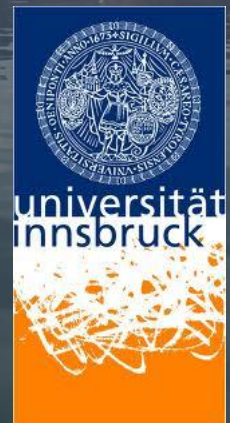


Vegetative survival and stress tolerance of *Zygnema* spp. (Zygnematophyceae, Streptophyta) in polar regions

Martina Pichrtová, Tomáš Hájek, Josef Elster & Andreas Holzinger



Algae in polar regions

arcicphoto.co.uk



the-earth-story.com



Škaloud et al. (2013)

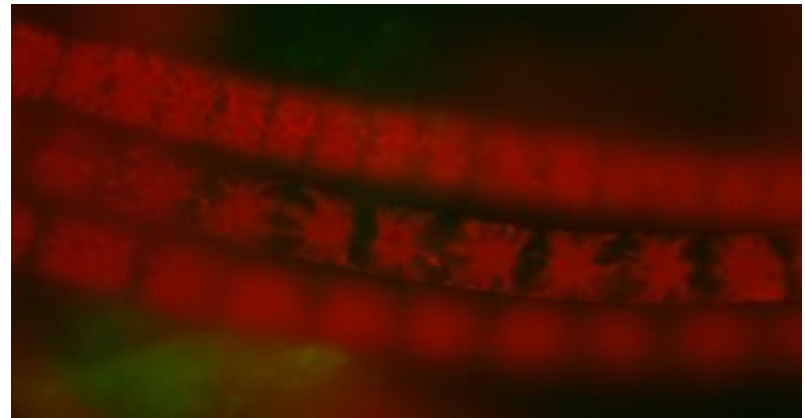
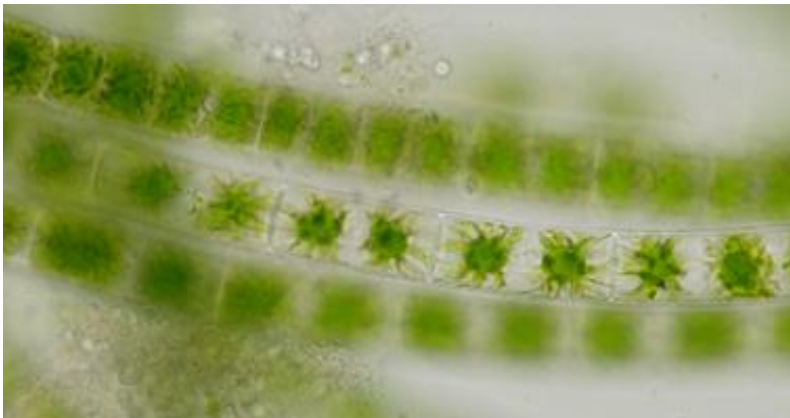


