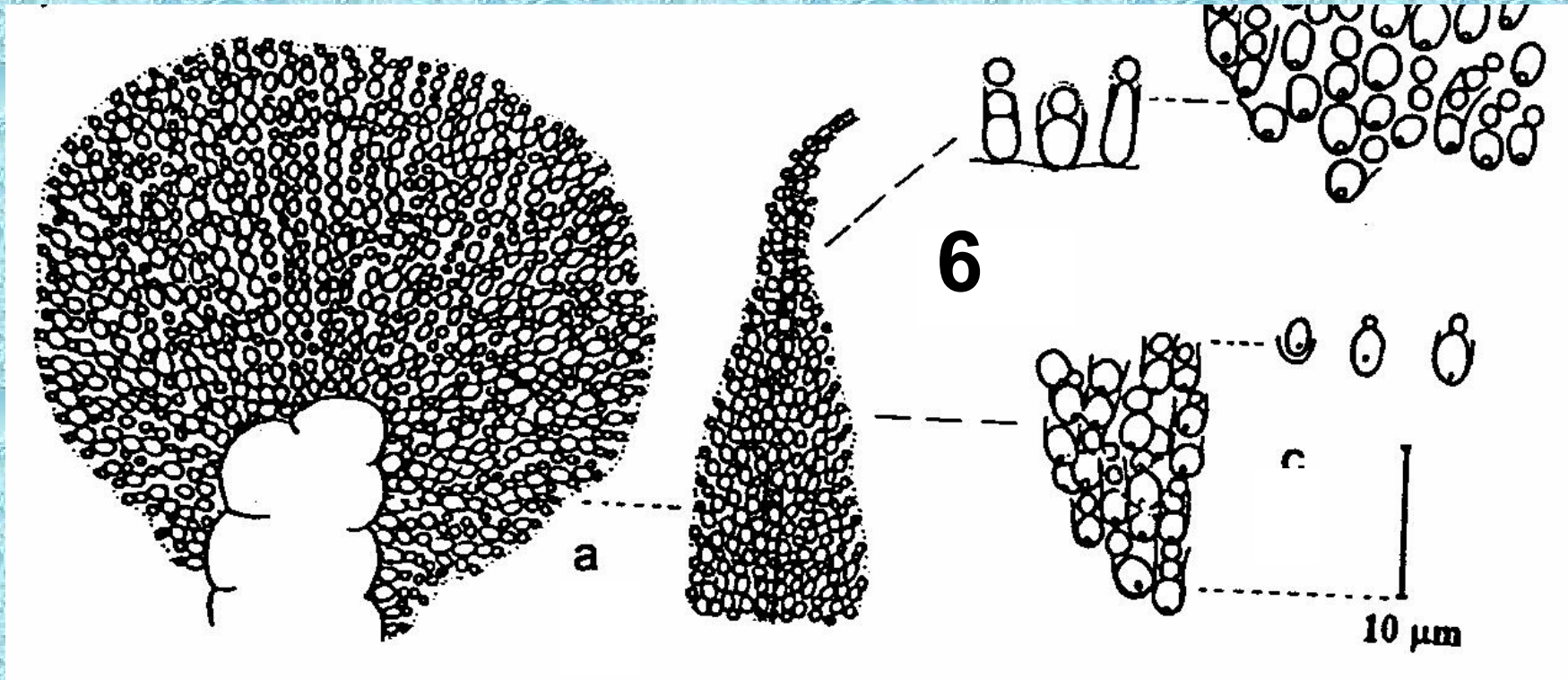
**Description:**

**Microscopic shrub-like colonies**

**Cells narrow club-shaped, straight, narrowed at the base, 10-25 × (2.5)3-5(6) μm**

**Locality: 36**

## 6. *Chamaesiphon oncobyrsoides* Geitler



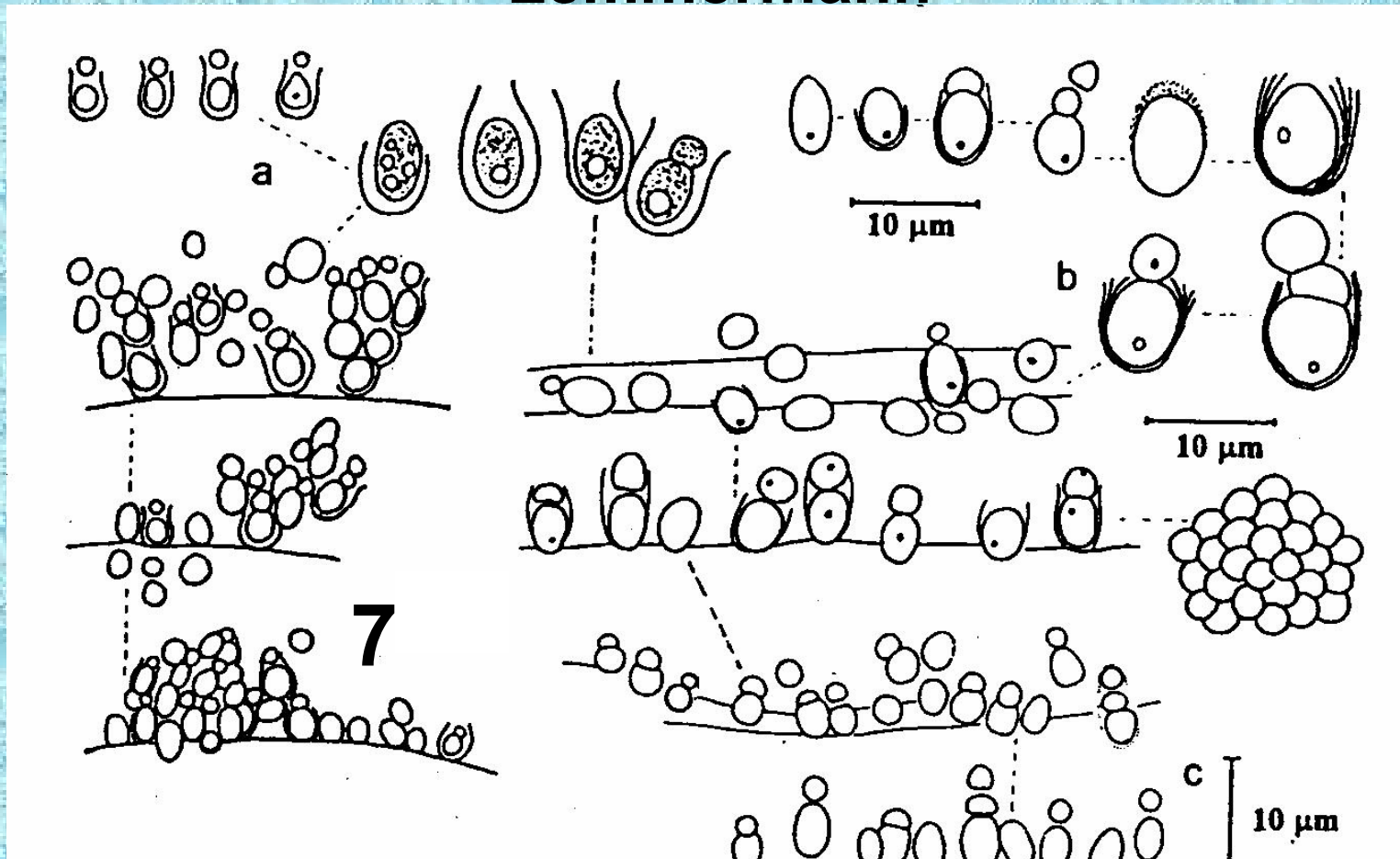
### Description:

