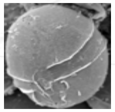
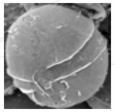


Revealing the Allelochemical Potential of *Alexandrium ostenfeldii*, a Marine Dinoflagellate

Bernd Krock, Urban Tillmann, Uwe John, Nina Jaekisch,
Allan D. Cembella



Alexandrium ostenfeldii

Marine gonyaulacoid mixotroph dinoflagellate in temperate waters

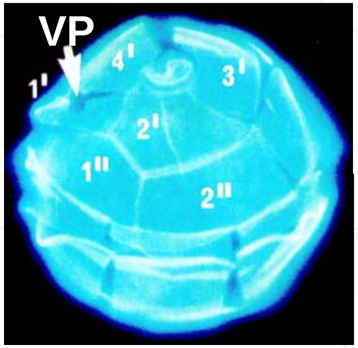
Ocurrence:

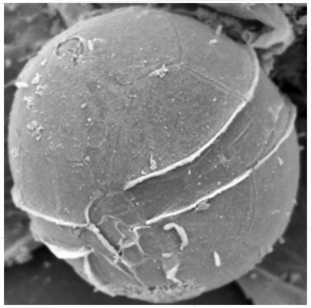
Atlantic (Canada, USA, Iceland, Faroe Islands, Spain)

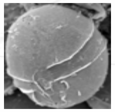
North Sea (Scottland, Norway, Denmark)

Mediterrean Sea (Italy, Egypt)

Pacific (USA, Russia, New Zealand)





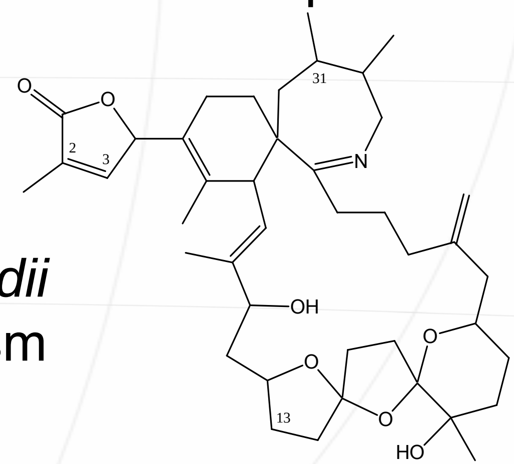


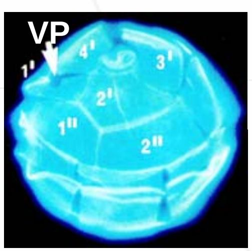
A. Ostenfeldii – Short History

1904*: A. ostenfeldii* first described as *Goniodoma ostenfeldii* by Paulsen in Iceland in 1904

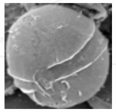
July 1990, 1991: Unusual mouse-deaths - lipophilic mussel extracts from Ship Harbour, Nova Scotia, Canada: "fast acting toxin" (FAT) symptoms and coincident consumer complaints of mild illness after shellfish consumption