pinterest.com

“*Zygnema* sp.” hydro-terrestrial mats

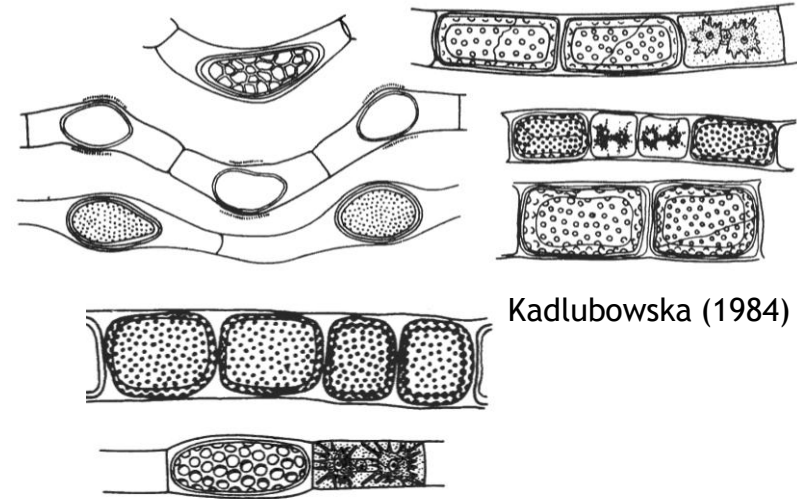


Vegetative cells

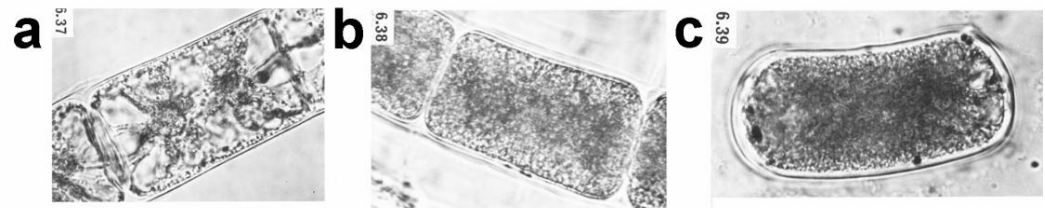
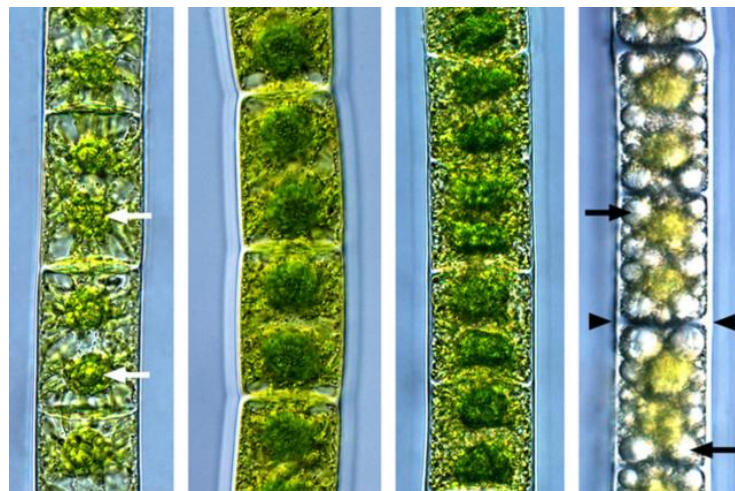


Formation of stress resistant cells

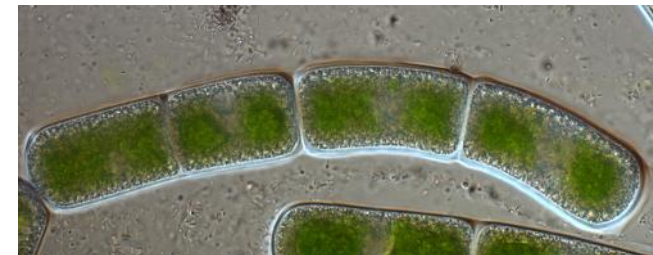
- Conjugation and zygospore formation



- Parthenospores, aplanospores, akinetes
- Pre-akinetes (mature, stationary phase cells)



McLean & Pessoney (1971)



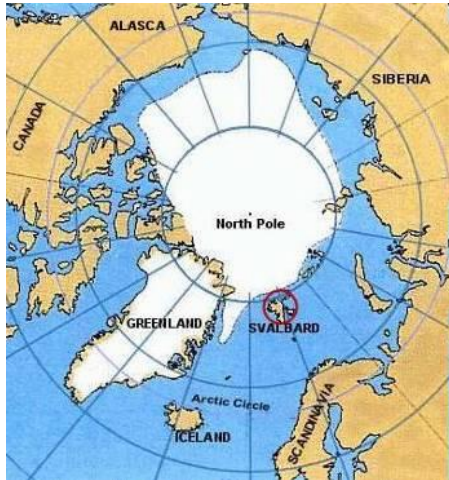
Herburger et al. (2014)

Research objectives

- Do *Zygnema* spp. under natural conditions in Svalbard form any specialized cells?
- What is the role of these cells in stress resistance?
- What conditions induce their formation and resistance?



