

# Effects of 3-chlorobiphenyl on photosynthetic oxygen production, glutathione content and detoxication enzymes in the aquatic macrophyte *Ceratophyllum demersum*

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## Abstract

Organic contaminants of environmental concern such as polychlorinated biphenyls have dispersed widely throughout the ecosystems and accumulate in living organisms, and a variety of adverse biological effects have been reported. In this study, we investigated the effects of 3-chlorobiphenyl in the aquatic macrophyte *Ceratophyllum demersum* and the capacity of its detoxication system. After 24 h of exposure to various concentrations of 3-chlorobiphenyl, the total glutathione content (tGSH) was determined and the dose–response curves for glutathione reductase (GR) and microsomal/cytosolic glutathione *S*-transferases (m- and c-GSTs, respectively) were established. *C. demersum* showed a decrease of photosynthesis after exposure to 3-chlorobiphenyl, although only significantly at 5  $\mu\text{g l}^{-1}$ . At 0.005 and 0.05  $\mu\text{g l}^{-1}$  the GR, m-GST and c-GST activities were significantly increased and concomitantly a non-significant effect on total GSH was observed. At 0.5  $\mu\text{g l}^{-1}$ , GR as well as c-GST were still significantly induced, while at 5  $\mu\text{g l}^{-1}$  none of the enzymes were activated. These results show that detoxication through glutathione conjugation takes place at low concentrations of 3-chlorobiphenyl, while concentrations in the order of parts per billion cause the inactivation of the enzymatic systems evaluated, enough to place *C. demersum* in an important physiological stress condition.

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