1995: Structural elucidation of spirolides

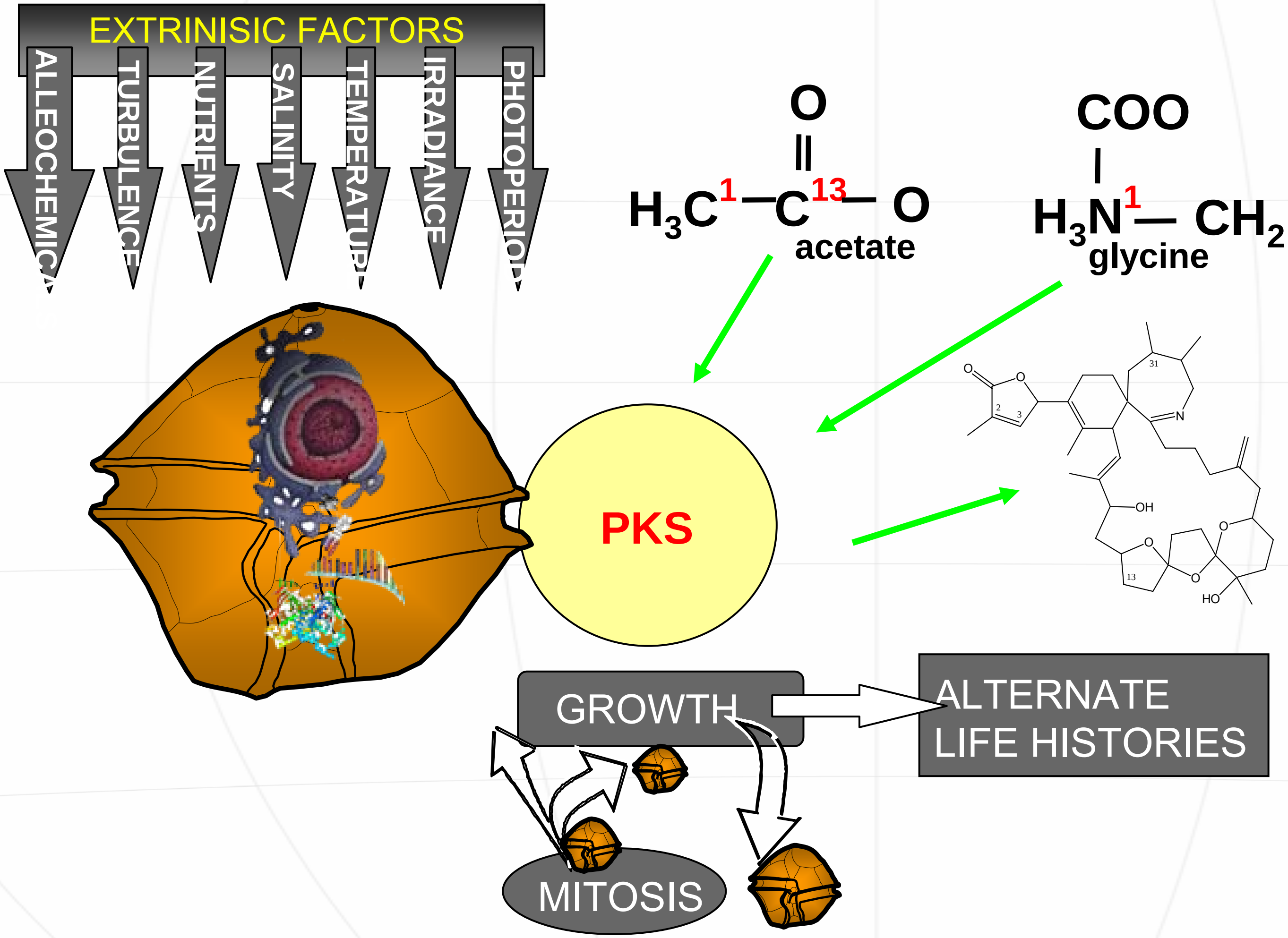




1996*: Identification of A. ostenfeldii* as spirolide producing organism



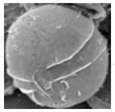
Regulation of Spirolide Biosynthesis



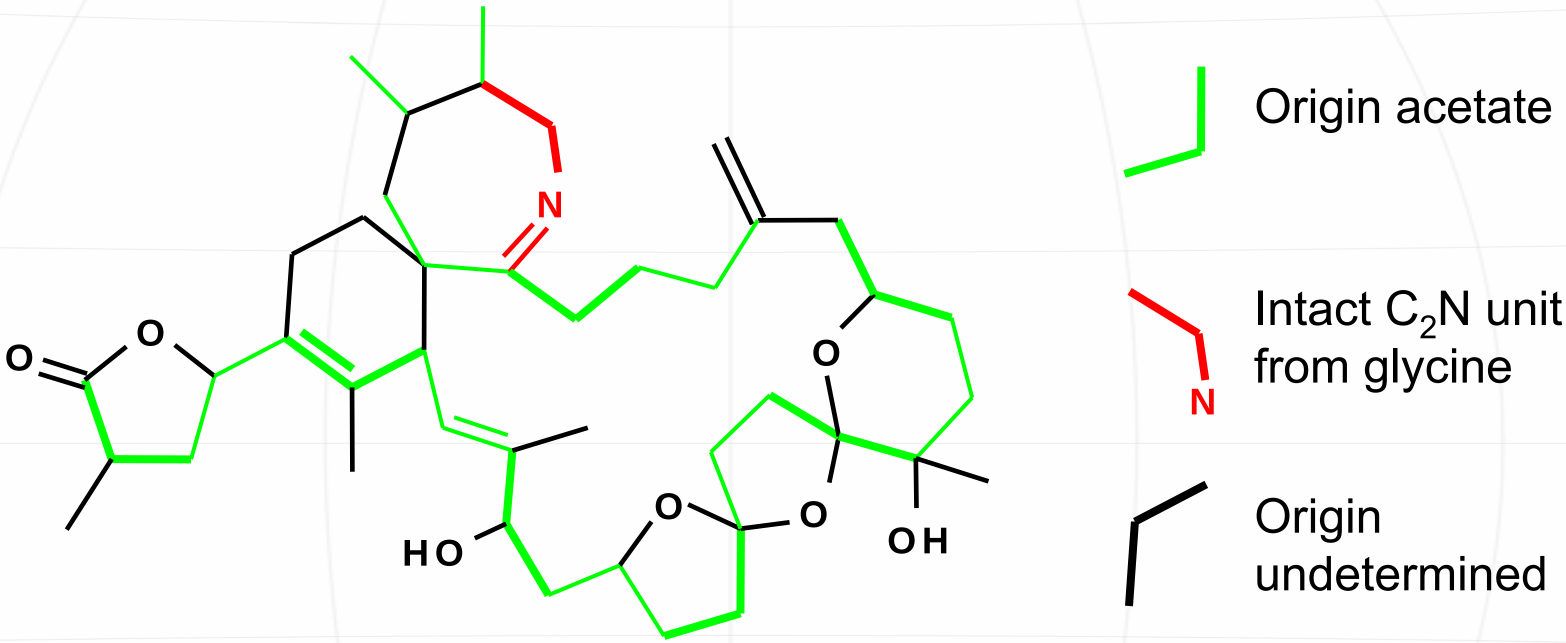
Toxin production is related to extrinsic factors

