



Ingestion of microcystins by *Daphnia*: Intestinal uptake and toxic effects

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ABSTRACT: We investigated the intestinal uptake and adverse effects of microcystins ingested with *Microcystis* on *Daphnia galeata*. The gut structure, blood microcystin concentration, appearance, and movements of *Daphnia* fed *Microcystis* PCC 7806 or a microcystin-deficient PCC 7806 mutant were monitored over time. Microcystins were rapidly taken up from the digestive cavity into the blood. This process apparently required a preceding disruption of the gut epithelium by an as-yet-unknown *Microcystis* factor. Once microcystins entered the blood, they affected the neuromuscular communication or another life function that influences major muscle systems. Consequently, the beat rates of the thoracic legs, mandibles, and second antennae as well as the activity of the foregut decreased, whereas the midgut muscles were stimulated. Finally, the animals exhibited symptoms of exhaustion and died. The present results suggest that an ingestion of between 10.2 ng and 18.3 ng of microcystin per 1 mg of *Daphnia* body fresh weight is sufficient to kill *D. galeata* within 2 d.

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