Zygnema spp. mats in natural conditions



Svalbard - High Arctic



Czech polar
research station
Longyearbyen



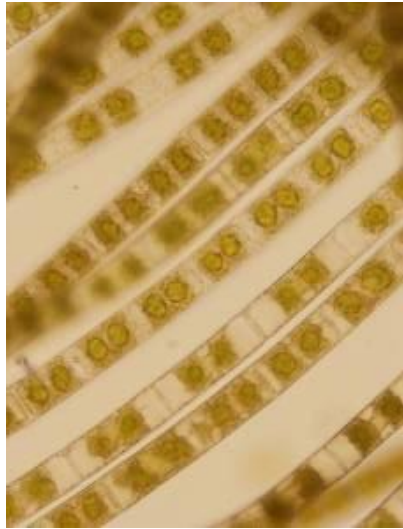
Field station
Petunia Bay

Seasonal development of mats

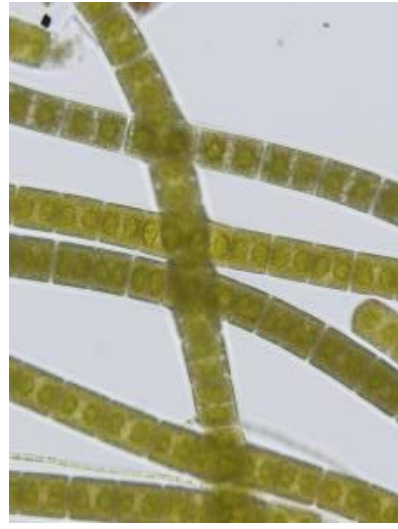


Zygnema spp. mats in natural conditions

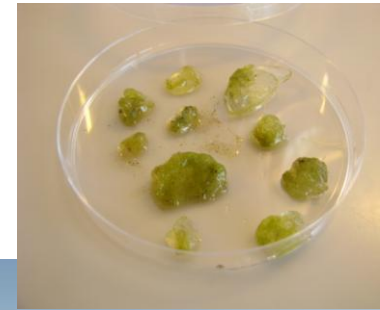
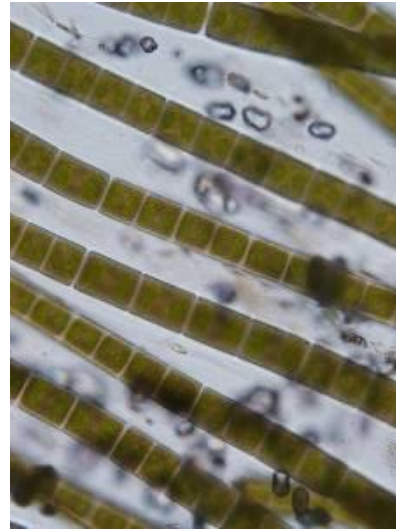
early summer



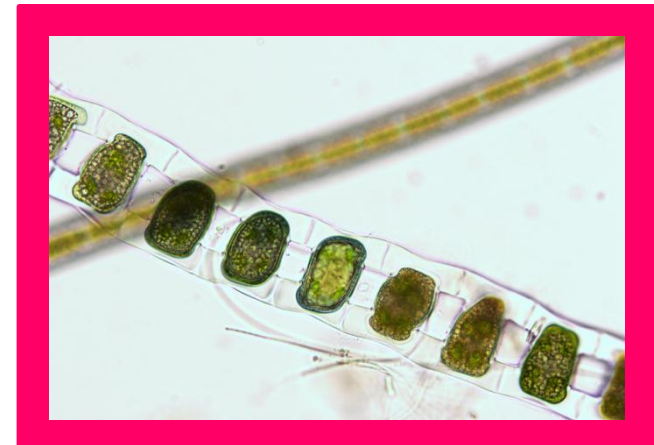
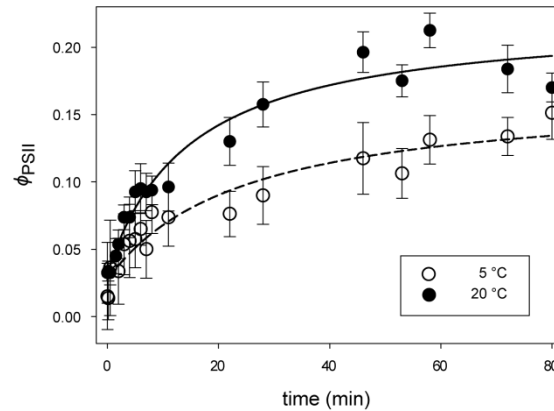
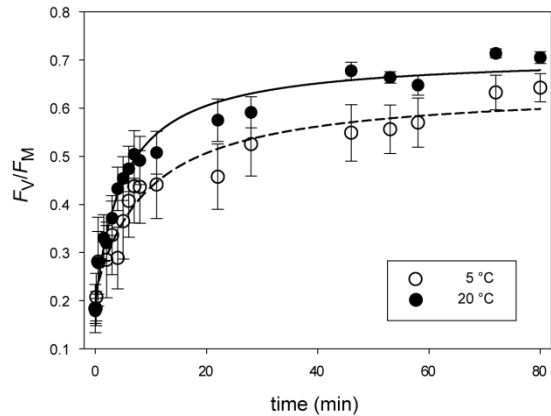
late summer