Toxin composition is maintained, presumably genetically determined

Effect of grazing pressure and competition with other microalgae needs further investigation

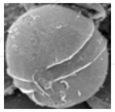


Stable Isotope Feeding of *A. ostenfeldii*



carbon skeleton is produced by polyketide synthases (PKS) out of acetate units

13-desmethyl Spirolide C is a polyketide derived compound



Genetic Analysis

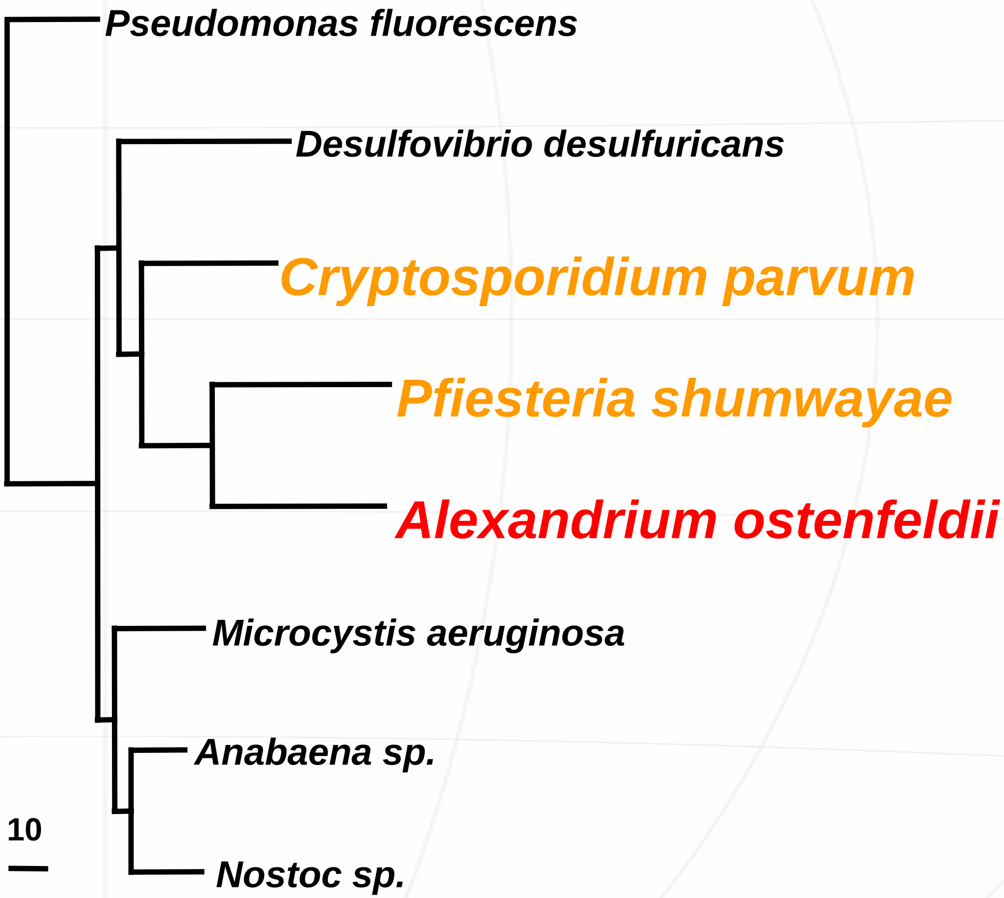
Generation of a normalized cDNA library of *A. ostenfeldii*.

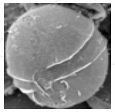
Secuencing of approx. 5000 clones.

Successful attribution of 15% of the clones to gene functions of almost all expected functional categories.

