CASE STUDY

TERMINAPHOS

Tier 3

BY TOXLEARN4EU
FUNDED BY ERASMUS+

Case study Terminaphos

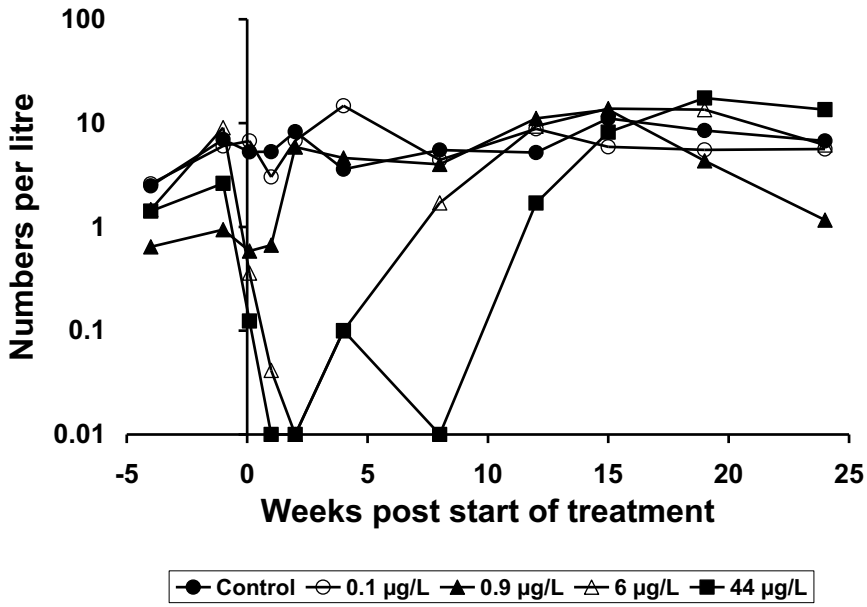
Tier 3: Field experiment Terminaphos

Terminaphos field experiments in large mesocosms

This data set was obtained from an experiment in outdoor experimental ditches. Twelve mesocosms were allocated at random to treatments; four served as controls and the remaining eight were treated once with the insecticide Terminaphos, with nominal dose levels of 0.1, 0.9, 6 and 44 µg/L in two mesocosms each. The example data set comprises that of the invertebrates, which is a combination of macro-invertebrate and zooplankton data sets. Sampling was done 11 times, from Week -4 through Week 24 post treatment. A total of 186 different taxa were identified, of which 127 belonged to the Arthropoda.