Microscopic colonies spherical or hemispherical, sincolor

Cells oval, ellipsoidal, paralelly arranged in rows, 2.5-5 x 2-3(3.5) μm

Localities: 34, 24, 12, 31

## 7. *Chamaesiphon subglobosus* (Rostafinski) Lemmermann



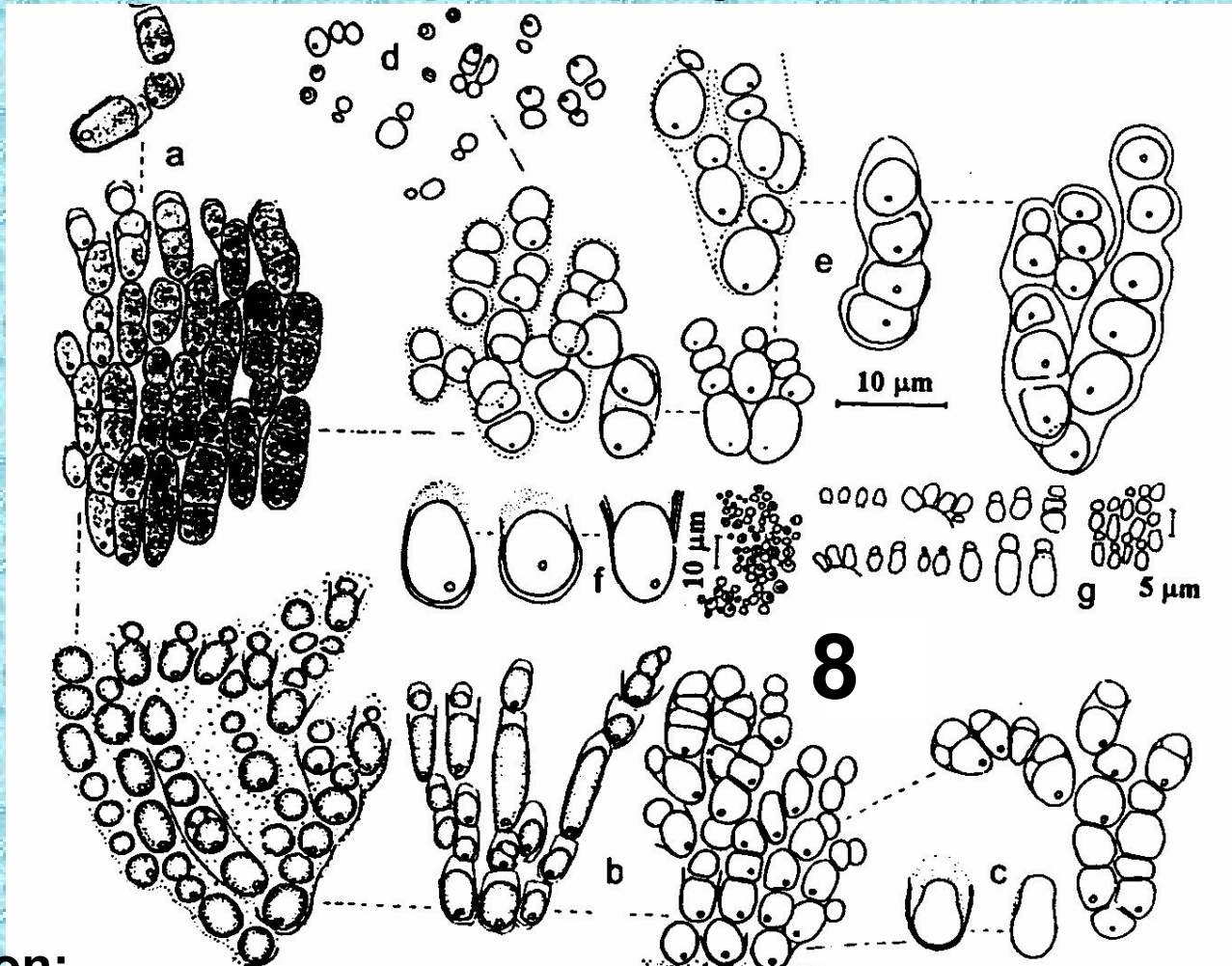
**Description:**

**Mikroskopische colonies later 3- or more-layered**

**Cells spherical, ovoid to oval, (2)3-7.5 × 2-3.5(4) µm**

**Localities: 25, 21**

## 8. *Chamaesiphon polymorphus* Geitler



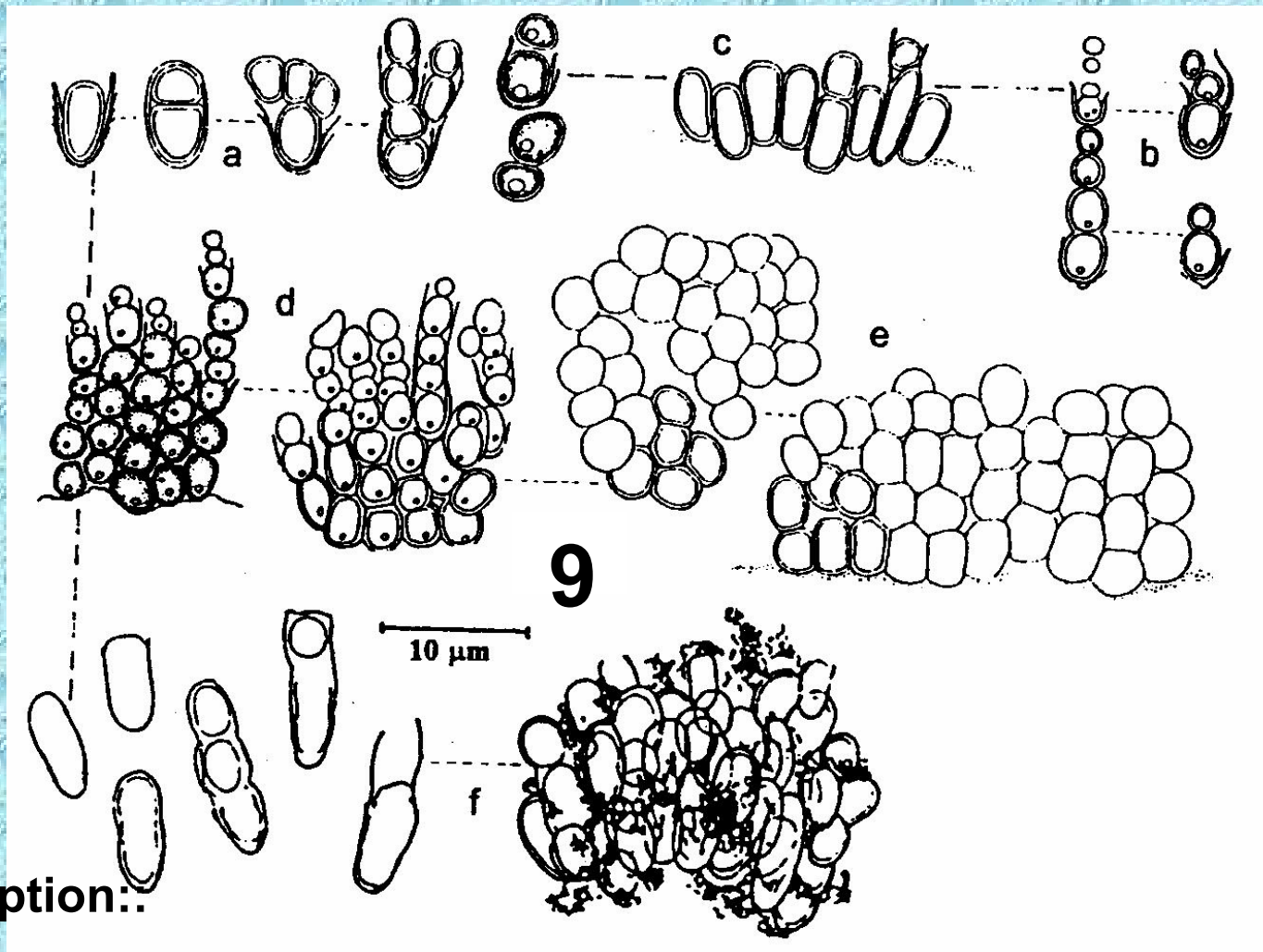
**Description:**

**Micro- or macroscopic colonies visible as violet spots**

**Cells oval, ellipsoidal, pear-shaped to cylindrical, 2.5-7.5(8) × 3-5 μm**

**Localities: 13, 20, 18**

## 9. *Chamaesiphon polonicus* (Rostafinski) Hansgirg



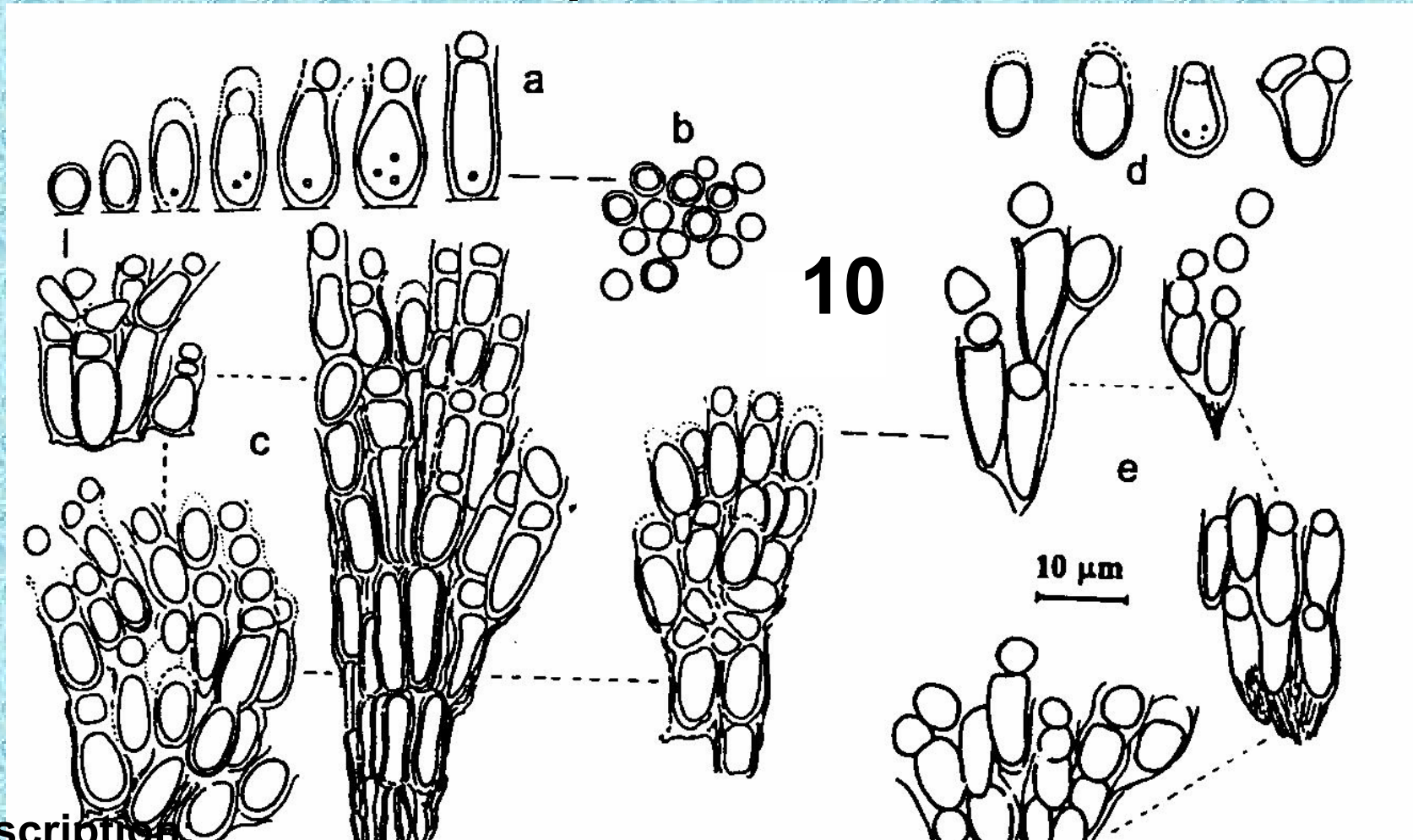
Description::