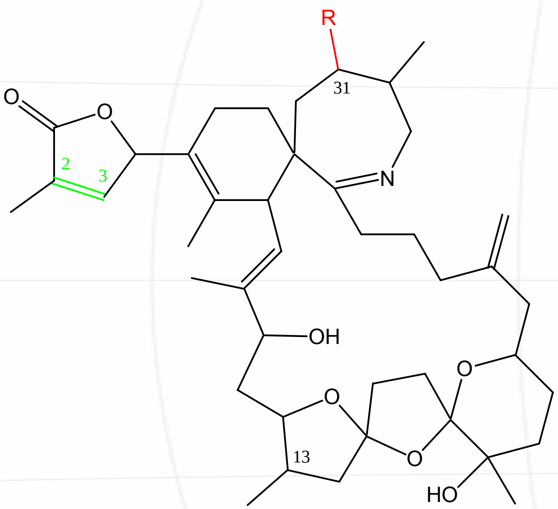
Identification of eight genes related to stress, defence and toxicity (putative PKS genes).

PKS EST Analysis

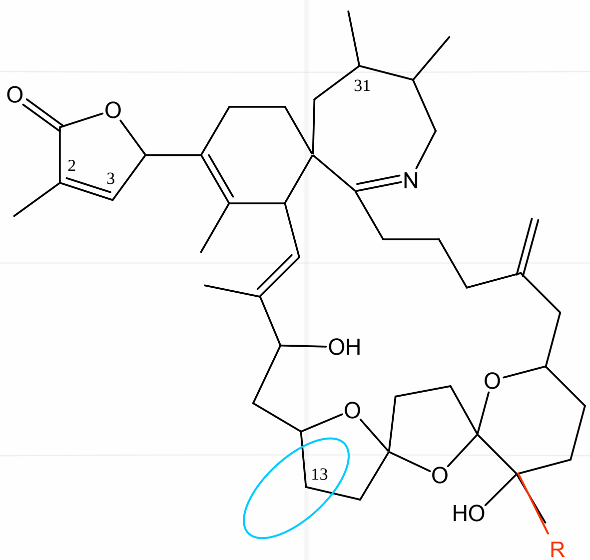




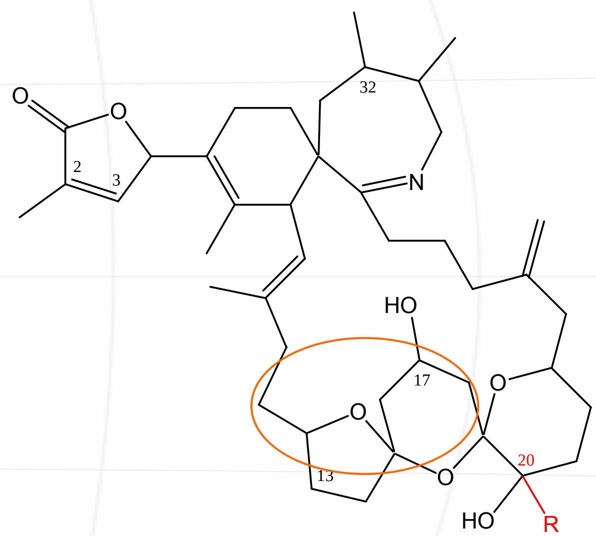
Spirolide Variability



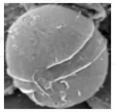
Spirolide A: R = H, $\Delta^{2,3}$
B: R = H
C: R = Me, $\Delta^{2,3}$
D: R = Me