late winter



Recovery after melting



Osmotic stress tolerance of pre-akinetes

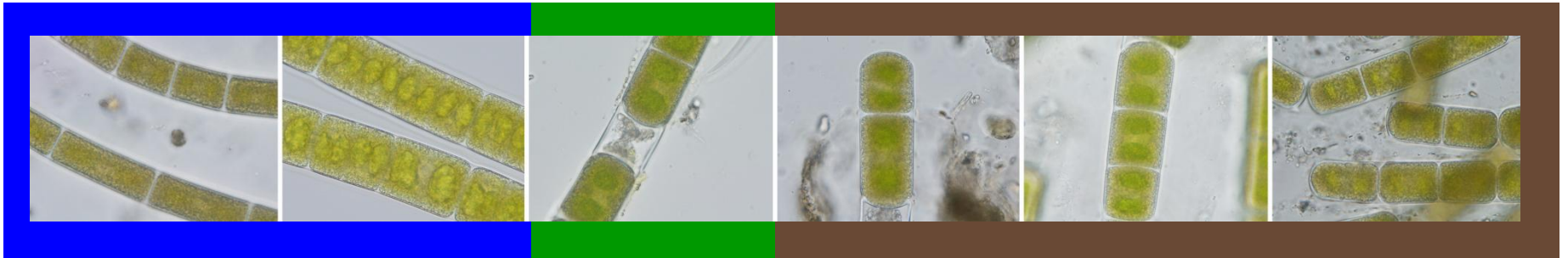
“wet“

“moist“

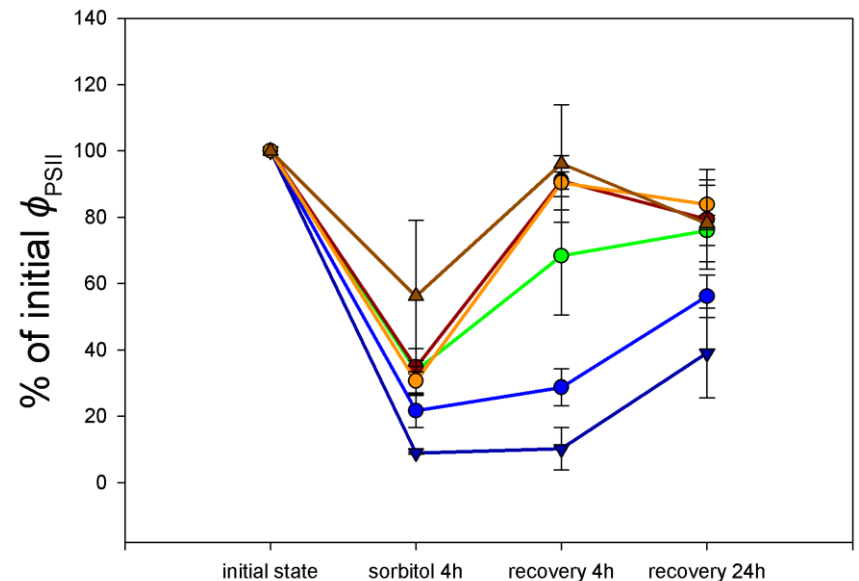
“dry“



Pichrtová et al. (2014) FEMS Microbiol Ecol

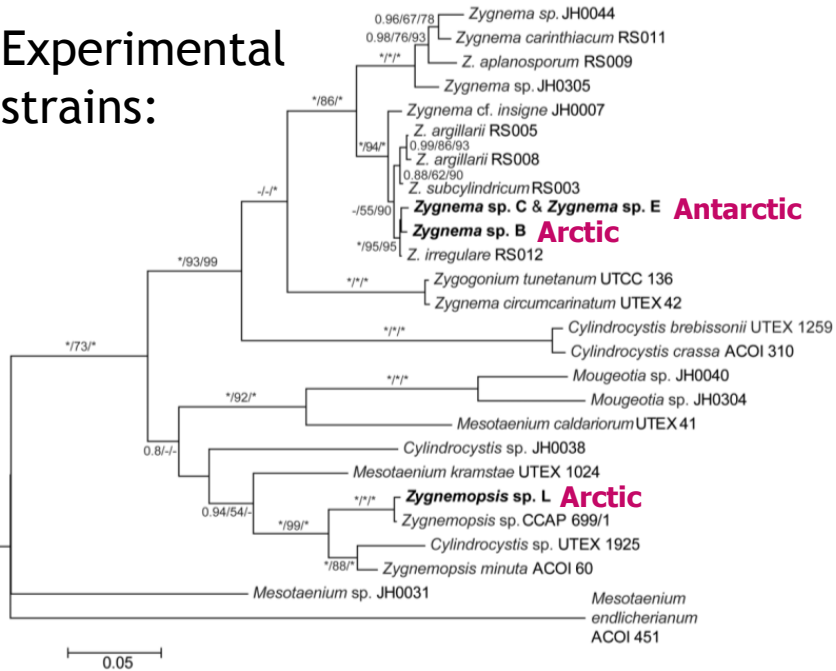


Mat	1	2	3	4	5	6
Plasmolysis occurrence in sorbitol solutions:						