Macroscopic colonies, flat, thin, rusty, yellow-orange spots

Cells spherical, later ellipsoidal or oval, (5)6-8(10.5) × 3-7(8) µm

Locality: 16

## 10. *Chamaesiphon starmachii* Kann



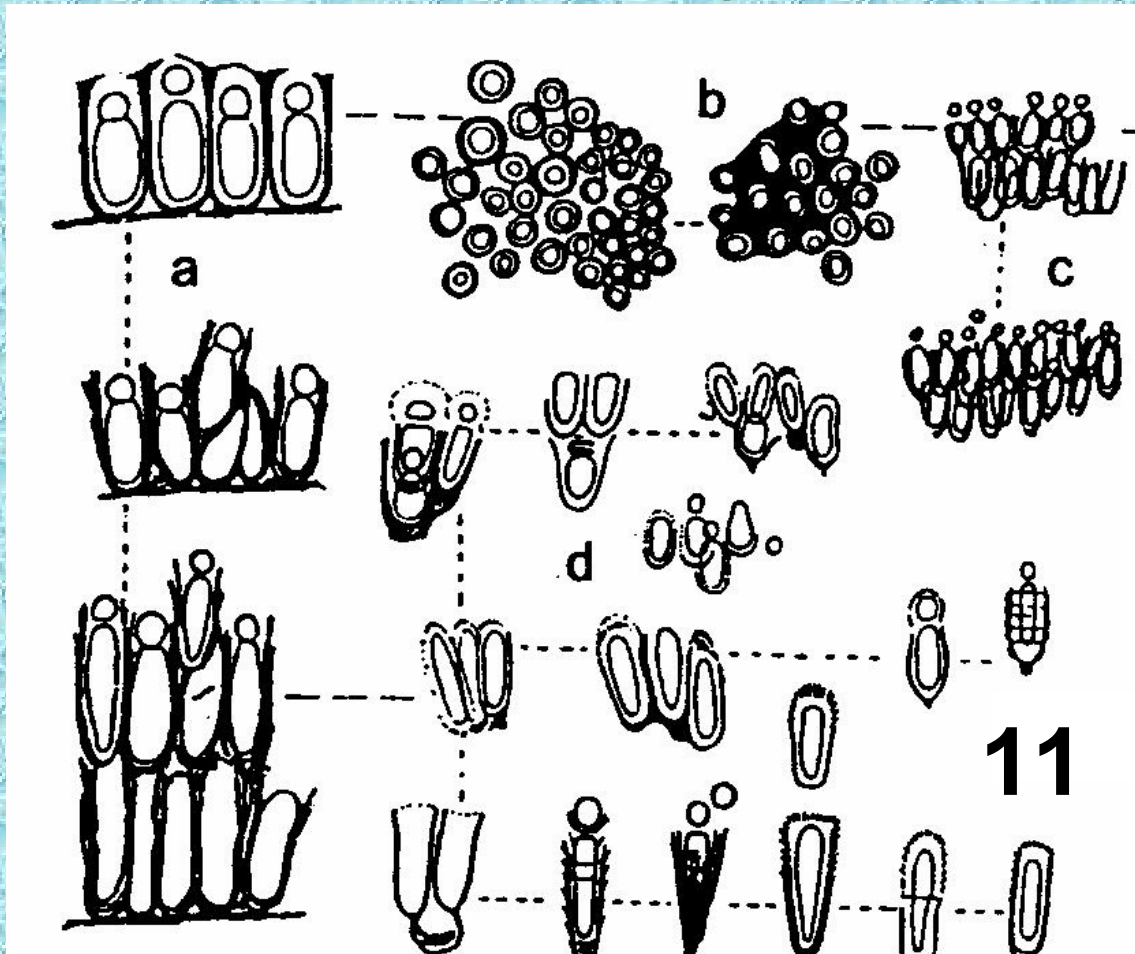
### Description:

Makroscopic colonies forming dark-brown spots on stones

Cells ellipsoidal, ovate, pear-shaped in 2-12 layers,  $5-15 \times 4-7.5 \mu\text{m}$

Locality: 30

# 11. *Chamaesiphon fuscus* (Rostafinski) Hansgirg



**Description:**

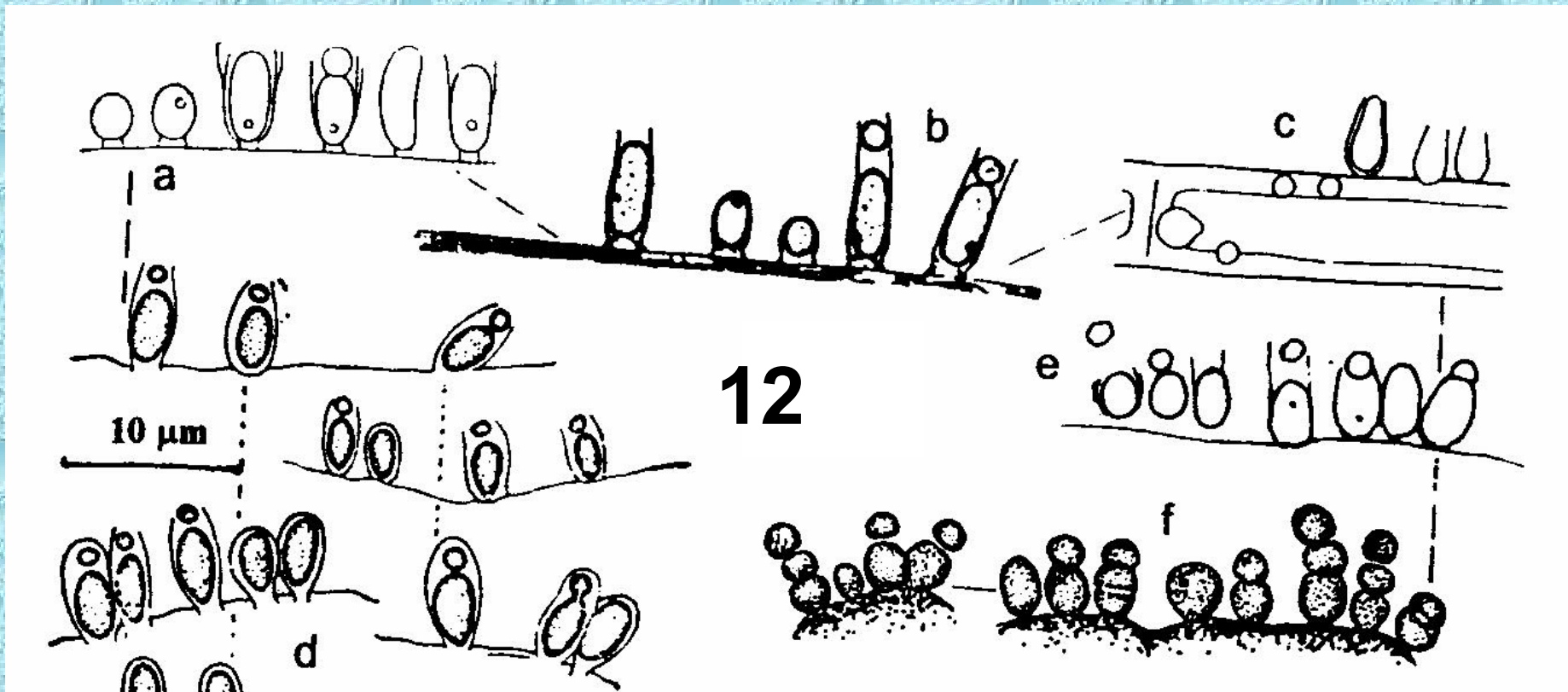
**Macroscopic colonies, irregular in outline black spots on stones**