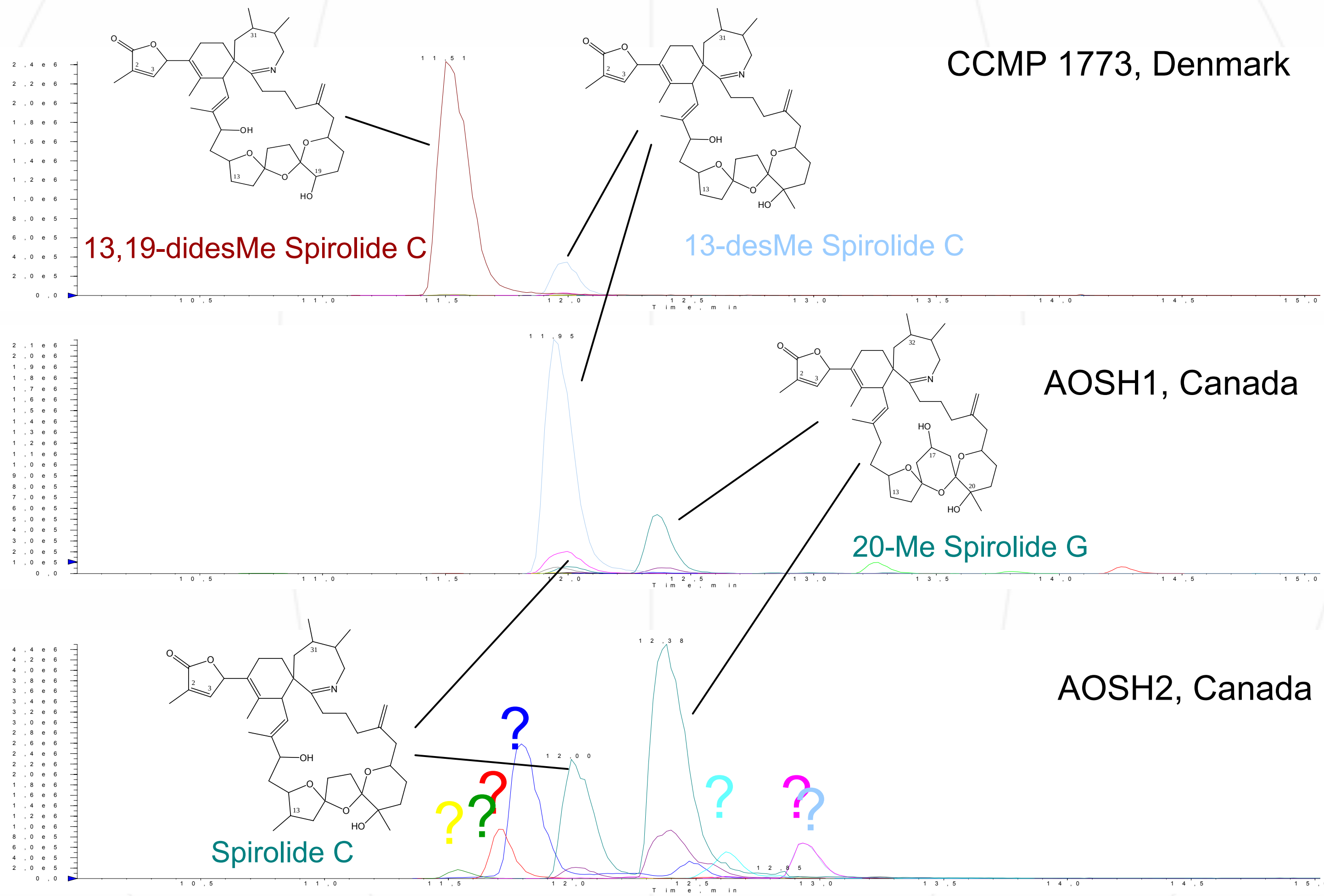
13-DesMe Spirolide C: R = Me
13,19-DidesMe Spirolide C: R = H

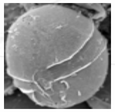


Spirolide G: R = H
20-Me Spirolide G: R = Me



Spirolide Variability





Lytic Effect of *A. ostenfeldii*

Oxyrrhis marina

Alexandrium ostenfeldii

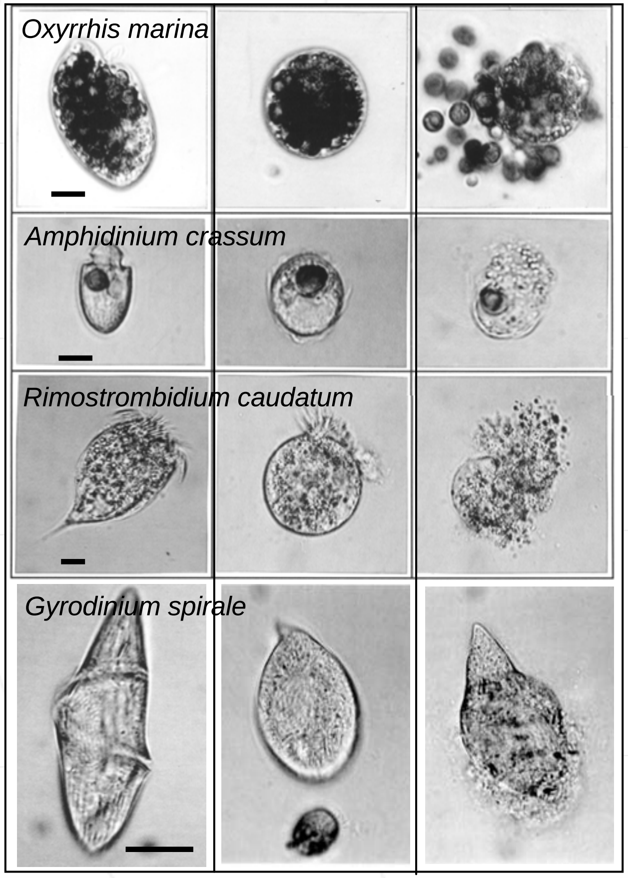
Lytic Effect of *Alexandrium* shown with *Oxyrrhis marina*.

