The influence of nonylphenol on life-history of the earthworm *Dendrobaena octaedra* Savigny: linking effects from the individual- to the population-level

T. H. Widarto[a, b], M. Holmstrup[c] and V. E. Forbes[a]

[a] Department of Life Sciences and Chemistry, Roskilde University, Universitetsvej 1, PO Box 260, Roskilde DK-4000, Denmark
[b] Department of Biology, Bogor Agricultural University, Indonesia
[c] Department of Terrestrial Ecology, National Environmental Research Institute, Denmark

Received 5 November 2003;
Revised 8 March 2004;
accepted 18 March 2004.
Available online 27 April 2004.

Abstract

We conducted a study to look at the effects of nonylphenol (NP) on the life-history of the parthenogenetic earthworm, *Dendrobaena octaedra*. During a 196-day study, we observed that the growth rate of juveniles and the percentage of worms producing cocoons were the only traits significantly affected by NP, while the total number of cocoons produced was marginally affected. Despite some fairly large changes in the average values of individual life-history traits caused by NP, the effects were difficult to detect statistically due to large interindividual variability. A declining trend was observed for population growth rate (λ) with increasing NP concentration, but the decline was not statistically significant. The percent reduction in λ was less than the percent reduction in the most sensitive life-history trait (fecundity). An elasticity analysis showed that λ was more sensitive to changes in survival than to changes in reproductive traits. However, neither juvenile nor adult survival were affected by NP, and decomposition analysis showed that the minor changes in λ were mainly caused by effects of NP on time to first reproduction, time between reproduction events and fecundity. The present study suggests that extrapolation from laboratory studies to population effects in the field may be greatly enhanced by combining ecotoxicological and demographic methods.

Author Keywords: *Dendrobaena octaedra*; Nonylphenol; Population growth rate; Decomposition and elasticity analysis