



Trophic upgrading of autotrophic picoplankton by the heterotrophic nanoflagellate *Paraphysomonas* sp.

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ABSTRACT: We investigated whether trophic repackaging of autotrophic picoplankton by phagotrophic protists is associated with an improvement in food quality for the metazooplankton *Daphnia magna* (i.e., whether trophic upgrading occurs in this system). The nutritional value of the autotrophic species *Microcystis aeruginosa* PCC7806, *Synechococcus* sp. strain BO8809, *Synechococcus elongatus* SAG 89.79, and *Choricystis minor* KR1988/ 8, and of the heterotrophic nanoflagellate *Paraphysomonas* sp. grown on these different picoplanktonic species was evaluated in standardized growth experiments with *D. magna*. In order to investigate the functional role of the flagellate in the simplified autotrophic picoplankton-*Daphnia* food chain, *Paraphysomonas* sp. was grown on the different picoplanktonic organisms and subsequently separated from the food items before being fed to *D. magna*. The presence of *Paraphysomonas* sp. as an intermediary trophic step enhanced somatic growth and reproduction of *D. magna*. Supplementation of *Synechococcus* sp. with lipids from *Paraphysomonas* sp. (grown on *Synechococcus* sp.) revealed that trophic upgrading of autotrophic picoplankton is due to the additional lipids present in the flagellate. *Paraphysomonas* sp. synthesized polyunsaturated fatty acids and sterols de novo, which most likely explains the trophic upgrading. *Paraphysomonas* sp. also improved the food quality of *M. aeruginosa* PCC7806, which is toxic for *D. magna*. The heterotrophic flagellate *Paraphysomonas* sp. is capable of trophically upgrading a poor quality food source not only by producing essential lipids, but also by detoxifying the cyanobacterial food organism.

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