Black arrows: *Alexandrium*
Red arrows: Remainders of *Oxyrrhis*

Photos: U. Tillmann

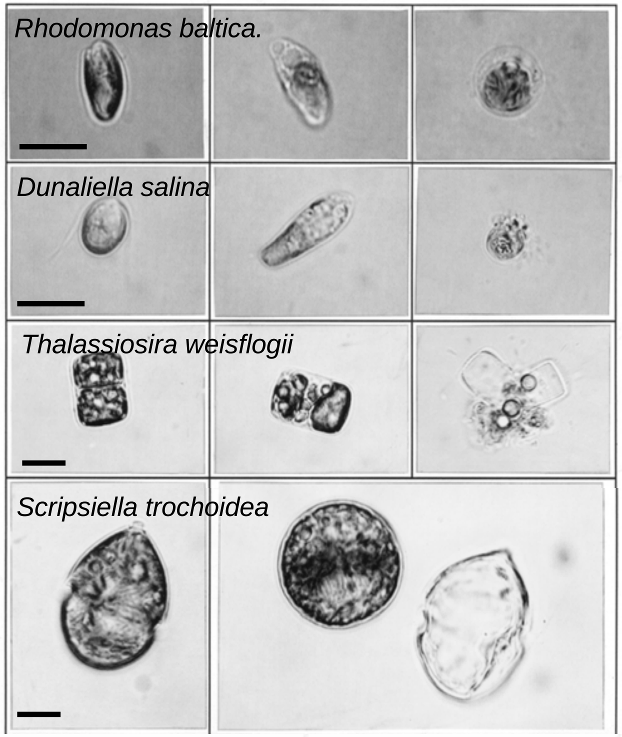
Lytic Effect of *A. ostenfeldii*

Heterotrophs

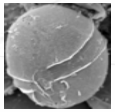


Scale bar = 10 µm

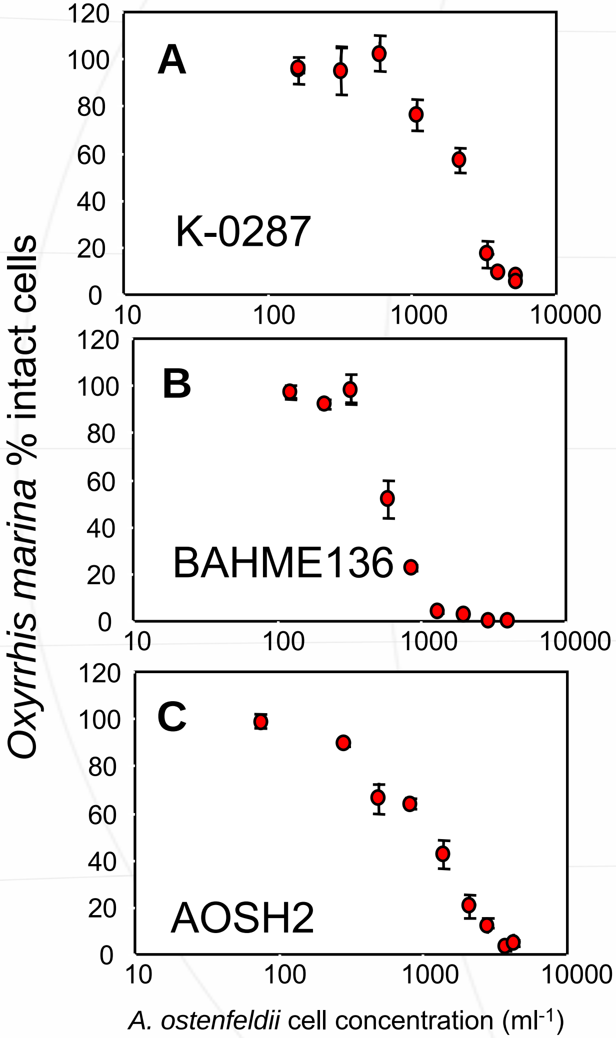
Autotrophs

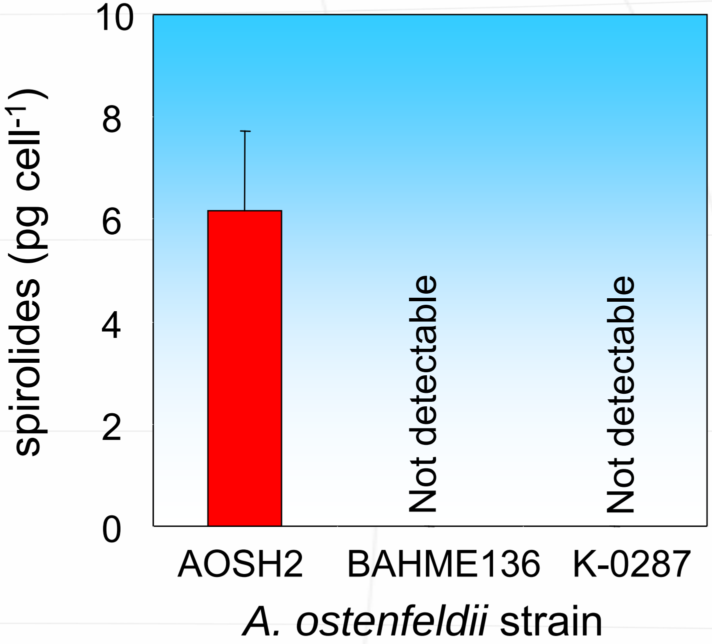