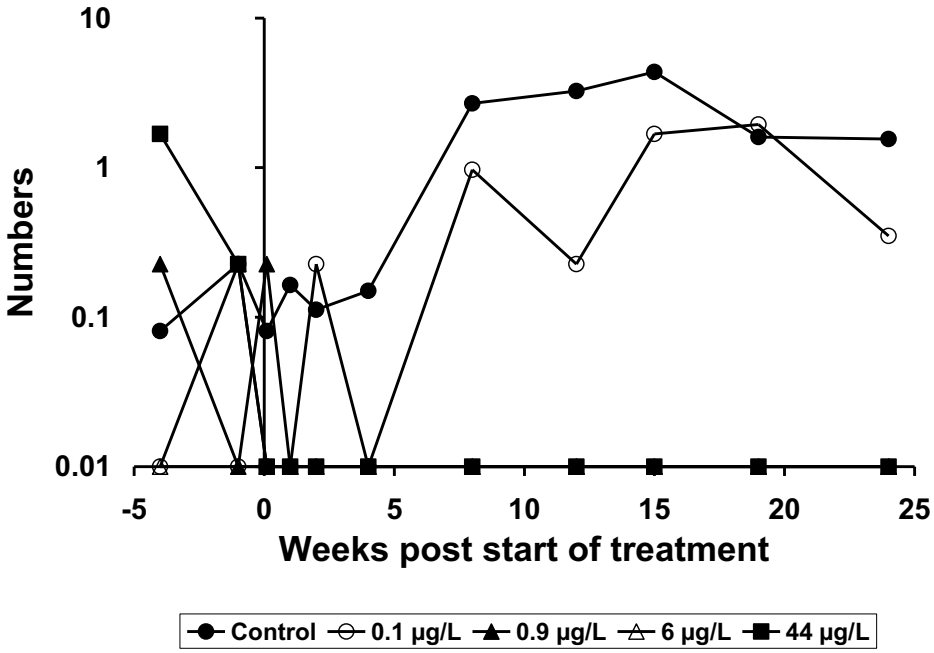
Dynamics of few taxa

Simocephalus vetulus

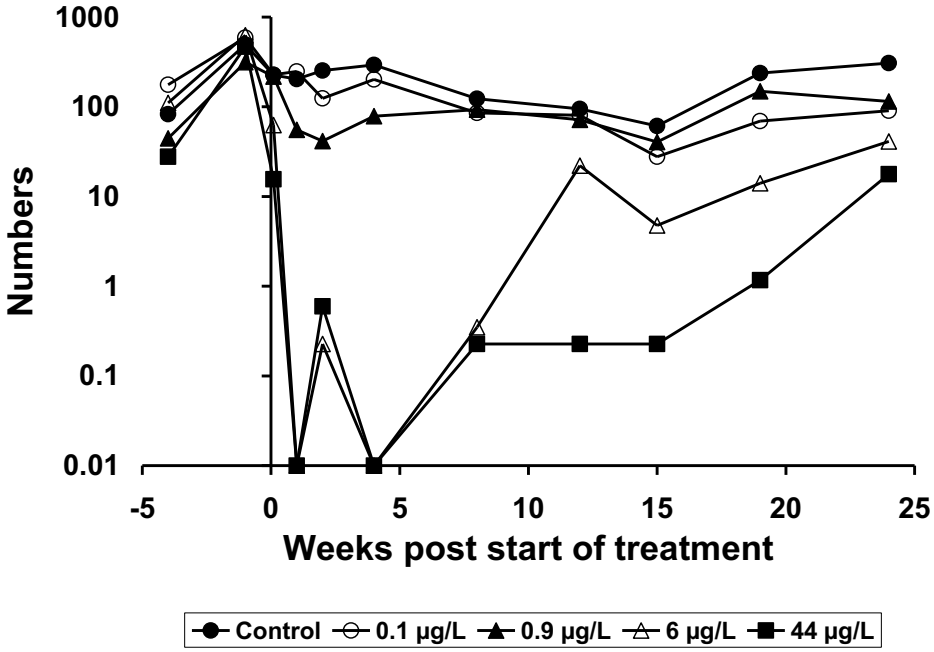


Gammarus pulex

Co-funded by the
Erasmus+ Programme
of the European Union

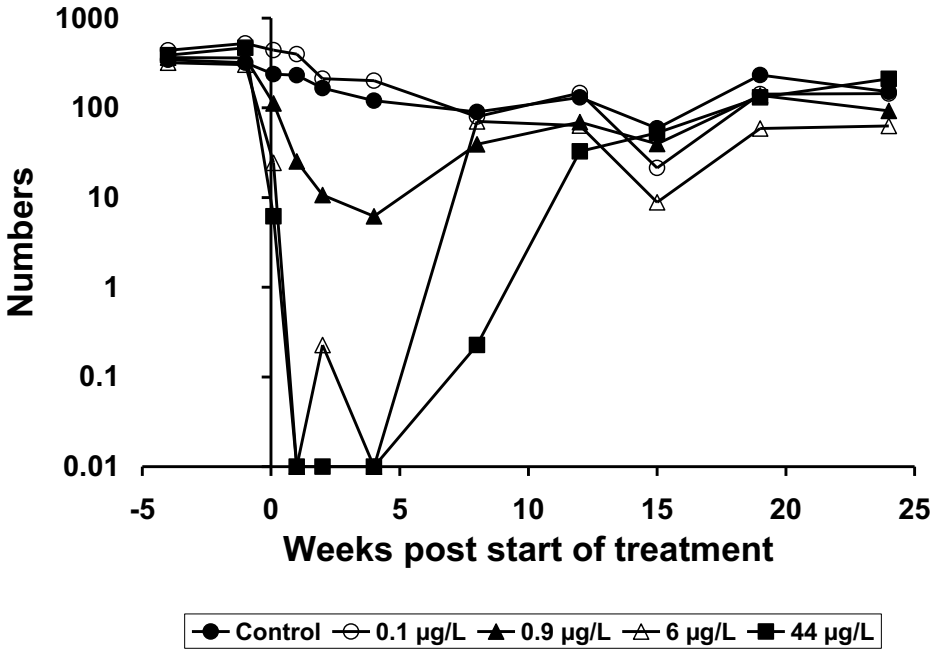


Caenis horaria



Cloeon dipterum

Co-funded by the
Erasmus+ Programme
of the European Union


1000
100
10
1
0.1
0.01
Numbers
-5
0
5
10
15
20
25
Weeks post start of treatment
Control
0.1 µg/L
0.9 µg/L
6 µg/L
44 µg/L

Literature review of threshold levels observed for Terminaphos in freshwater (semi-)field experiments

Selection criteria for (semi-)field experiments

The following criteria were applied in the selection of the studies (see Brock *et al*. 2000):

1. The test system represents a realistic freshwater community (organisms of various trophic levels are present).
2. The description of the experimental set-up is adequate and unambiguous.
3. The exposure concentrations that are relevant for the study can be derived (at least the nominal concentrations are known).
4. The investigated endpoints are sensitive to the substance and the effects can reasonably be expected to be related to the working mechanisms of insecticides. Especially Arthropoda and fish are considered as sensitive endpoints for insecticides.
5. The effects are statistically significant and show an unambiguous dose-effect relationship, or the observed effects are in agreement with a dose effect relationship from additional studies.

This review focussed on (semi-)field experiments that studied relatively low exposure concentrations. These studies are in particular relevant when comparing threshold levels from micro/mesocosms with HC5 values of Species Sensitivity Distribution Curves.