300 mM	-	-	-	-	-	-
450 mM	+	+	-	-	-	-
600 mM	++	++	-	-	-	-
750 mM	++	++	+	-	-	+
% viable cells:						
natural state	100	100	100	80	90	100
2M sorbitol	40	25	95	80	90	100

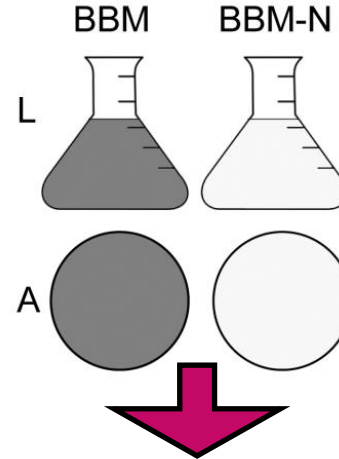


Pre-akinete formation

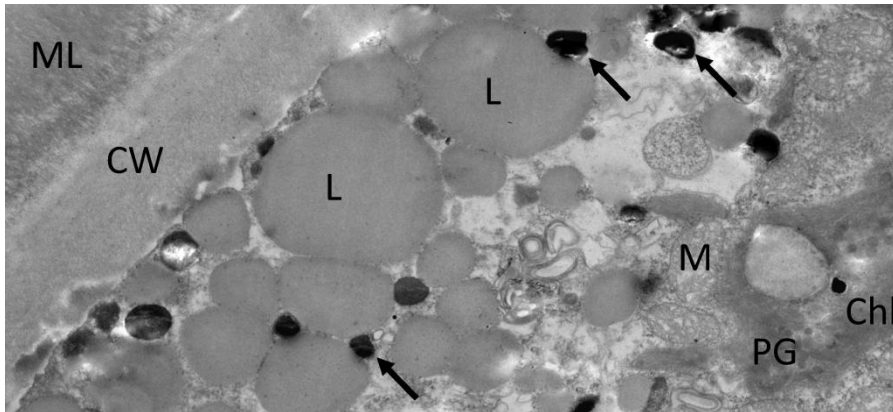
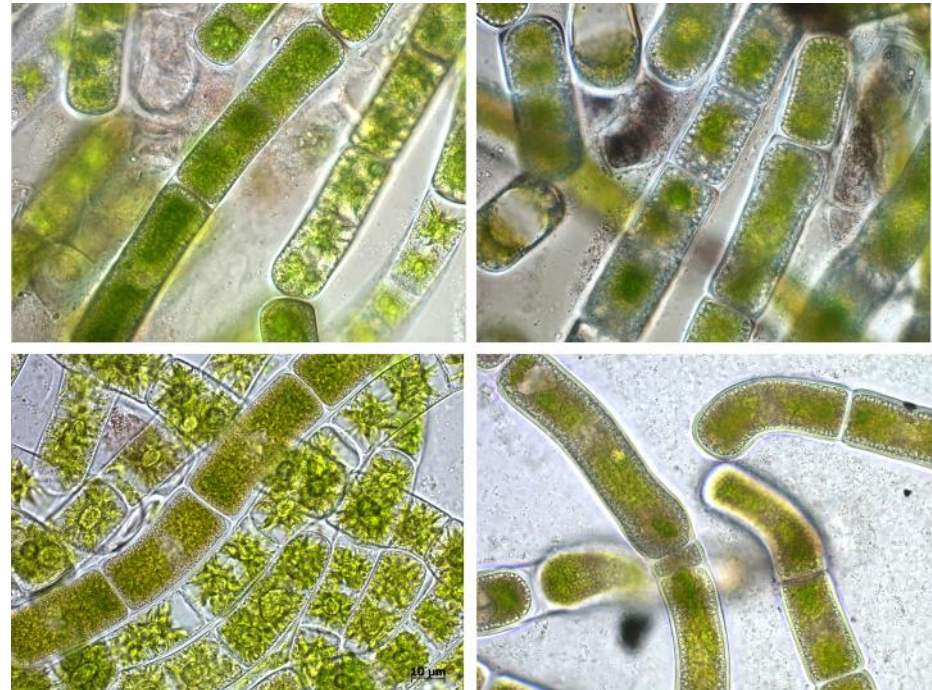
Experimental strains:



9-week cultivation

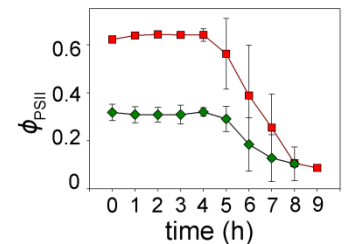
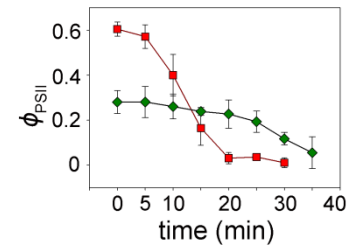
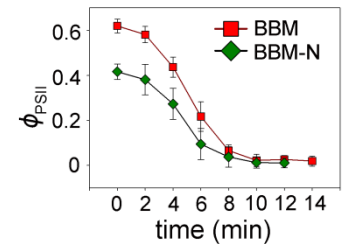
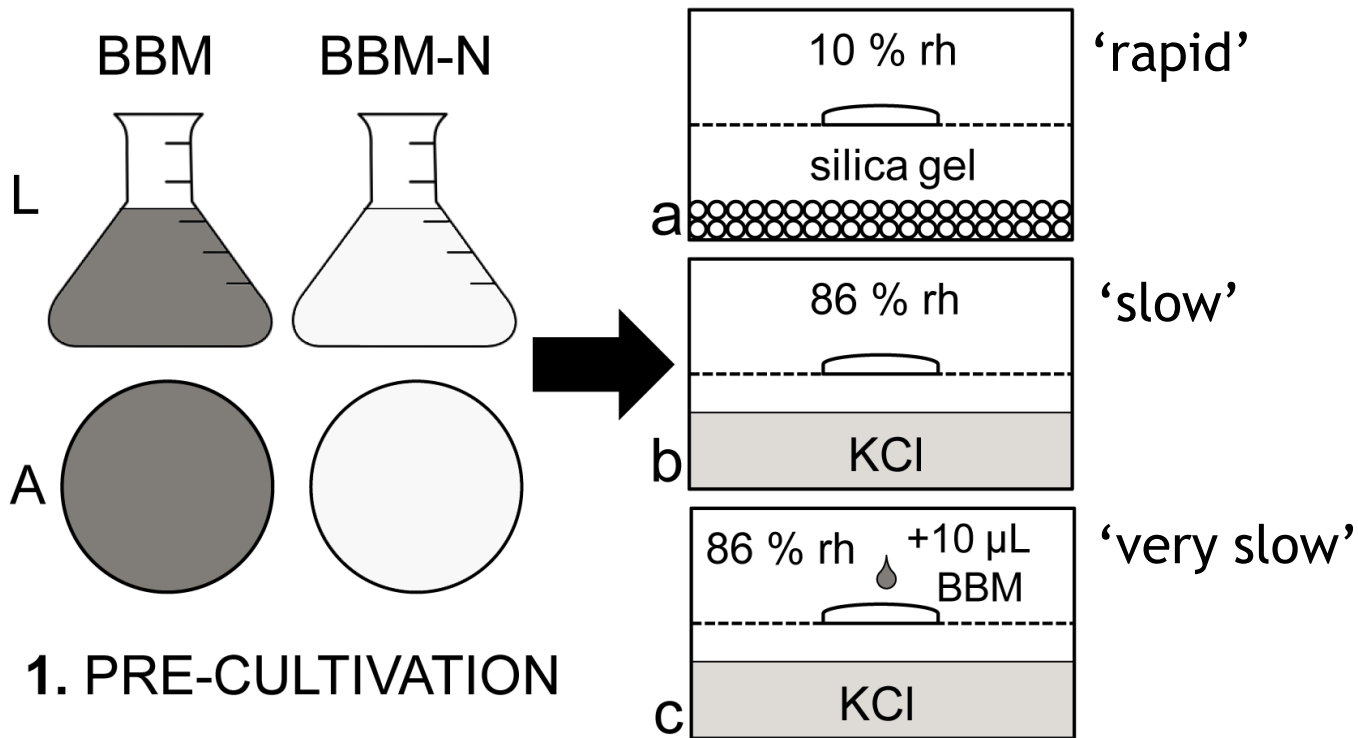


