



Contribution ID : 17

Type : **Oral**

Why Algal Blooms Suppress Duckweed Growth: Mechanisms Behind Growth Inhibition

mercoledì 30 settembre 2026 10:00 (15)

In duckweed pond systems established either for biofiltration or biomass production, excessive proliferation of planktonic algae reduces ecosystem services. In this study we revealed those algal related mechanisms resulting duckweed growth inhibition. We isolated 26 algal species from duckweed covered mesocosms and measured their impact on axenic culture of *Lemna gibba*. At low duckweed coverage (<50%), 18 algal and cyanobacterial species significantly reduced the growth rate of duckweed. The strongest inhibitory effects were exerted by unicellular green algae. When the combined effects of dominant algal species were examined, all tested algae drastically inhibited duckweed growth. The elemental flux between the water, algal biomass and *Lemna* fronds was followed in time. Algal biomass increase was closely associated with the depletion of nutrients from the water column. In aquarium experiment, under low and moderate nitrogen concentrations together with the absence of algal shading, algae significantly inhibited the growth and chlorophyll content of *Lemna* by 60-80%. The algal inhibitory effect weakened with increasing nitrogen concentration and under conditions of stronger shading affecting the algae. Laboratory experiments demonstrated that duckweed growth was most strongly inhibited by algal-induced nitrogen deficiency, followed by elevated pH (10.2), phosphorus deficiency, and iron deficiency, resulting in growth inhibition of 72%, 52%, 51%, and 47%, respectively. By the final day of the experiment, both algal-induced nitrogen depletion and high pH completely reduced duckweed growth.

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Scientific Session

Microbiome & Interactions

Keywords

algae inhibition competition pH

References

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Session Classification : Microbiome & Interactions I