**Cells club-shaped, rarely oval,  $5-12.5 \times (2.5)3-7.5 \mu\text{m}$**

**Locality: 5**



## 12. *Chamaesiphon minutus* (Rostafinski) Lemmermann



**Description:**

**Microscopic clononies, all attached separately to the substrate**

**Cells ovate, oval, 3-6.5(7.5) × 1.5-3(4) μm**

**Localities: 29, 11, 9, 4**

### 13. *Chamaecalyx chamaesiphonoides* (Geitler) Komárek et Anagnostidis

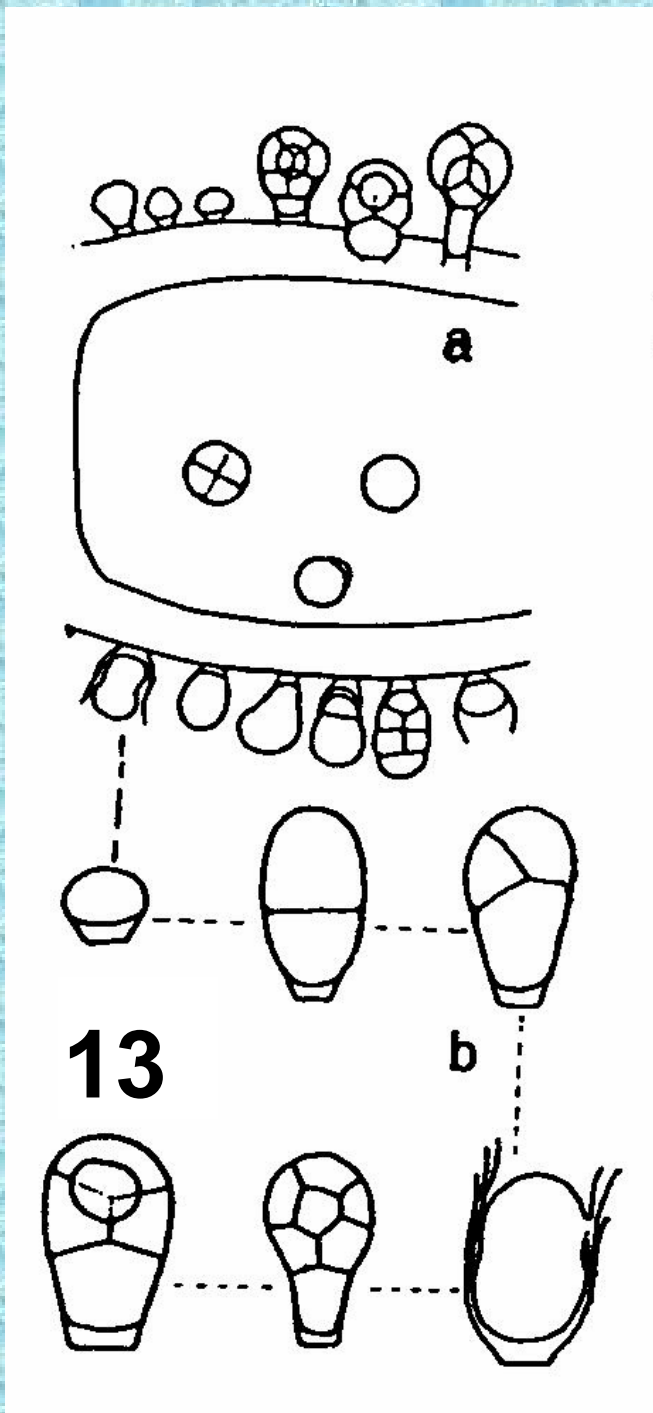
**Description:**

**Mikroskopische Kolonien, alle getrennt an den Substraten**

**Zellen heteropolar, an der Substratseite durch den schmaleren Teil einzeln, 5-10.5 × 7-8 µm**

**Baeozyten 6-8 nummeriert, differenzieren von der oberen, kugelförmigen Zelle**

**Localität: 1**



## 14. *Pleurocapsa minor* Hansgirg

### Description:

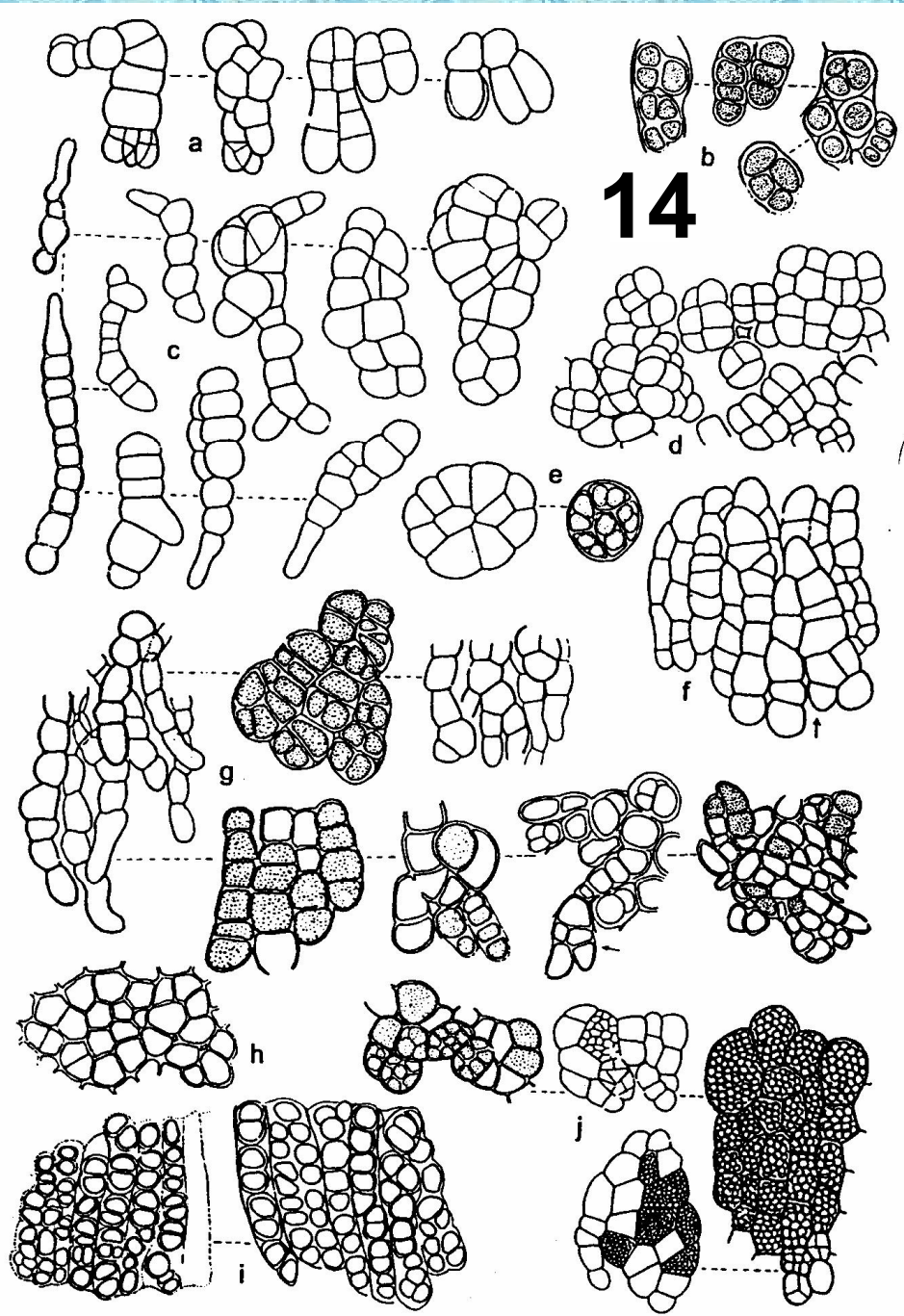
Microscopic colonies forming flat aggregations or parenchymatous layers

Pseudofilaments 3-10  $\mu\text{m}$  wide

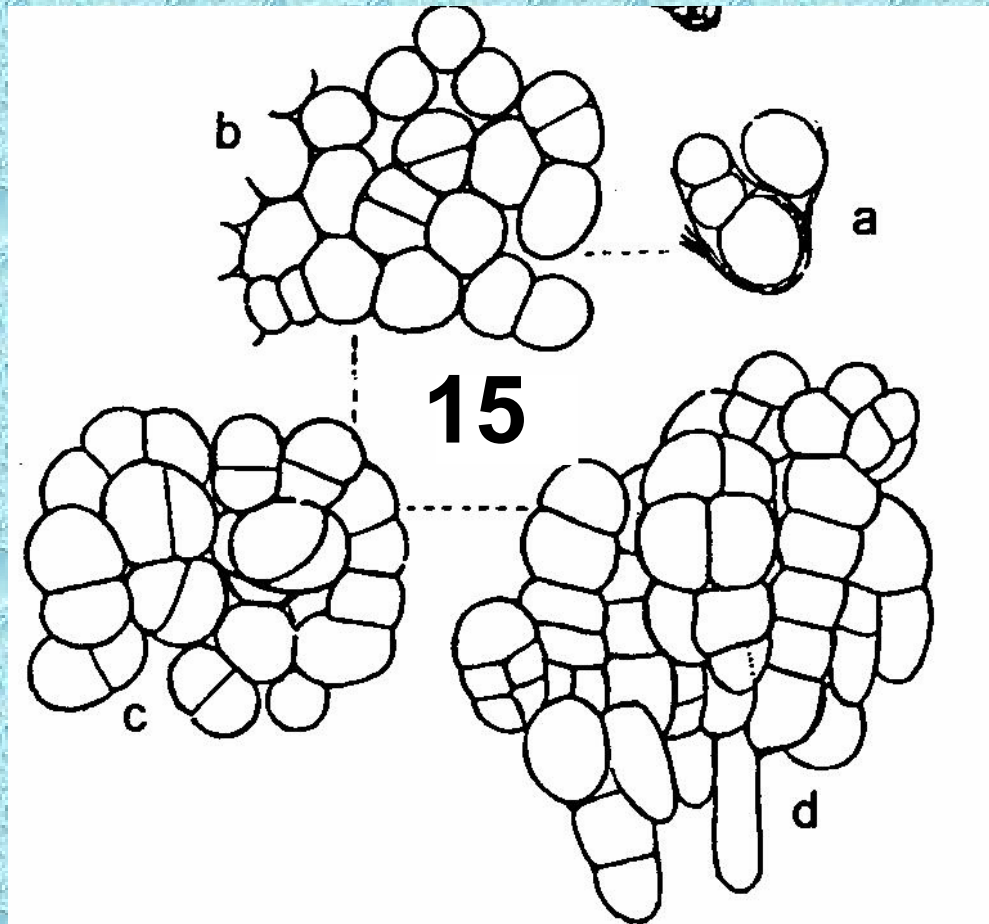
Cells barrel-shaped to polygonal rounded, 2.5-12.5  $\mu\text{m}$  in diameter