Microscopical observations of *Alexandrium* lytic effects on different target species

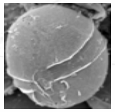


Lytic Effect of *A. ostenfeldii*



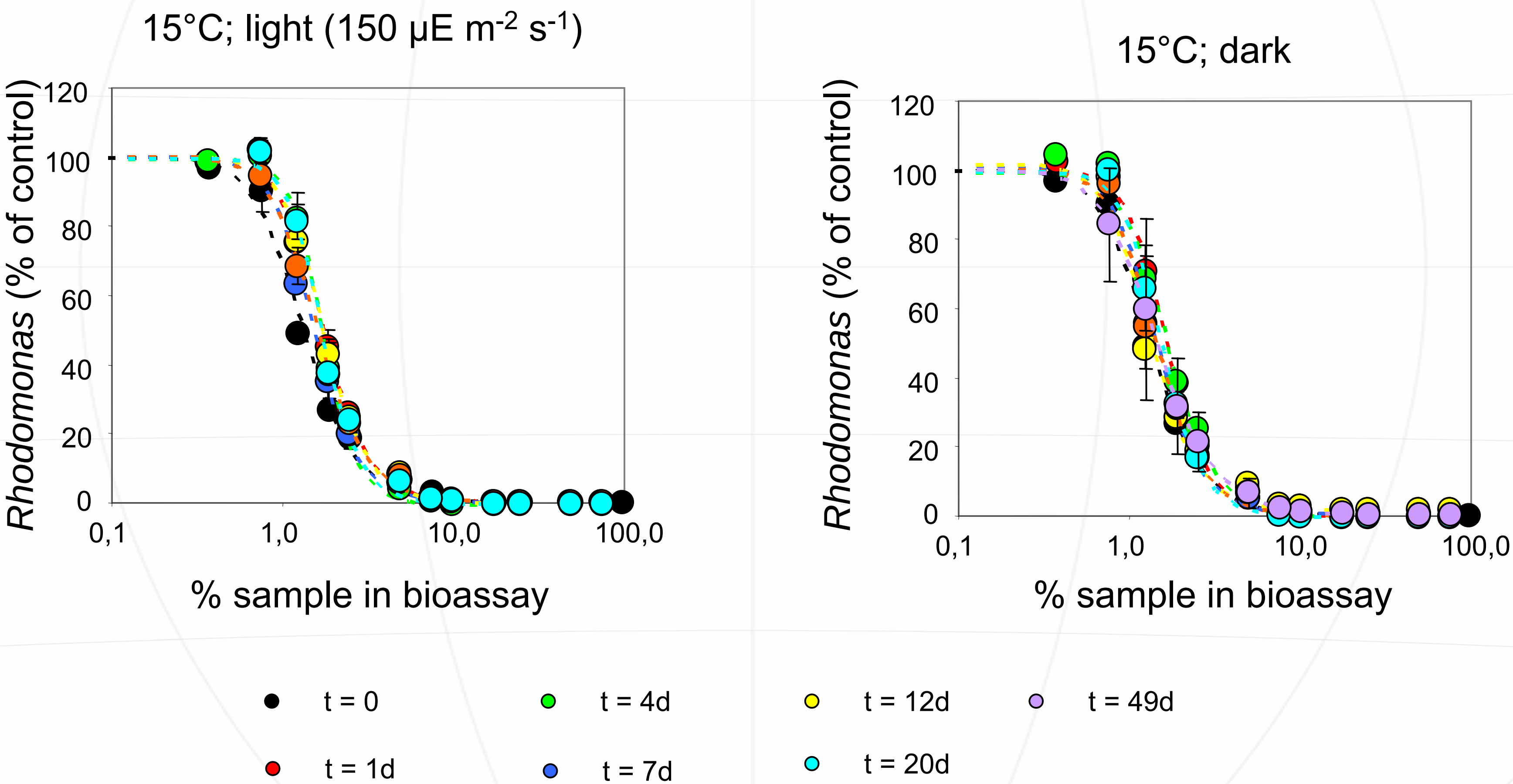


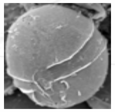
Allelochemical potency is not related to spirolide production