Strain C



Pichrtová et al. (2014) PLoS One

Desiccation tolerance of pre-akinetes

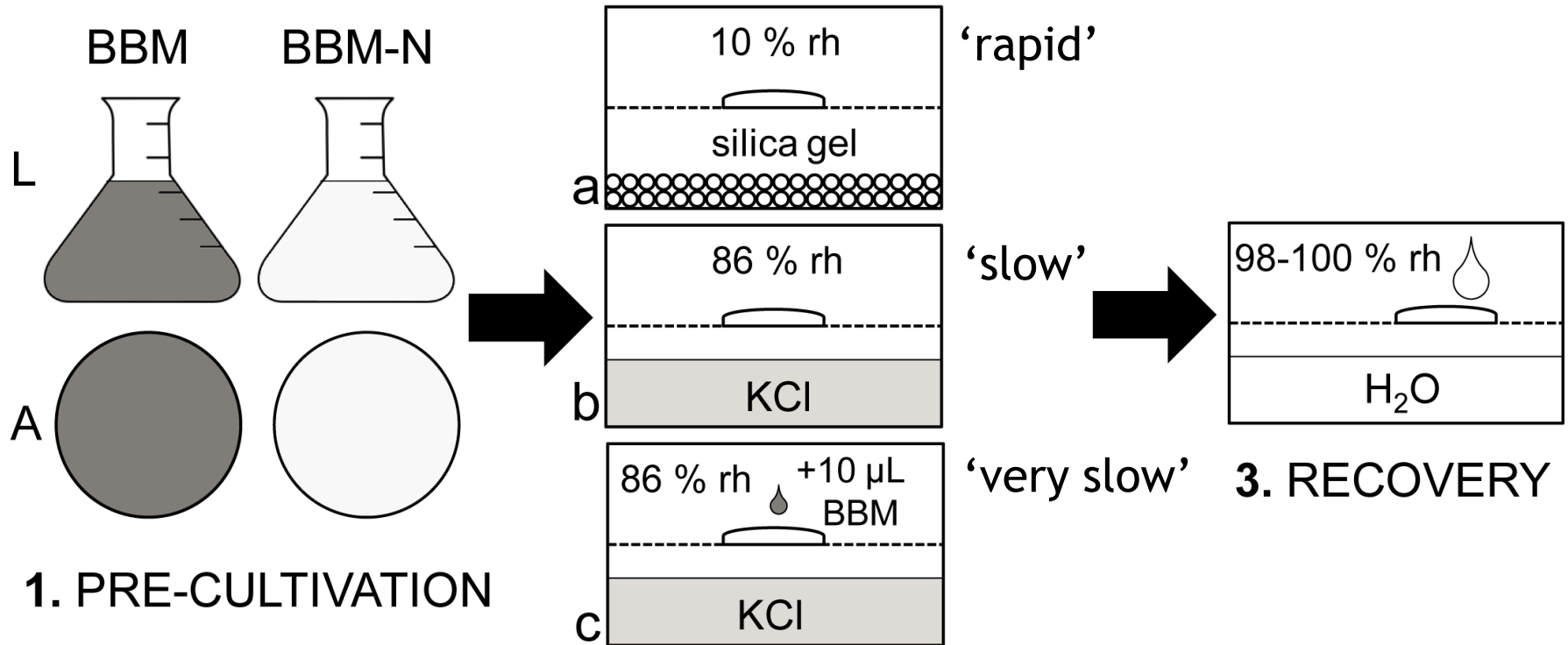


Strain C (agar)