Evaluation criteria

Evaluation criteria as described by Brock *et al*. (2000) were used. The measured endpoints in the selected microcosm and mesocosm tests were classified into six groups. These groups comprise one functional category [Community metabolism] and seven structural categories [microcrustaceans; macrocrustaceans; insects; fish; other zooplankters; other macro-invertebrates; algae and macrophytes]. The functional category "Community metabolism" usually refers to dynamics of dissolved oxygen (DO), pH, inorganic carbon and nutrients in the water column or decomposition as studied by the litter bag technique. The structural categories refer to changes in species composition or population densities and biomass. In this review the most sensitive endpoint within each experiment was selected for each exposure concentration studied, resulting in a more or less worst case evaluation of the reviewed papers. The responses observed for the most sensitive endpoint at each exposure concentration were assigned to five effect classes, viz.:

1. No effects demonstrated: No consistent adverse effects are observed as a result of the treatment. Observed differences between treated test systems and controls do not show a clear causality.
2. Slight effects: Confined responses of sensitive endpoints (e.g., partial reduction in abundance of sensitive arthropods). Effects observed on individual samplings only and/or of a short duration directly after treatment.
3. Clear short-term effects, lasting < 8 weeks: Convincing reductions in sensitive endpoints. Recovery, however, takes place within eight weeks. Transient effects reported on both sensitive and less sensitive endpoints. Effects observed on a sequence of samplings.

