The effects of leaf litter on the filamentous alga Cladophora sp., with an emphasis on photosynthetic physioresponses

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Filamentous algae accumulate along the shorelines of lakes, rivers, and coasts on a vast scale, causing severe ecological risk and economic damage. It is important to identify a cost-effective and environmentally acceptable method to control filamentous algal growth. Previous studies have shown that deciduous leaf extracts inhibit the growth of filamentous algae. Therefore, the efficacy of three types of leaf litter extracts (ginkgo [*Ginkgo biloba* L.], metasequoia [*Metasequoia glyptostroboides* Hu & W.C. Cheng], and willow [*Salix babylonica* L.] leaf) were evaluated in this study for controlling the growth of filamentous algae (green algae, Cladophora Kutz sp.), with an emphasis on photosynthetic physioresponses. These experiments were conducted in a laboratory setting, and the responses of filamentous algae were measured in terms of photosynthesis parameters and growth (fresh weight). The fresh weight of Cladophora sp. was significantly inhibited by ginkgo and willow leaf extracts, whereas optimum quantum yield (F_v/F_m), maximal relative electron transfer rate ($rETR_{max}$), and initial slope (a) of Cladophora sp. were significantly (P , 0.05) lower after ginkgo and willow leaf extract treatments than those in the control. In contrast, metasequoia leaf extract exhibited no inhibition effect but slightly stimulated the growth of Cladophora sp., whereas there were no significant (P . 0.05) differences in the F_v/F_m, $rETR_{max}$, and a of Cladophora sp. between the metasequoia leaf extract treatment and the control. In addition, ginkgo and willow leaf extracts were found to be nontoxic to nontarget organisms within 96 h, such as eelweed [*Vallisneria natans* (Lour) H. Hara] and zebrafish (*Brachydanio rerio* Hamilton). These results suggest that ginkgo and willow leaf extracts may be useful in controlling the growth of Cladophora sp. and that photosynthesis inhibition may be the underlying mechanism.