

The beauty and the yeast: can the microalgae *Dunaliella* form a borderline lichen with *Hortaea werneckii*?

Muggia L.

Zalar P.

Azua-Bustos A.

González-Silva C.

Grube M.

Gunde-Cimerman N.

Lichenized fungi usually develop complex, stratified morphologies through an intricately balanced living together with their algal partners, but several species are known to form only more or less loose associations with algae. These borderline lichens are still little explored although they could inform us about early stages of lichen evolution. We studied the association of the extremely halotolerant fungus *Hortaea werneckii* with the alga *Dunaliella atacamensis*, discovered in a cave in the Atacama Desert (Chile), and with *D. salina*, common inhabitant of saltern brines. *D. atacamensis* forms small colonies, in which cells of *H. werneckii* can be frequently observed, while such interaction has not been observed with *D. salina*. As symbiotic interactions between *Dunaliella* and *Hortaea* have not been reported, we performed a series of co-cultivation experiments to inspect whether these species could interact and develop more distinct lichen-like symbiotic structures. We set up co-cultures between axenic strains of *Hortaea werneckii* (isolated both from Mediterranean salterns and from the Atacama cave) and isolates of *D. atacamensis* (from the Atacama cave) and *D. salina* (isolated from Mediterranean salterns). Although we used different growth media and cultivation approaches, bright field and SEM microscopy analyses did not indicate any mutual effects in these experiments. We discuss the implications for fungal algal interactions along the transition from algal exploiters to lichen symbioses. © 2020, The Author(s).

Atacama Desert

Black yeast

Culture

Halotolerant

Mutualism

Salterns