Co-funded by the Erasmus+ Programme of the European Union

4. Clear effects, recovery not studied: Clear effects are demonstrated (e.g., sever reductions of sensitive taxa over a sequence of samplings), but the duration of the study is too short to demonstrate complete recovery within eight weeks after the last treatment.
5. Clear long-term effects, lasting > 8 weeks: Convincing reductions in sensitive endpoints and complete recovery of these endpoints later than 8 weeks after the last treatment. Negative effects reported over a sequence of samplings.

Table 1. Freshwater (semi-)field experiments used to evaluate the SSD's of Terminaphos.

Study no and	Test system	Water regime	Dose	Location	Reference(s)
2a	microcosms	stagnant	single	USA, Kansas	Gelly *et al*. 2011
2b	exp. ditches	stagnant	single	Netherlands	Pickle *et al*. 2006
2c	microcosms, lab	stagnant	single	Netherlands	Never *et al*. (in prep)
2d	field enclosures	stagnant	single	USA, Minnesota	Bush *et al*. 2010
2e	microcosms, lab	stagnant	single	USA, Oregon	Sly *et al*. 2011
2f	microcosms, lab	stagnant	single	Netherlands	Vicar et al. 2012 a, b; 2013
2g	exp. pond	stagnant	single	Canada	Old *et al*. 2010
2h	exp. streams	flow-through	6 h pulse	Australia	Aussi *et al*. 2009
2i	microcosms	stagnant	chronic	Netherlands	Stinky *et al*. 2006
2j	exp. streams	flow-through	chronic	Australia	Sward *et al*. 2013

Table 2. Classification of the most sensitive endpoints in (model) stream experiments that studies the ecological impact of a short-term (6 h pulse) exposure to Terminaphos. Exposure concentrations are expressed in μg/L (nominal). For a description of effect classes see Materials and Methods section.

Study no (Table 1)	**Class 1 (NOEC)**	**Class 2 LOEC**	**Class 3 LOEC**	**Class 4 LOEC**	**Class 5 LOEC**	**Type of test system**
2h	0.1 μg/L	-	5 μg/L[a]	-	-	Experimental streams

[a] insect drift and change in community structure macro-invertebrates

Table 3. Classification of the most sensitive endpoints in model stream experiments that studies the ecological impact of a chronic exposure regime to Terminaphos. Exposure concentrations are expressed in μg/L (nominal) For a description of effect classes see Materials and Methods section.

Study no (Table 1)	**Class 1 NOEC**	**Class 2 LOEC**	**Class 3 LOEC**	**Class 4 LOEC**	**Class 5 LOEC**	**Type of test system**
2j	-	-	0.1 μg/L[a]	-	5 μg/L[a]	Flow-through exp. streams

[a] Decrease arthropod populations

Table 4. Classification of the most sensitive endpoints in model ecosystem experiments that simulated a community of a stagnant freshwater ecosystem and that studied the ecological impact of a single application of Terminaphos. Exposure concentrations are expressed in μg/L (nominal). For a description of effect classes see Materials and Methods section.

Study no (Table 1)	**Class 1 NOEC**	**Class 2 LOEC**	**Class 3 LOEC**	**Class 4 LOEC**	**Class 5 LOEC**	**Type of test system**
2a	0.1 μg/L	0.3 μg/L[b]	1 μg/L[b]	-	3 μg/L[d]	outdoor microcosms
2b	0.1 μg/L	-	-	-	0.9 μg/L[b]	experimental ditches
2c	0.1 μg/L	-	1 μg/L[e]	10 μg/L[e]	-	lab microcosms

2d	-	-	0.5 µg/L [d]	6.3 µg/L [d]	-	field enclosures
2e	-	0.5 µg/L [a]	-	5 µg/L [a]	-	lab microcosms
2f	-	-	-	-	5 µg/L [b]	lab microcosms
2g	-	-	-	10 µg/L [e]	-	experimental ponds

[b] Decrease crustaceans and insects; [c] Decrase crustaceans and some mortality fish; [d] Decrease arthropoda and fish; [e] Decrease microcrustaceans and increase algae