Microalgae for the remedy of parasitic and bacterial infections in fish: a substitute to conventional chemical treatments

J. H. Kim, Inna Khozin-Goldberg and Dina Zilberg

The French Associates Institute for Dryland Agriculture and Biotechnology, The Jacob Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev, Midreshet Ben-Gurion, 8499000, Israel. Email: jihyunkim1129@gmail.com; dzilberg@bgu.ac.il

Abstract

The potential of *Phaeodactylum tricornutu* (a diatom) as a treatment against monogenean and bacterial infections of fish was studied. A monogenean parasite, *Gyrodactylus turnbulli*, and two bacterial pathogens affecting fish, *Streptococcus iniae* and *Vibrio harveyi* were used. The microalgae was cultured at different conditions and extracts were prepared using different solvents, aiming to optimize the conditions for effective therapeutic preparation.

Extracts were screened *in vitro* against *G. turnbulli* followed by *in vivo* immersion treatment against *G. turnbulli*-infected guppies. *In vitro* exposure to 5 ppt of ethanolic *P. tricornutum* extract killed 97% of the parasites within 4 hours. Fish were effectively treated by immersion in 2.5 ppt over 24 hours, showing significant reduction of both infection prevalence and intensity to almost complete clearance of the parasites.

Anti-bacterial effect against *S. iniae* and *V. harveyi* was analysed by the disc diffusion assay. Significant antibacterial effect was confirmed *in vitro*. Ethanolic extract from 2 weeks-cultured microalgae showed 28 and 14 mm of growth inhibition against *S. iniae* and *V. harveyi*, respectively.

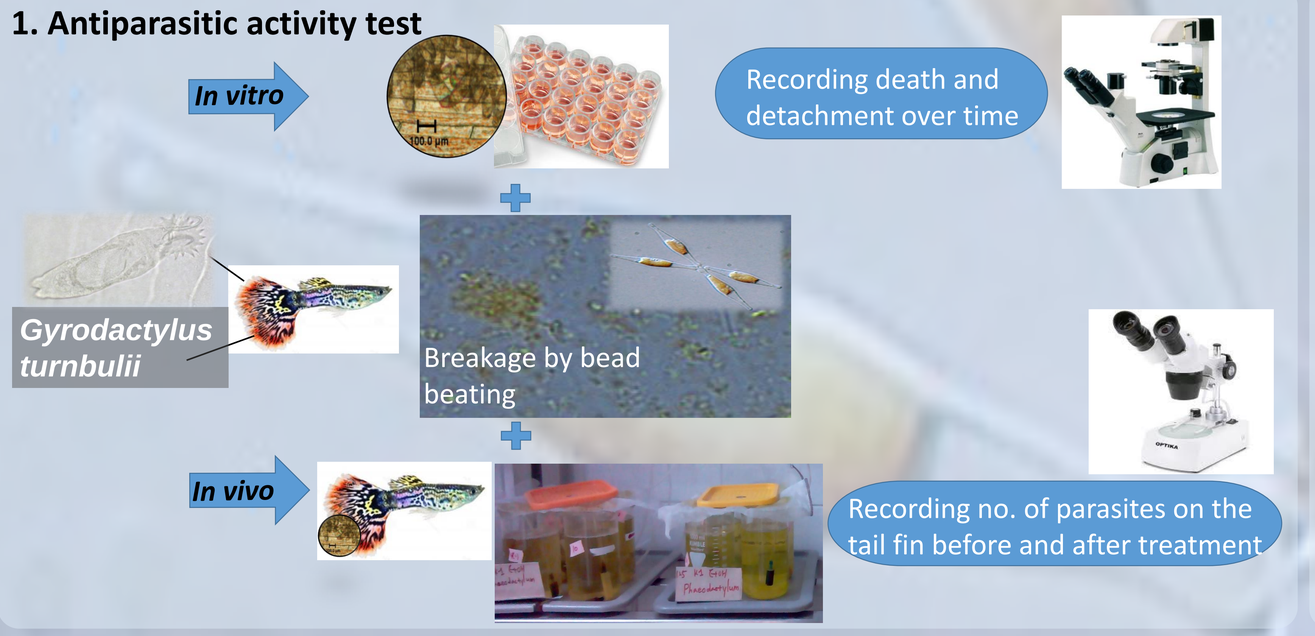
Introduction

Disease outbreaks cause substantial losses in aquaculture. Traditional chemical and antibiotic treatments pose adverse effects on human health and the environment and there is therefore **a growing trend and need to develop natural therapeutants for aquaculture**. *Phaeodactylum tricornutum* is a microalga (of the diatoms) with proven anti-bacterial effect.

