

Single-figure Publication

Author-formatted document posted on 06/06/2025

Published in a RIO article collection by decision of the collection editors.

DOI: <https://doi.org/10.3897/arphapreprints.e161262>

Environmental triggers of resting spore germination in the chytrid parasite *Staurastromyces oculus*



Laura Garzoli,



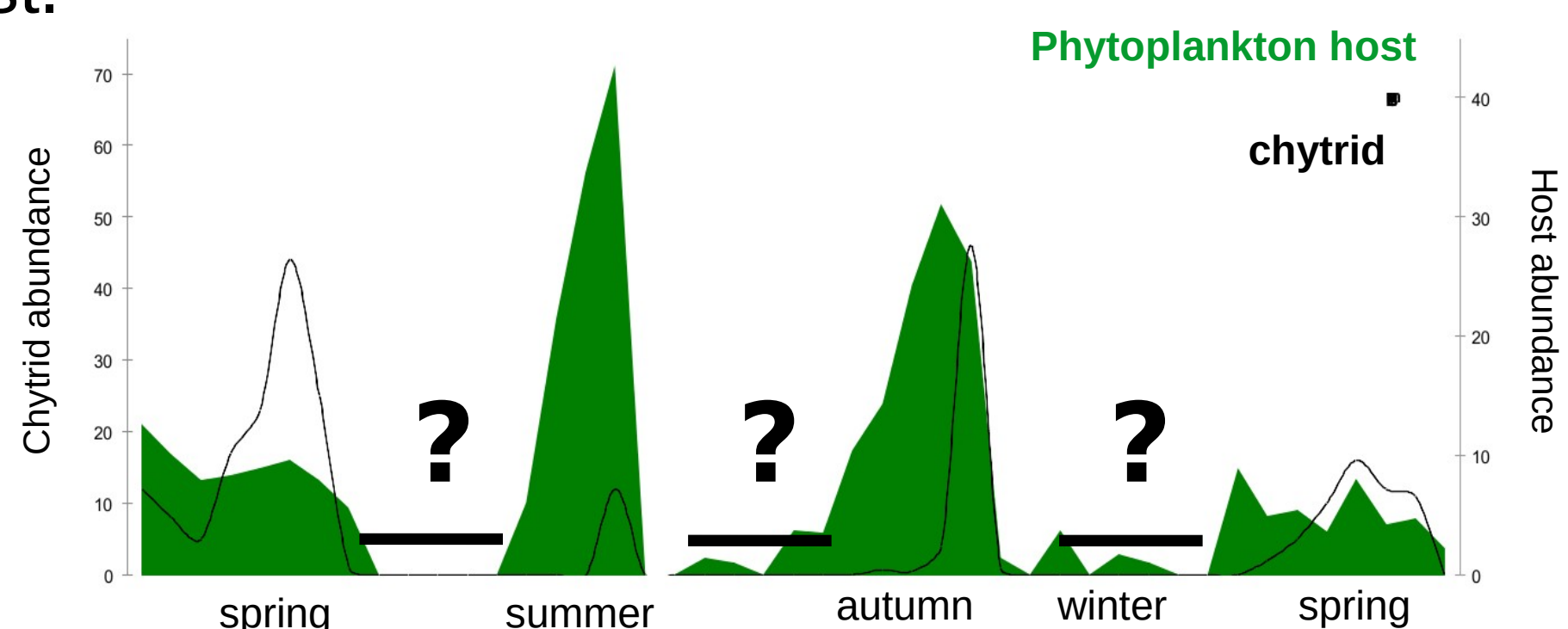
Alena Gsell,



Silke Van den Wyngaert

Who and why?

- **Chytrid fungi** are globally distributed parasites that infect phytoplankton.
- Their **lethal infections regulate** phytoplankton populations in natural environments and can pose serious challenges for the algal industry.
- Chytrid **epidemic outbreaks** follow the seasonal growth dynamics of their host.



- **Resting spores** enable chytrids to survive host absence or unfavorable conditions (Figure 1)
- Understanding resting spore **germination strategy** is essential for predicting infection outbreaks.