Sheaths firm, thin, colourless

Localities: 36, 17, 7, 33, 4



## 15. *Pleurocapsa aurantiaca* Geitler



### Description:

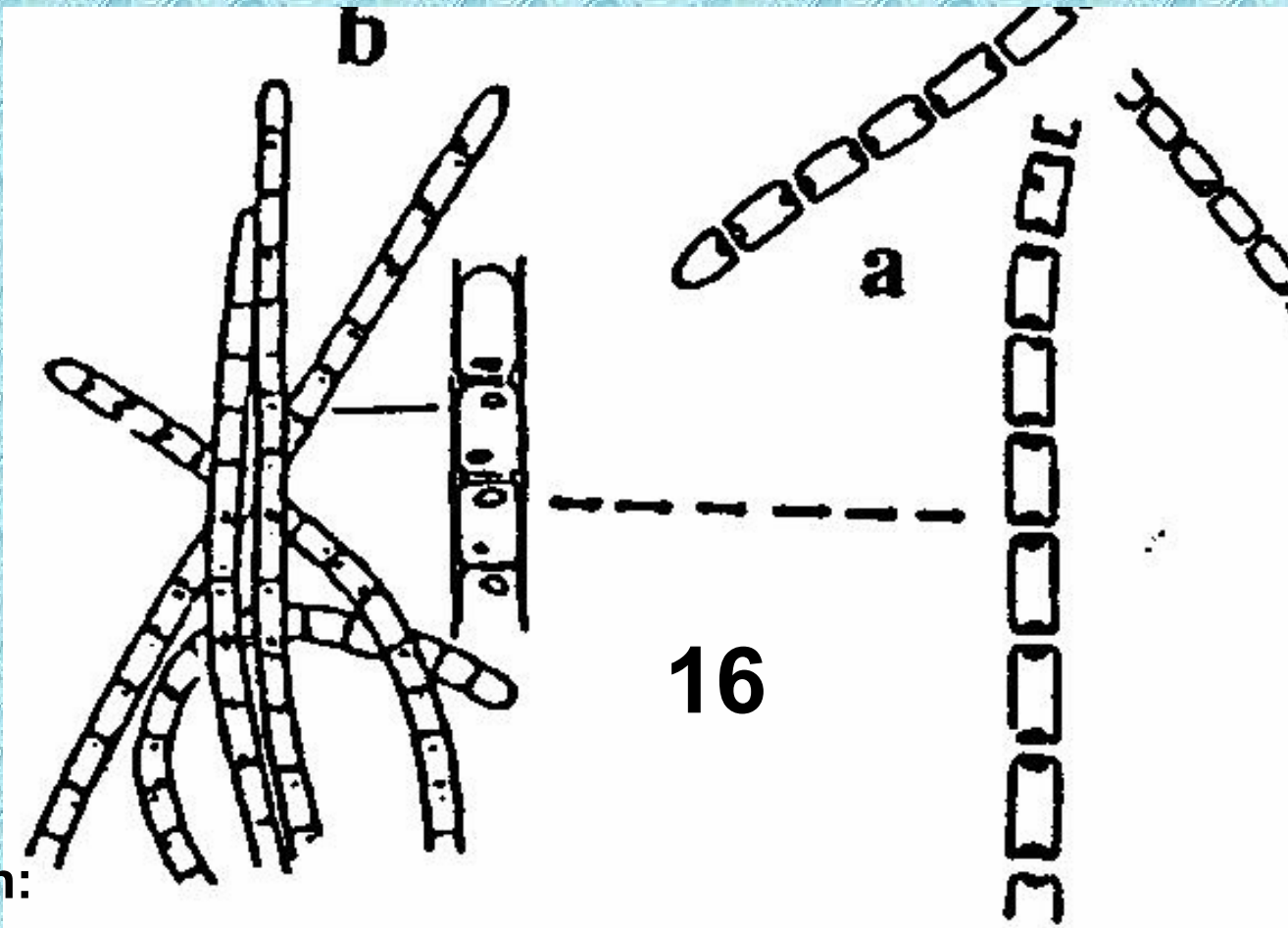
Macroscopic, flat colonies, forming reddish brown or yellow-brown crustose spots on stones, 30-80  $\mu\text{m}$  thick

Cells spherical, barrel-shaped to polygonal, 5-10  $\mu\text{m}$  in diameter

Sheaths thin or thick, orange-yellow to reddish brown

Locality: 28

## 16. *Pseudanabaena frigida* (Fritsch) Anagnostidis



### Description:

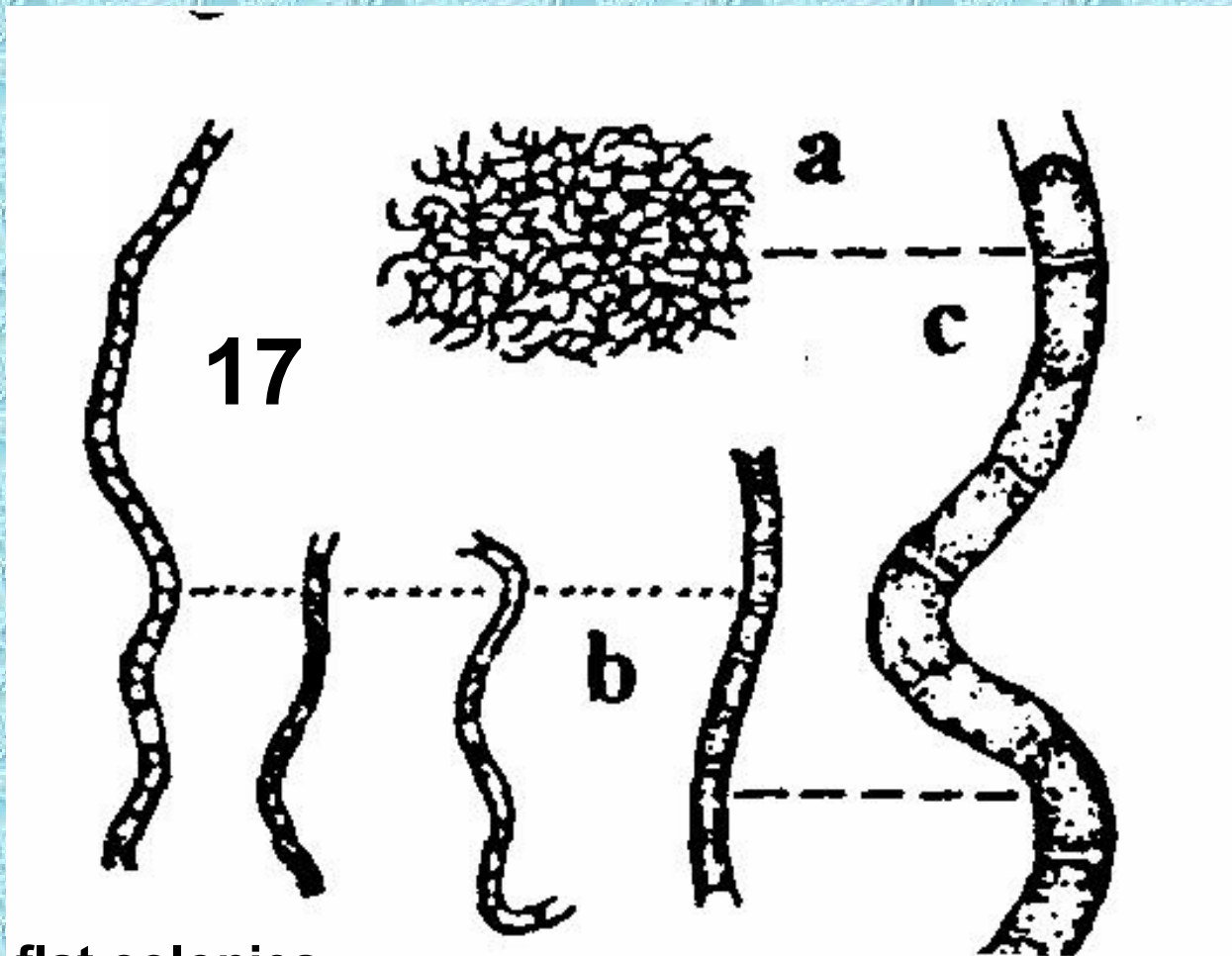
Macroscopic, flat, brittle colonies

Trichomes waved, sometimes paralelly formed, 1-1.5  $\mu\text{m}$  wide, with slimy sheath, by cross-walls constricted