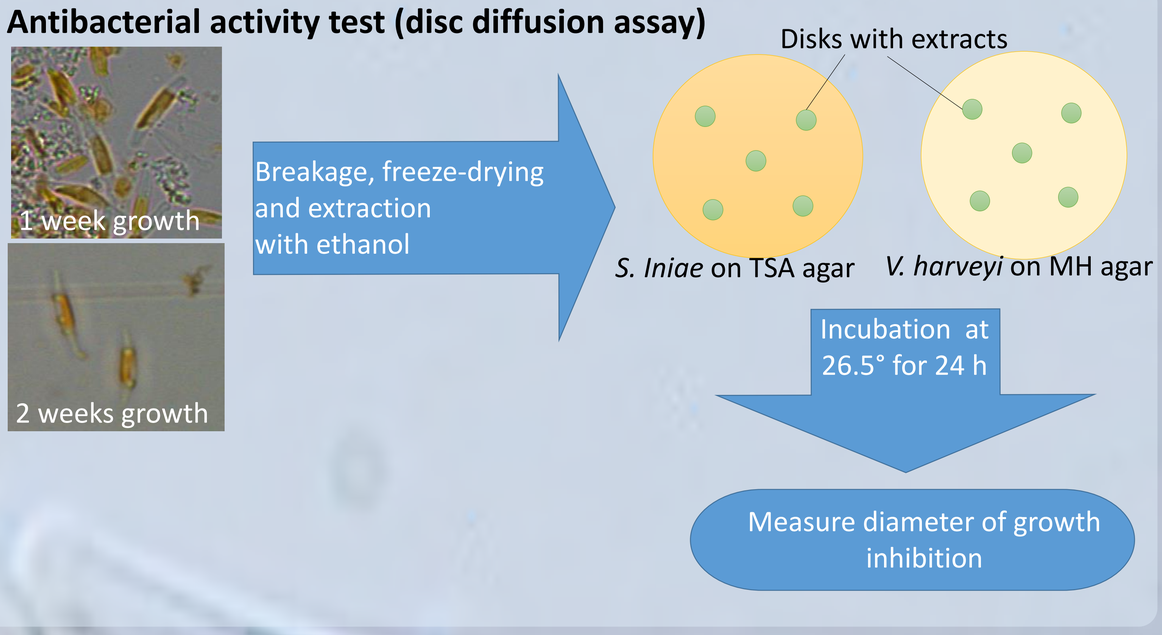
Our aim was to test the potential of *P. tricornutum* as a treatment against monogenean and bacterial infections of fish.