What triggers resting spore germination?

Expectation: Environmental cues related to phytoplankton host growth such as **temperature, light** and cues from **phytoplankton host** themselves, trigger chytrid resting spore germination.

Transition between dormancy and activity: **a key knowledge gap** in the chytrid life cycle

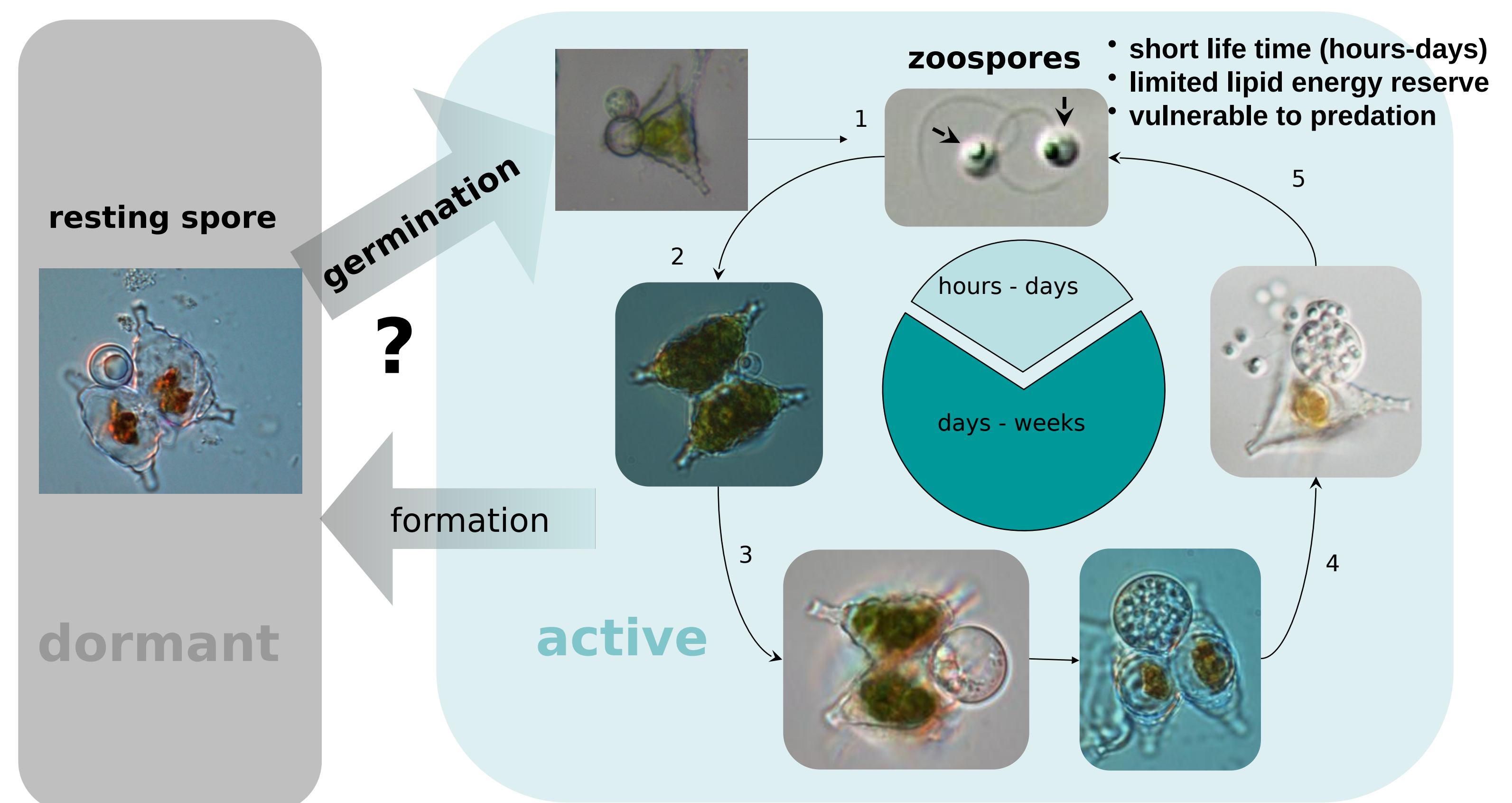
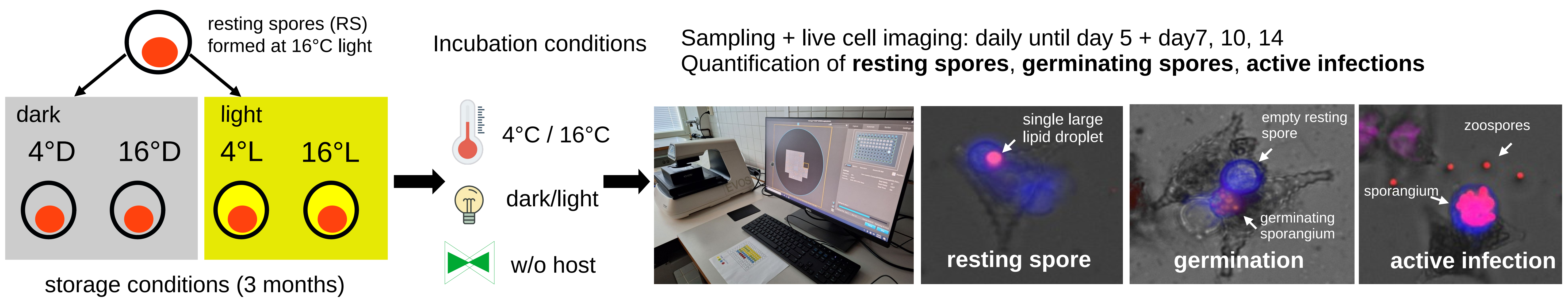