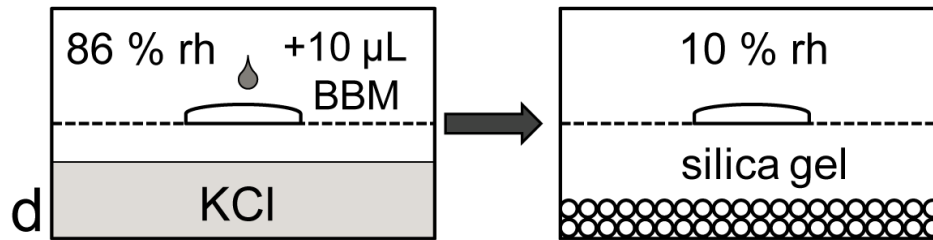
2. DESICCATION

Desiccation tolerance of pre-akinetes



1. PRE-CULTIVATION

c

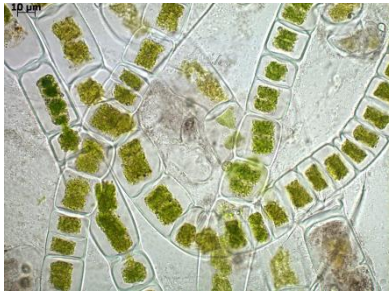


2. DESICCATION

d

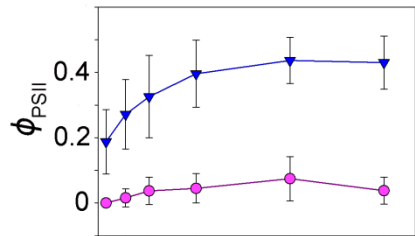


Desiccation tolerance of pre-akinetes

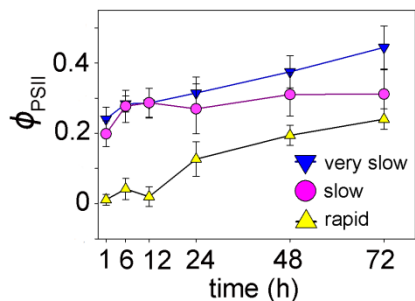


Strain C

A BBM



A BBM-N



strain	culture		desiccation rate			
	name		rapid	slow	very slow	very slow + rapid
B	A	N+	x	x	✓	✓
	A	N-	x	✓	✓	✓
	L	N+	x	x	✓	ND
	L	N-	x	✓	✓	ND
C	A	N+	x	✓	✓	✓
	A	N-	✓	✓	✓	✓
	L	N+	x	✓	✓	ND
	L	N-	x	✓	✓	ND
E	A	N+	x	✓	✓	✓
	A	N-	✓	✓	✓	✓
	L	N+	x	✓	✓	ND
	L	N-	x	✓	✓	ND
L	A	N+	x	✓	✓	x
	A	N-	x	✓	✓	x
	L	N+	x	✓	✓	ND
	L	N-	x	x	✓	ND

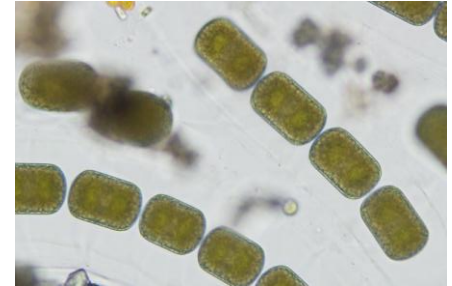
Conclusions

Occurrence of specialized cells in polar *Zygnema*

- Production of pre-akinetes at the end of summer
- Zygospores rare, but present

Formation of pre-akinetes

- Induced by nitrogen starvation



Stress tolerance

- Key role of pre-akinetes in seasonal cycle and dispersal
- Pre-akinetes - modified vegetative cells
- Hardening of pre-akinetes by slow drying
- What causes the annual character of the mats?

Related presentations

- Differences in FA composition - 13:30, Andreas Holzinger
- Molecular diversity in Arctic *Zygnema* sp. - poster, 18:00

Acknowledgements



Andreas
Holzinger



Josef Elster



Tomáš Hájek



Yvonne Němcová



Jana Kulichová

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INVESTMENTS IN EDUCATION DEVELOPMENT

Thank you for your attention!