Materials & Methods

1. Antiparasitic activity test

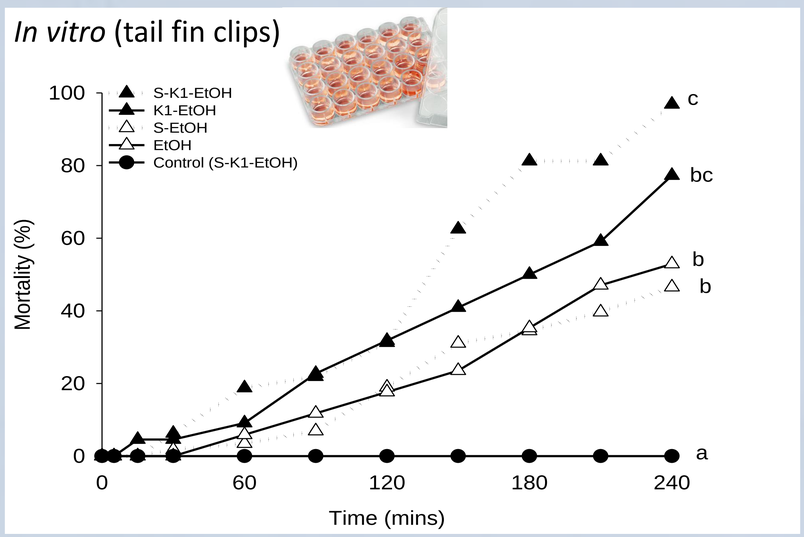


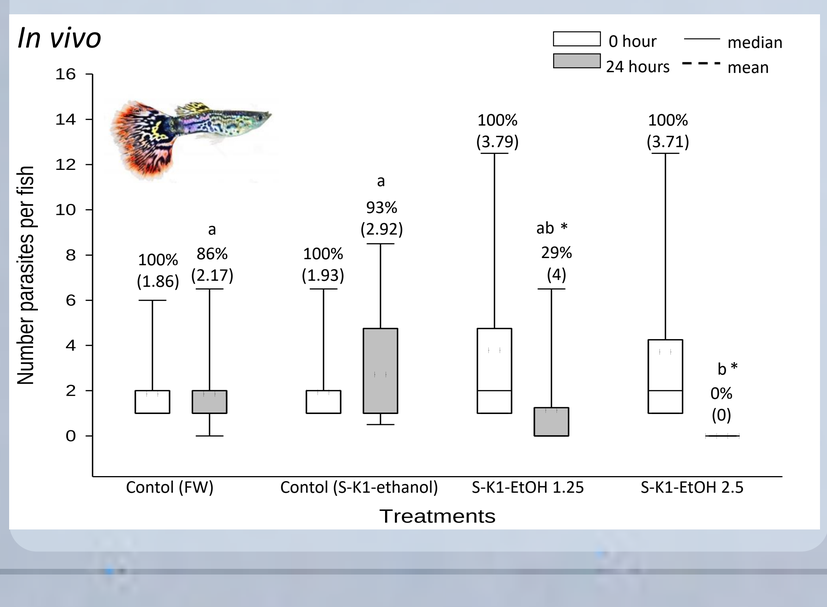
2. Antibacterial activity test (disc diffusion assay)



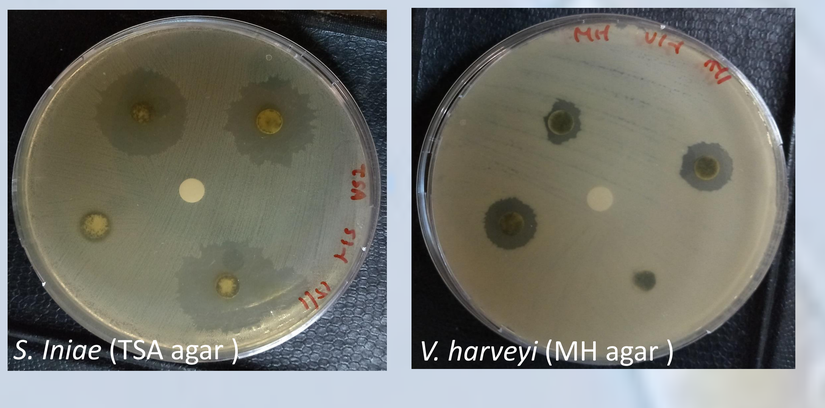
Results

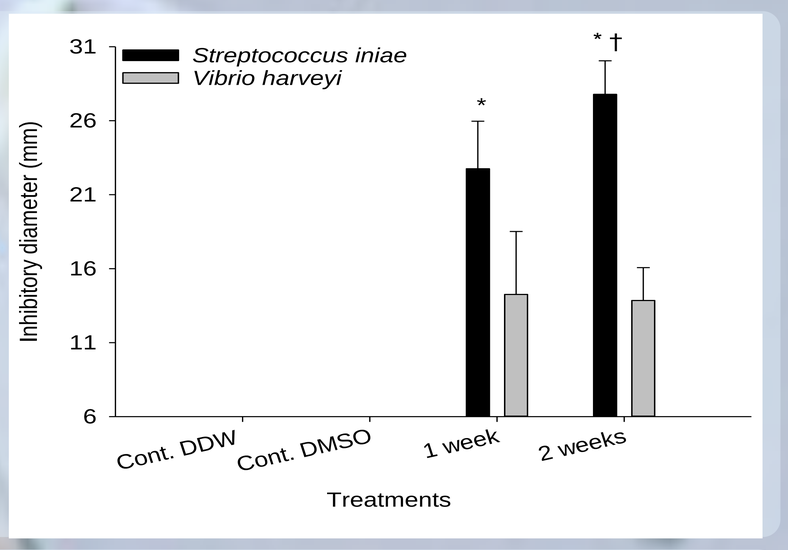
1. Antiparasitic effect of microalgal extracts





