Acetate Consumption Confers Resistance of *Chlamydomonas reinhardtii* to Abiotic Stress

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C. reinhardtii is a model alga commonly used in the study of photosynthesis. One quality which led to the establishment of *C. reinhardtii* as a model organism was its capacity to grow autotrophically, mixotrophically, or heterotrophically depending on the availability of light and acetate. In the natural environment, this capacity allows for interactions between *C. reinhardtii* and organisms within the soil community. In the laboratory, mixotrophic growth has attracted the interest of many as it allows for production of photosynthetic mutants, exhibits fast growth rates, accumulates high biomass, and has high stress resistance. The popularity of the mixotrophic model has led to many studies of stress acclimation in mixotrophically grown *C. reinhardtii*, but few studies have focused on the photosynthetic response to stress. This project aims to expand upon knowledge of the differences in the photosynthetic response of mixotrophically and autotrophically grown *C. reinhardtii* to abiotic stress. To test this, *C. reinhardtii* was grown in the presence and absence of acetate under control and stress (high salt, high light, and combined high salt/high light) conditions. Upon entry into logarithmic growth, samples were collected to evaluate differences in photochemistry, energy distribution, and expression of key photosynthetic proteins between the two growth methods during control and stress. In general, it was found that mixotrophically grown *C. reinhardtii* exhibited faster growth rates and achieved higher densities than autotrophically grown *C. reinhardtii.* Photosynthetic capacity and rates of cyclic electron flow were higher in mixotrophic cells during stress. In addition, both induction of non-photochemical quenching (NPQ) and shifts in expression of major photosynthetic proteins was reduced in mixotrophic cells during all stressors. These findings suggest that acetate consumption may protect the photosynthetic electron transport chain (PETC) during abiotic stress, allowing mixotrophic cells to continue robust growth in conditions which stunt autotrophic *C. reinhardtii* cultures. While further study of protein and metabolite production is necessary to support differences in downstream activity, we have concluded that growth method should be considered when using *C. reinhardtii* to study the photosynthetic stress response.