Lytic Activity of Extracellular Compounds – Stability

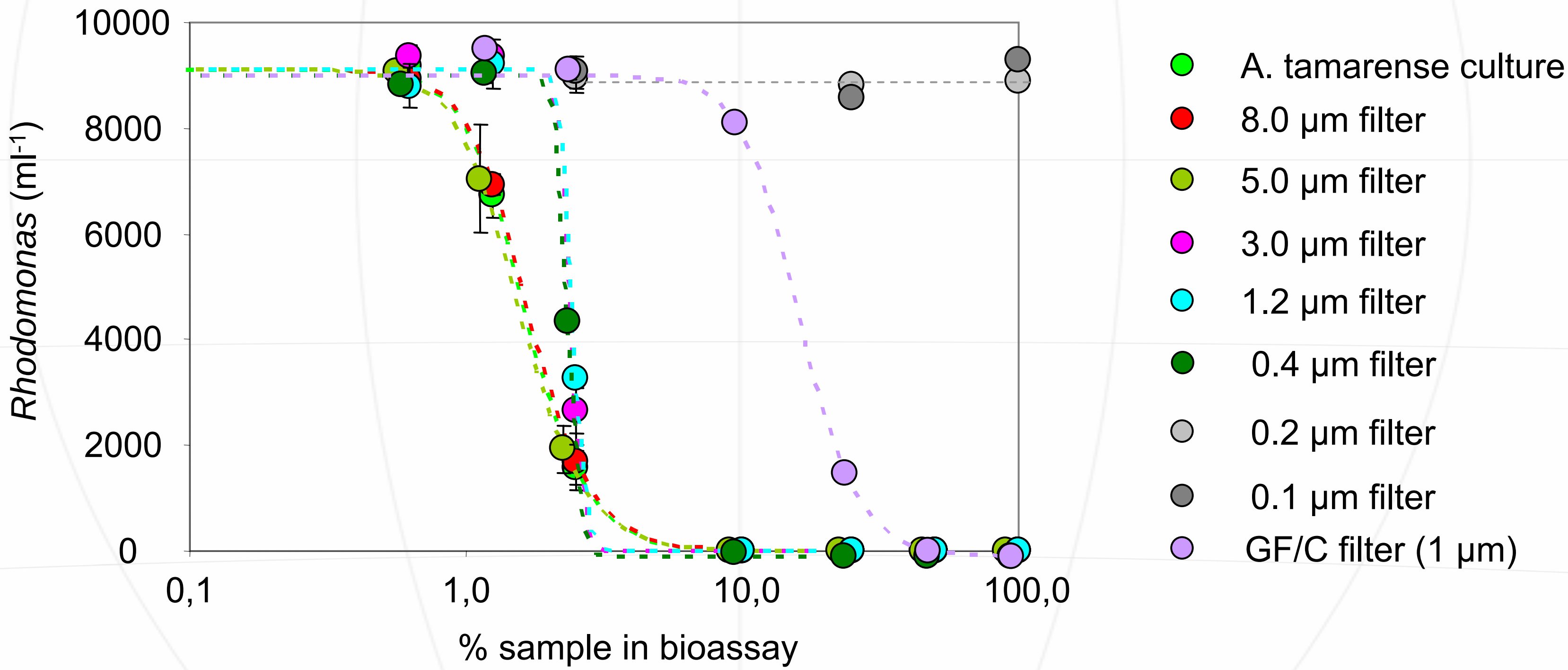
Alexandrium tamarense supernatant – Lytic Effect on *Rhodomonas*

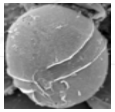




Lytic Activity – Filterability

Alexandrium tamarense supernatant – Lytic Effect on *Rhodomonas*

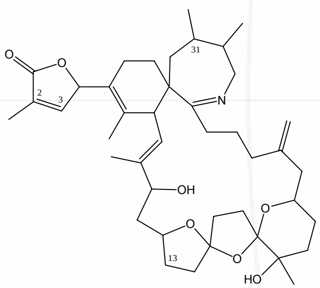




Summary – *A. ostenfeldii* Allelochemistry

Secondary Metabolite

Spirolides, marine toxins



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Ecological Function

?

Defense against Predators

Elimination of Competitors