Cells ovate, apical cell conical without calyptra

Locality: 4

# 17. *Leptolyngbya undosa* (Čado) Anagnostidis et Komárek



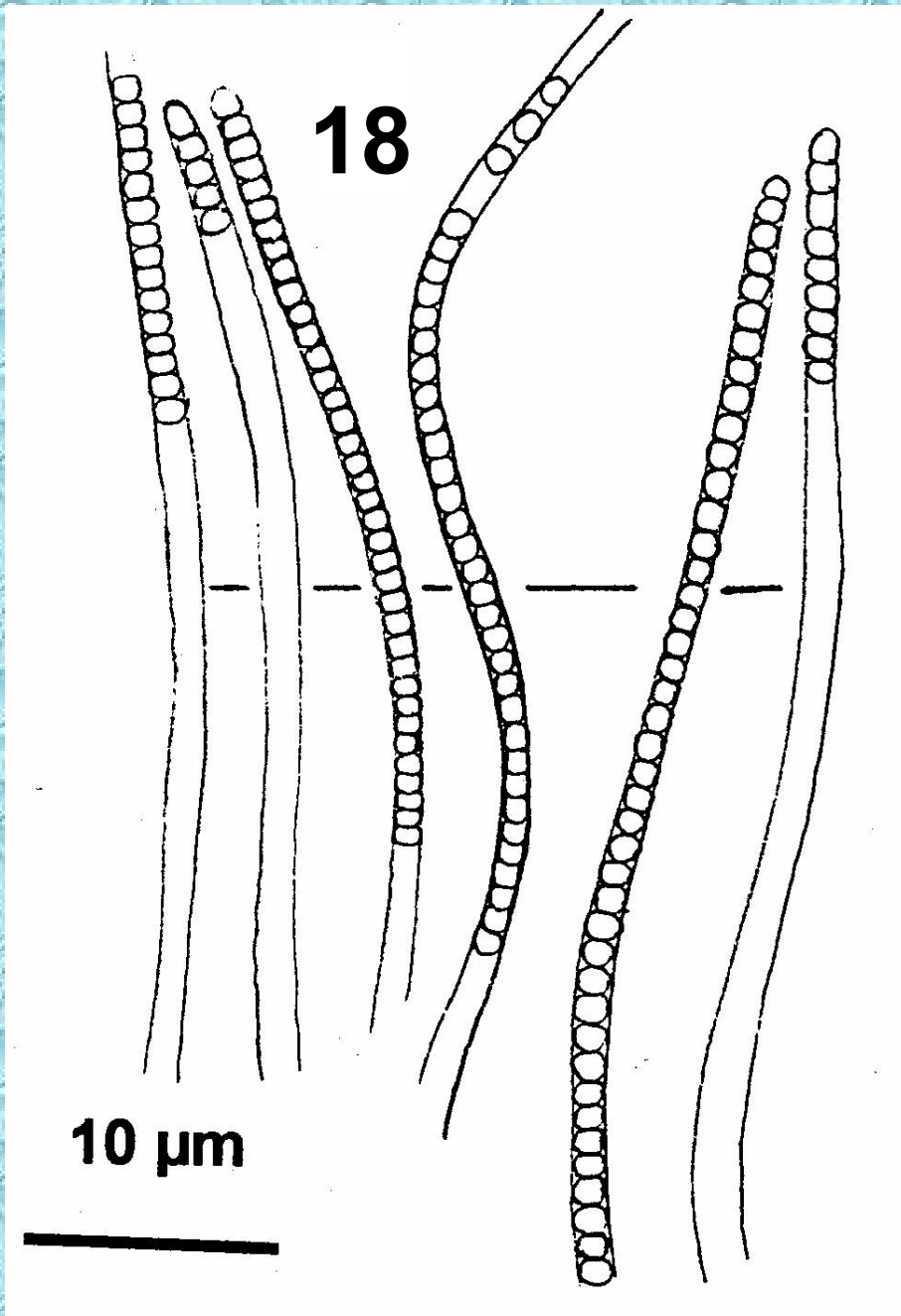
**Description:**

**Microscopic flat colonies**

**Trichomes waved, entangled, 2.5  $\mu$  m wide, with thin sheath, by cross-walls not constricted**

**Cells  $\pm$ 3  $\mu$  m long, cylindrical, apical cell rounded without calyptra**

**Locality: 6**



**18. *Leptolyngbya olivacea*  
(Kützing ex Hansgirg)  
Anagnostidis**

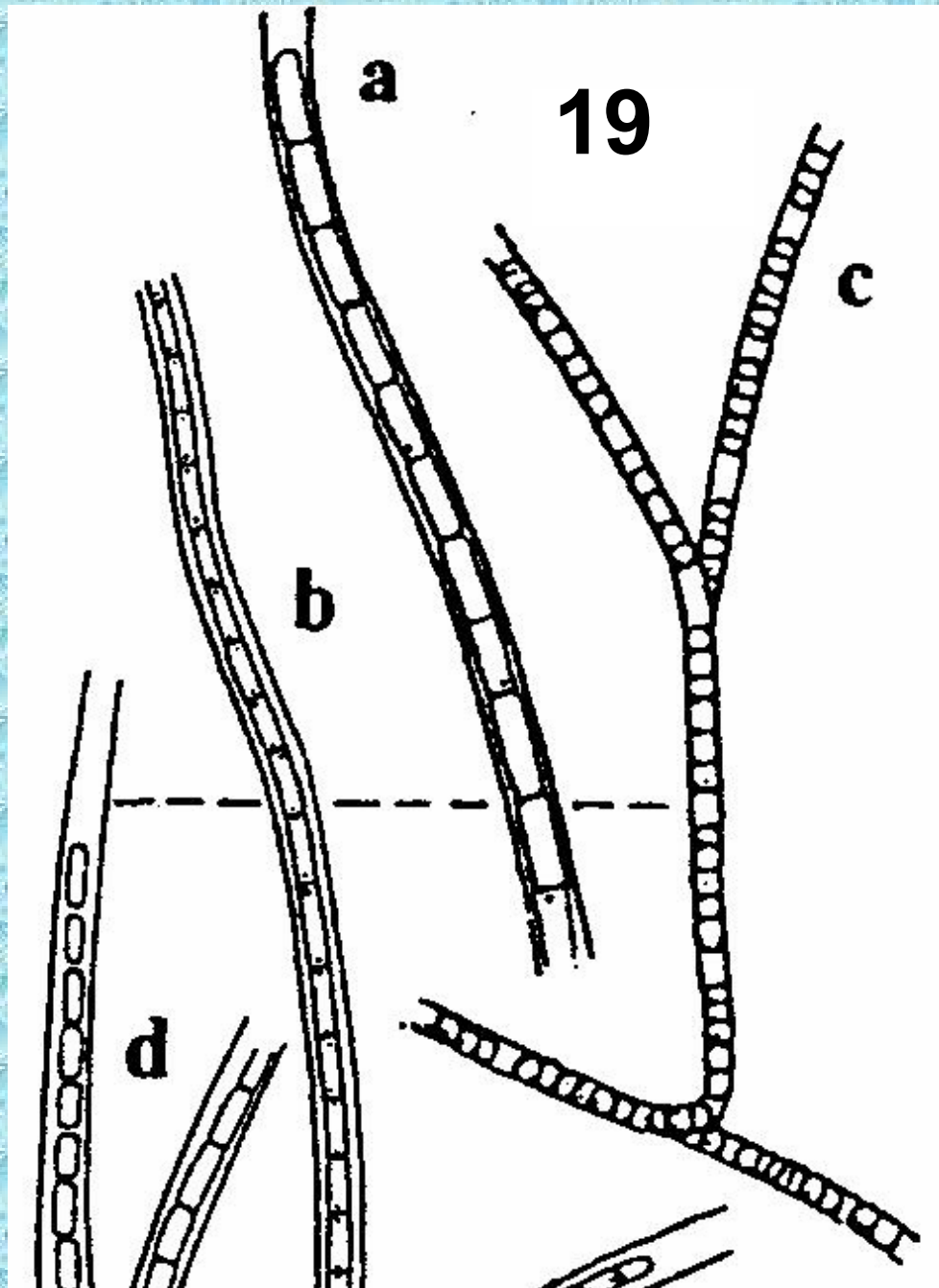
**Description:**

**Macroscopic, brittle, flat colonies forming biofilms**

**Trichomes entangled, 1-2 μm wide, with thin sheath, by cross-walls not constricted**

**Cells isodiametric, apical cell rounded without calyptra**

**Localities: 15, 2, 19, 23, 26**



**19. *Leptolyngbya notata*  
(Schmidle) Anagnostidis**

**Description:**

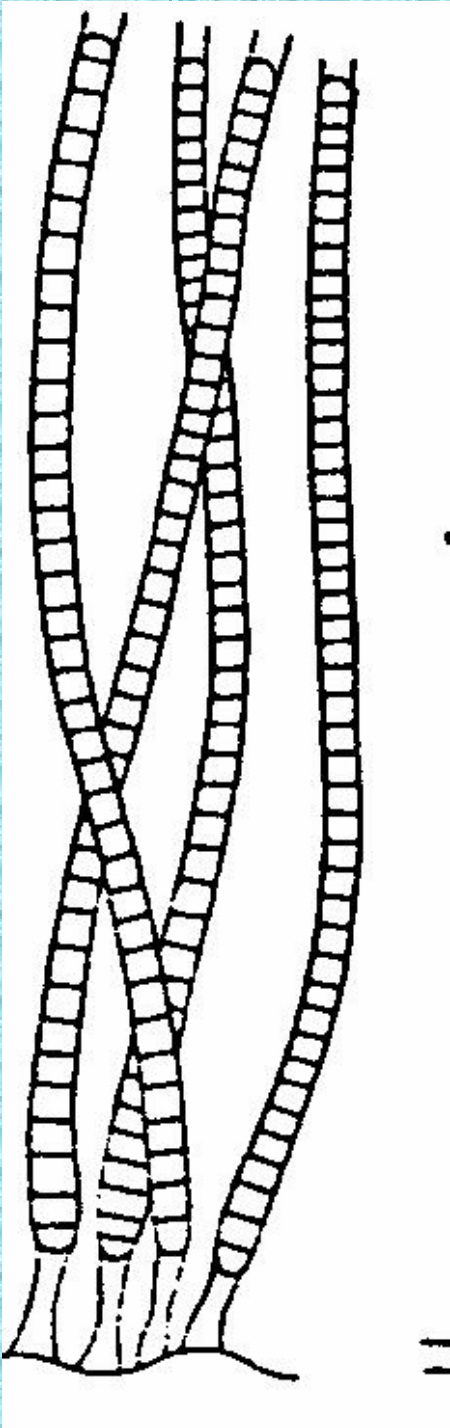
**Microscopic colonies**

**Trichomes entangled, rarely pseudo-branched, 1.5-2  $\mu$  m wide, with thin colorless sheath, by cross-walls not constricted with 1-2 granules in protoplast**

**Cells cylindrical, 2-3-times longer than wide, apical cell rounded without calyptra**

**Localities: 8, 27, 3**





## 20. *Heteroleibleinia fontana* (Hansgirg) Anagnostidis et Komárek

### Description:

Filaments attached by narrowed end to the substrate

Trichomes 2.5-3  $\mu\text{m}$  wide, with thin sheath, by cross-walls not constricted

Cells isodiametric, apical cell rounded without calyptra

Locality: 1

## 21. *Homoeothrix varians* Geitler

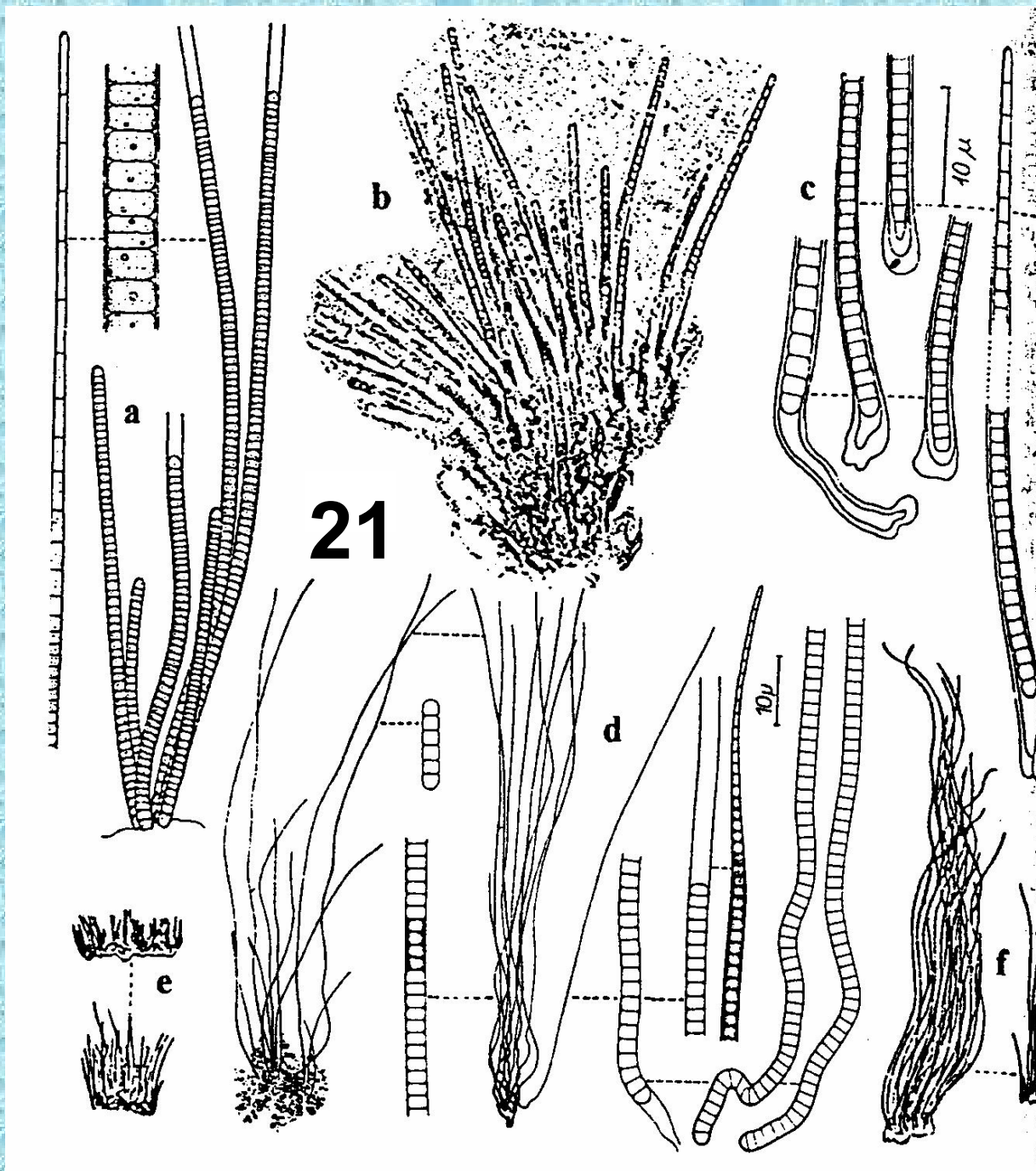
### Description:

Filaments in aggregates and tufts, forming mucilaginous thallus up to 3 mm in diameter

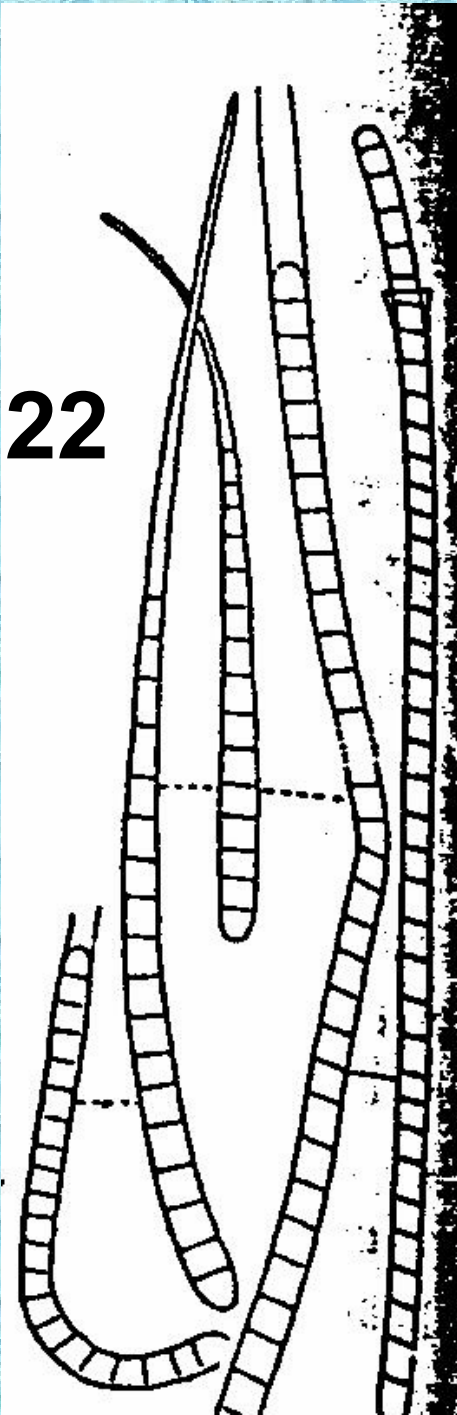
Trichomes up to 3  $\mu\text{m}$  wide, with thin sheath, by cross-walls not constricted

Cells disc-shaped, by the end of trichome prolonged and colorless

Locality: 10



**22**



## **22. *Homoeothrix rivularis* (Hansgirg) Komárek et Kann**

### **Description:**

**Filaments forming small colonies, sometimes tufts, black when dried**

**Trichomes short up to 20  $\mu\text{m}$  long a 4,5  $\mu\text{m}$  in diameter, with thin sheath, by cross-walls not constricted**

**Cells isodiametric, at the end of trichome prolonged and colorless**

**Locality: 22**

**23. *Homoeothrix gracilis*  
(Hansgirg) Komárek et  
Kováčik**

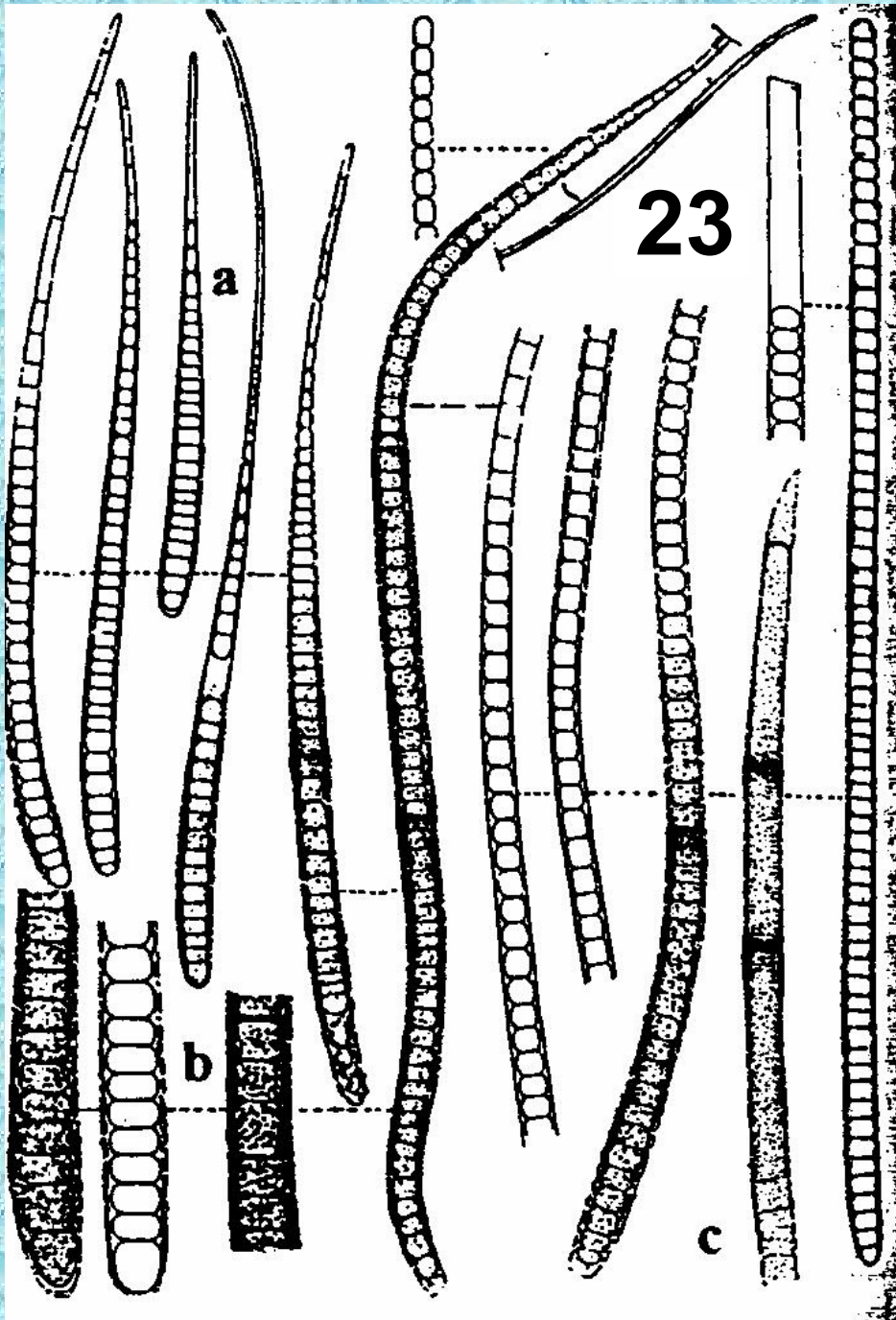
**Description:**

Trichomes bunched, forming  
macroscopic brownish, crustose, up  
to 0.5 mm thick layers