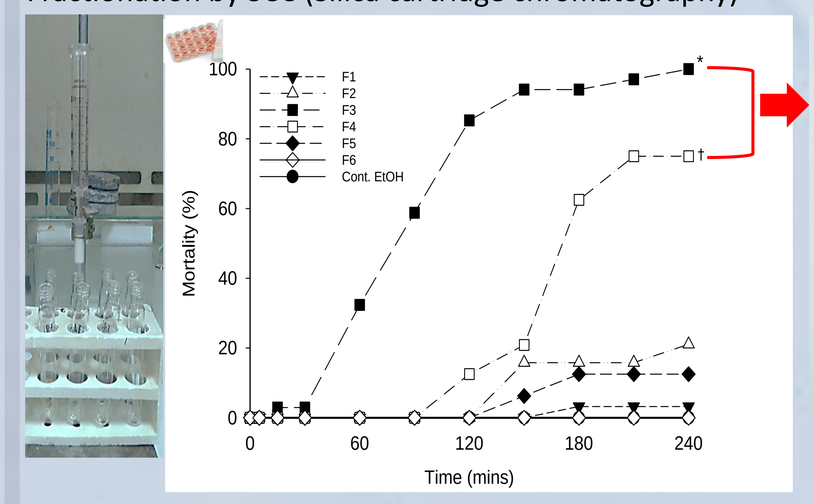
2. Antibacterial effect of microalgal extracts



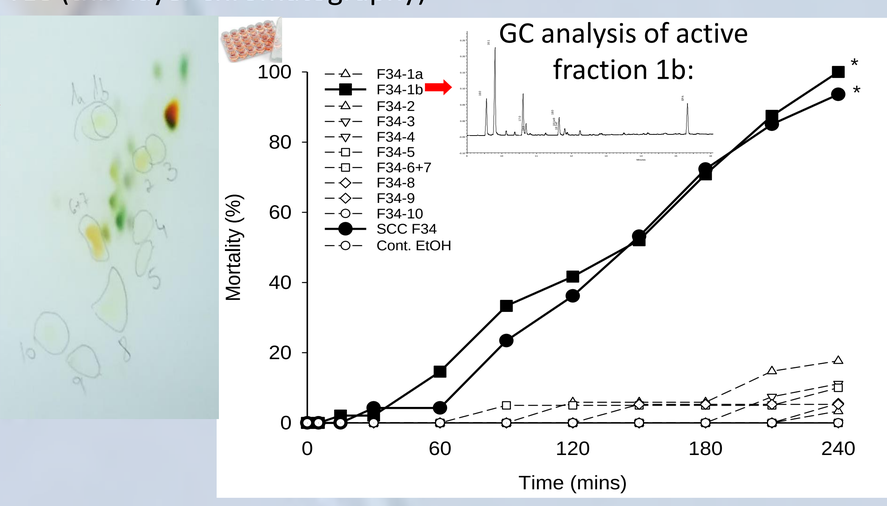


3. Attempting to identify the active compound in the algal extract:

Fractionation by SCC (Silica cartridge chromatography)



TLC (thin layer chromatography)



Conclusion

Phaeodactylum tricornutum-based preparations were confirmed to be affective against a parasite and bacteria affecting fish and can be potentially used to develop a natural therapeutant for aquaculture. Identification of the active ingredient in the extract is underway.

Further research will be directed to evaluate anti-bacterial treatments *in vivo*, using infected fish. The application of this preparation against other parasites of significance to aquaculture should be explored. Finally, a cost-effective production of the extract needs to be developed.