Forever intimate : Investigating the evolutionary implications of seaweed-bacterial symbiosis in *Bryopsis*

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Seaweeds are important marine primary producers and ecosystems engineers, supporting diverse marine organisms, including bacteria. Ties between bacteria and algae actually date to the origin of eukaryotic algae themselves, millions of years ago! A chloroplast symbiosis event between a Cyanobacterium and a non-photosynthetic eukaryote kick-started what would become a world-changing collaboration. From this single interaction, a chain of events was set in motion, giving rise to the amazing algal and plant diversity that we enjoy today.

Interactions between seaweeds and bacteria, however, are not limited to the enslavement of a Cyanobacterium eons ago. Current day seaweeds also associate with bacteria resulting in diverse benefits and drawbacks for the partners involved. Nutrient exchange, protection from predators, disease causation and nitrogen fixation are just a few of the roles played by bacteria hosted by seaweeds. On the other hand, the macroalgae provide an organic-matter-rich home for the bacteria and photosynthetically generate oxygen required by the bacteria for respiration. Associations between bacteria and seaweeds can be permanent or temporary.

Our study is an exploration of the diversity and evolutionary history of the bacteria associated with one remarkable macroalga - *Bryopsis*. The alga is characterized by a tubular structure which is essentially one giant cell with a large centralized vacuole surrounded by a cytoplasmic region teeming with bacteria. *Bryopsis* has a very wide distribution, which might be due to its bacterial symbionts that enable it to adapt to a broad variety of ecological conditions.

The bacterial communities living within different *Bryopsis* species sampled from several locations along the European coast haven't been characterized. Our first goal is to relate the bacterial community composition genetic relatedness between hosts so as to understand the role of the symbioses in shaping their evolutionary histories. Subsequently, we shall investigate the nature and stability of the symbiosis between *Bryopsis* and its different bacterial symbionts through *in vitro* monitoring of the temporal changes that occur in the bacterial diversity throughout the life history of the algae. Novel high throughput amplicon sequencing techniques are being applied to identify and quantify the bacteria present in different *Bryopsis* strains at different stages in their complex life history.

Preliminary findings show significant variations in bacterial communities hosted in *Bryopsis* samples collected from different sites, implying the role of the environmental parameters in shaping bacterial - macroalgal symbioses. The findings of this work will not only enable further understanding of the diverse bacteria associated with *Bryopsis* but also provide insights into the bacterial transmission mechanisms and evolutionary implications of bacterial - algal symbioses.

Keywords: Symbiosis; Seaweeds; Algae; Bryopsis; Bacteria; Diversity; Evolution