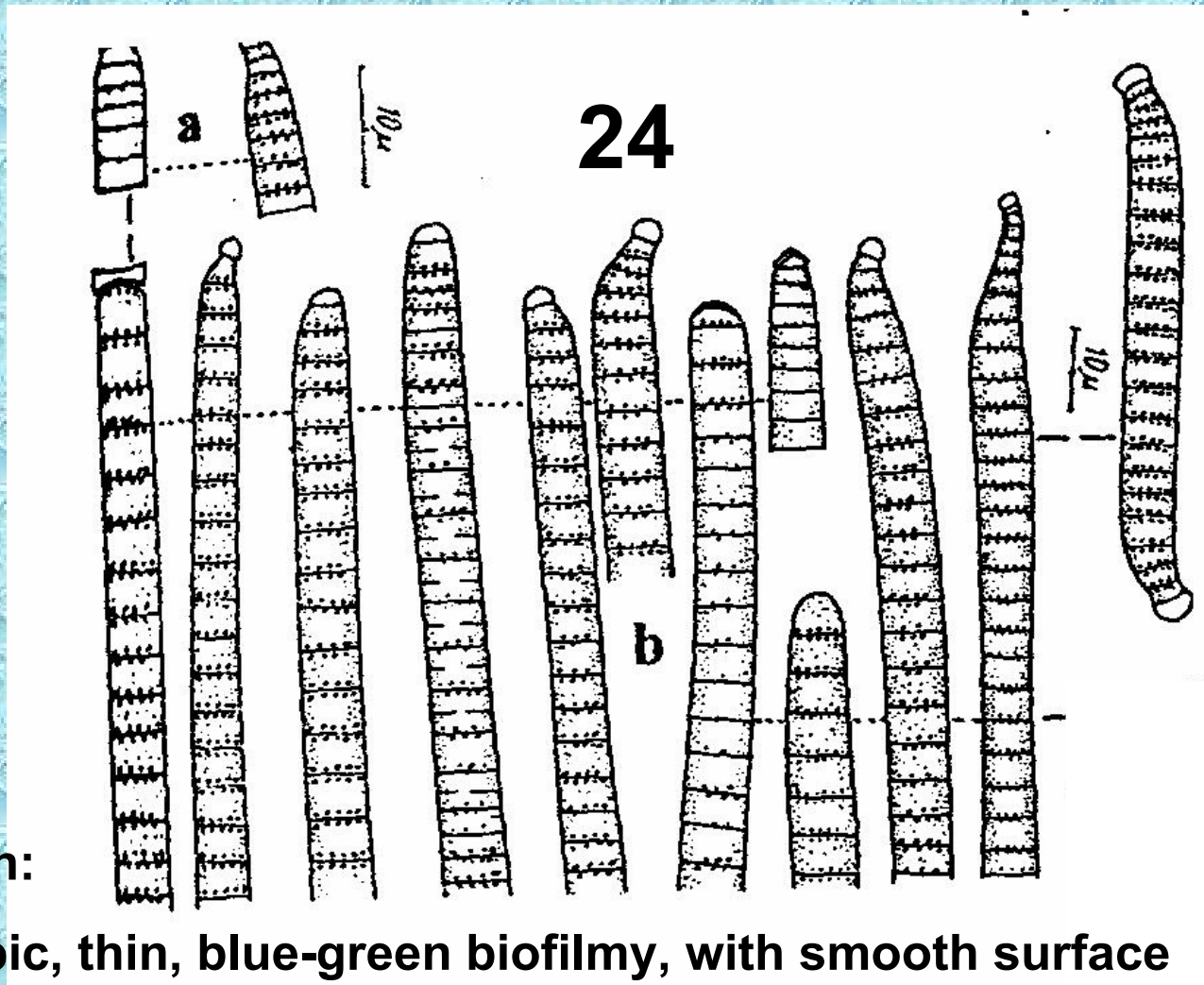
Trichomes 3-6  $\mu\text{m}$  wide, with thin  
brownish sheath, by cross-walls  
constricted

Cells isodiametric, at the end of  
trichome prolonged and colorless

Locality: 13



## 24. *Phormidium fonticolum* Kützing ex Gomont



### Description:

Macroscopic, thin, blue-green biofilmy, with smooth surface

Trichomes 4.5-6.5(7) μm wide, without sheath, by cross-walls not constricted

Cells isodiametric, apical cells thinner with calyptra

Localities: 13, 15, 36

## 25. *Microcoleus subtorulosus* Gomont ex Gomont

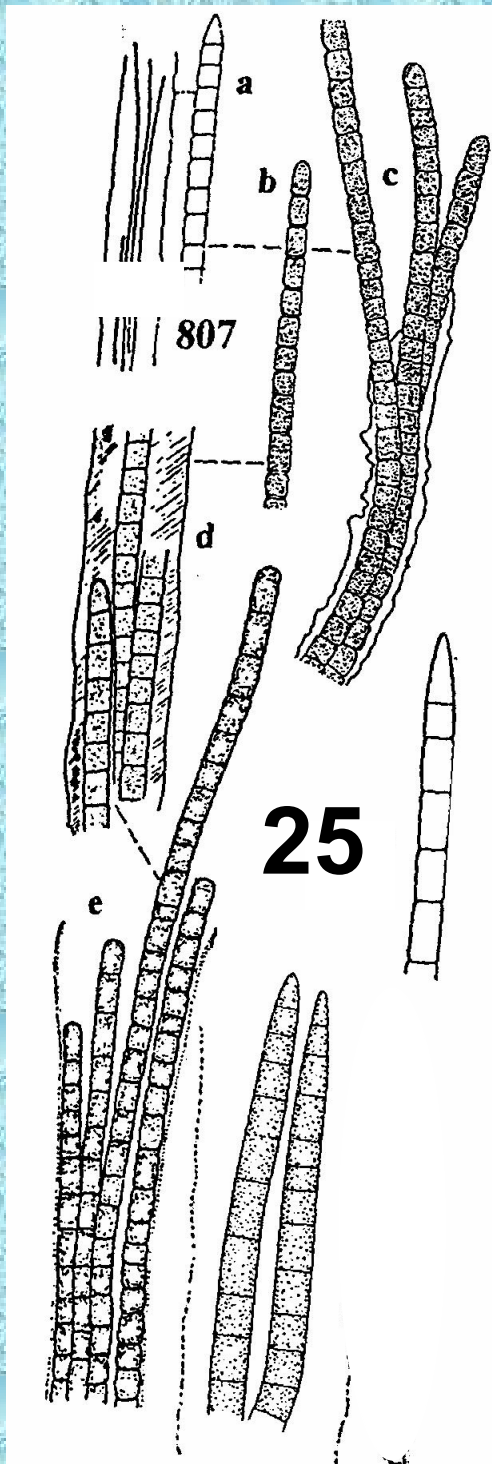
**Description:**

**Macroscopic, large, brownish biofilms**

**Trichomes blue-green, 6-10  $\mu\text{m}$  wide, friable,  
sheaths mucilaginous**

**Cells barrel-shaped, apical cells conical without  
calyptra**

**Locality: 14**



**26. *Tolypothrix distorta*  
f. *penicillata* (Agardh)  
Kossinskaja**

**Description:**

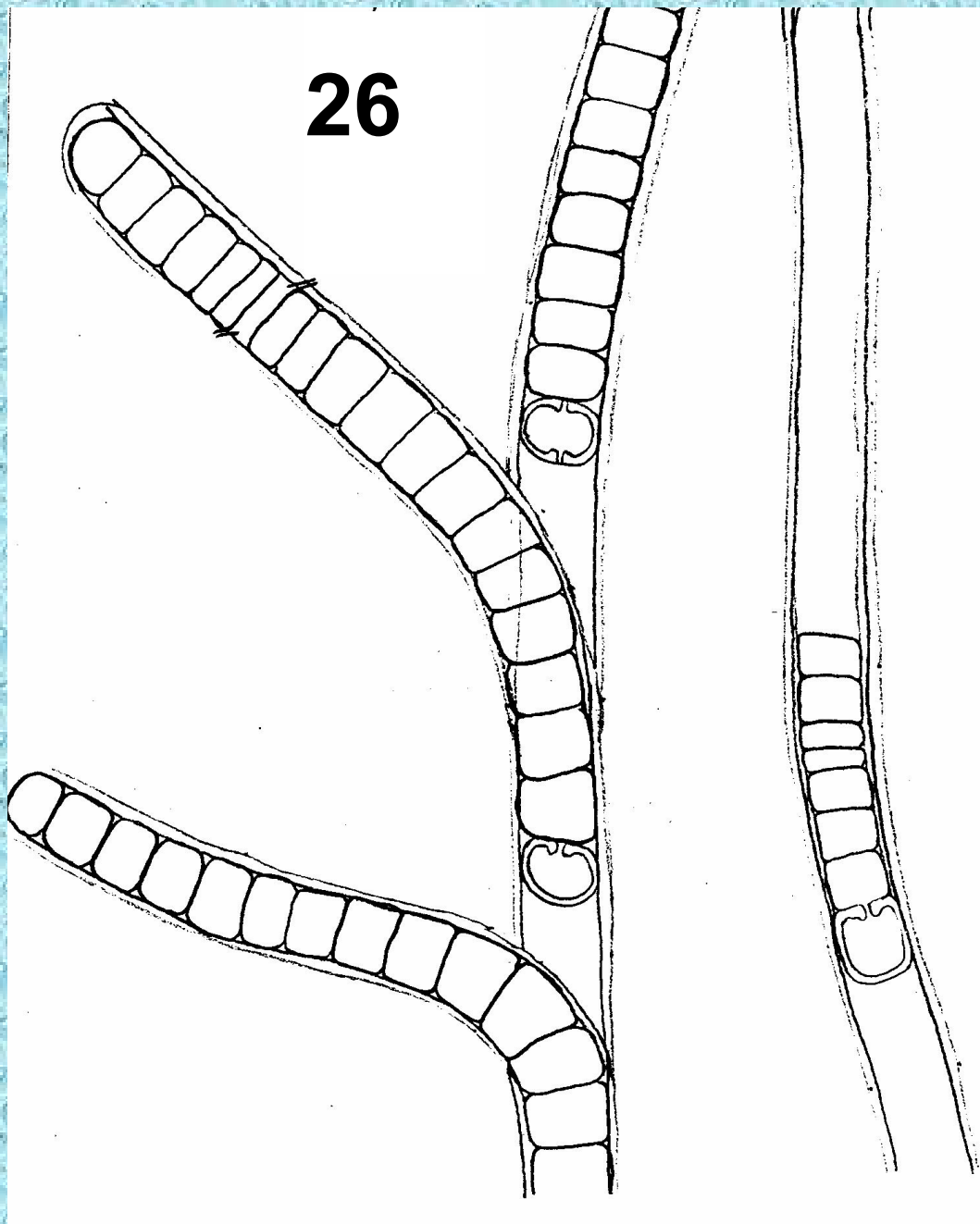
**Macroscopic heteropolar, bushy,  
dark green colonies**

**Trichomes blue-green, 6-12  $\mu\text{m}$   
wide, sheaths thin, colorless to  
yellowish**

**Cells shorter than wide, barrel-  
shaped, 3.5-5  $\mu\text{m}$  long**

**Heterocytes spherical or  
subspherical, up to 15  $\mu\text{m}$  in  
diameter**

**Locality: 32**



# CONCLUSIONS

- In total, 26 epilithic cyanobacteria
- The most frequent species (36 sites):  
*Chamaesiphon oncobyrsoides*  
*C. minutus*  
*Pleurocapsa minor*  
*Leptolyngbya olivacea*
- The highest species diversity – genus  
*Chamaesiphon*
- All determined species are known only from unpolluted, clear streams and rivers
- Further investigations are necessary



# Acknowledgements

- To RNDr. Jarmila Makovinská, PhD.
- To the Crew of National WATER Reference Laboratory for Slovakia
- To RNDr. Lubomír Kováčik, PhD.
- To The Grant of Comenius University in Bratislava No. UK/222/2006

**THANK YOU FOR YOUR ATTENTION!**