Figure 1. Chytrid life cycle: Chytrid parasites transmit via motile zoospores (1), which attach and encyst on the host surface (2). The cyst germinates, forming rhizoids that penetrate and extract nutrients from the host (3), leading to new zoospore production and release (4,5). Chytrids can enter dormancy as resting spores and germinate under specific environmental conditions. The frequency, triggers, and role of this pathway in seasonal outbreaks remain unclear.



Storage conditions	Incubation conditions				
	4D+ host	16D	16D+host	16L	16L+host
4D	NO germination or infection	to do	germination + infection	germination	germination + infection
16D	-	to do	infection germination?	infection germination?	infection germination?
16L	-	-	-	infection germination?	infection germination?
4L	-	-	-	to do	to do

- Temperature shift upwards triggers germination of RS after 3 month storage in cold + dark conditions and leads to new infections
- Infection occurs at 16°C in 16°C storage treatments but no germination observed
- No need for host to trigger RS germination
- No need for light exposure to trigger RS germination

Multiple resting spore germination strategies in the parasitic chytrid *Staurastromyces oculus* ?

4°C → 16°C = **Seasonal strategy**: resting spores require a temperature shift to break dormancy, aligning with host-parasite seasonal dynamics in nature.

16°C = **Bet-hedging strategy**: at favorable temperatures, resting spores germinate at a very low (undetected) rate ensuring a persistent infection potential if hosts appear **OR** at 16°C the parasite maintains a low (undetected) level of active infection which rapidly increases when host abundance increases.

➤ A **dual germination strategy** would ensure both long-term survival by allowing synchronized germination with seasonal cues and short-term opportunism by maintaining a low-level infection potential.

Author affiliations:

- 1 IRSA - Water Research Institute | CNR - National Research Council of Italy, Italy
- 2 Institute of Environmental Sciences (CML), Leiden University, The Netherlands
- 3 Department of Aquatic Ecology, Netherlands Institute of Ecology, the Netherlands
- 4 Department of Biology, University of Turku, Finland

Acknowledgments:

This research is supported by the Research Council of Finland granted to SVdW and ParAqua – COST ACTION CA20125 supporting the STSM of Laura Garzoli