

**Key factors limiting the distribution of sensitive aquatic insect species: effects of copper and diazinon on larvae of the caddisfly *Hydropsyche angustipennis***

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**Biodiversity of European rivers strongly reduced by:**

- habitat deterioration
- water pollution

**Especially insect biodiversity reduced:**

- insects can play a key role in indicating ecological recovery

**However:**

- lack of autecological and ecotoxicological data

**This limits the interpretation of data on the distribution of aquatic insects**

**This project aims**

to disentangle key factors limiting the distribution of aquatic insects

**general approach**

- analysis of natural and man-made stress factors

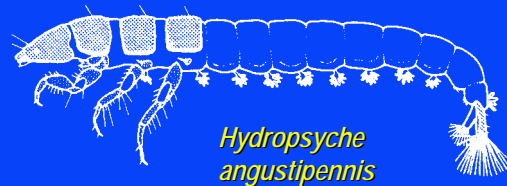
**tools**

- standardised ecotoxicological laboratory tests
- laboratory cultures of sensitive aquatic insects

**objective**

- to determine the sensitivity of selected species to selected stress factors

**test organism**



- representative for undisturbed river ecosystems
- not found in polluted rivers
- laboratory culture recently started

**model toxicants**

**copper**

- metal
- present in many industrial discharges
- relatively few ecotoxicological data

**diazinon**

- organophosphate insecticide
- high peak concentrations caused by frequent incidents
- adverse biological effects at low concentrations

**experiments**

- survival test
- behavioural test

**materials and methods**

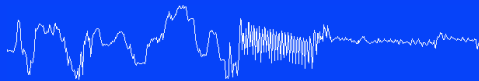
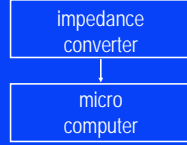
**survival test**

- glass jars, 100 mL Dutch Standard Water
- food: *Urtica* suspension
- aeration, 20° C, 16h light : 8h dark
- 20 first instar larvae
- exposure time: 48, 96, 168 hour
  
- determination of survival

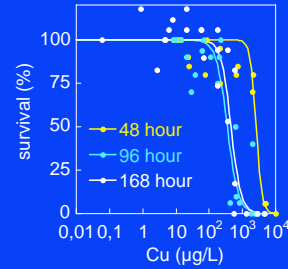
### behavioural test

- impedance converter
- 10 fifth instar larvae
- exposure time: 48 hour
- determination of time spent on different types of behaviour: rest, ventilation and 'other activity'

larvae between electrodes

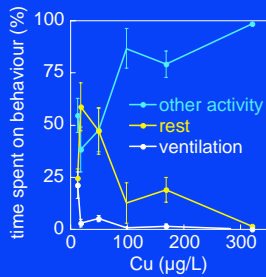


### Copper survival test



time	LC50 (µg/L)
48 h	2510 (2100-3003)
96 h	350 (257-478)
168 h	454 (354-582)

### Copper behavioural test

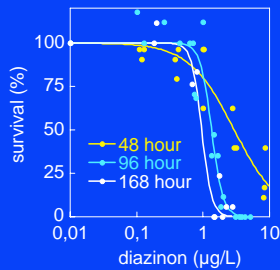


behaviour	EC50 (µg/L)
ventilation	17 (nd)
rest	160 (105-245)
other activity	204 (95-439)

### Copper

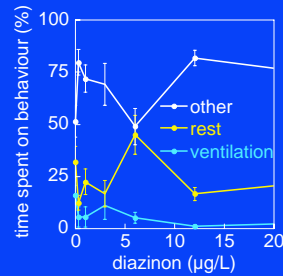
- copper toxicity to 1st instars increased strongly with increasing exposure time  
48 h → 168 hour : 2510 → 454 µg/L (6 times more toxic)
- chronic LOEC *Clistorinia magna* 13 µg/L (Nebeker *et al.*, 1984)  
life cycle changes may be expected at low conc.
- behavioural responses of 5th instars occur at much lower concentrations (17 µg/L) than 1st instar LC50s  
and are predicted by impedance converter technique

### diazinon survival test



time	LC50 (µg/L)
48 h	2.1 (1.5 - 3.1)
96 h	1.3 (1.2 - 1.5)
168 h	1.0 (0.8 - 1.1)

### diazinon behavioural test



no behavioural effects of diazinon on *H. angustipennis* larvae observed

## diazinon

- relatively small influence of exposure time on diazinon toxicity to 1st instar larvae
  - no behavioural effects on 5th instar larvae observed (max. 20 µg/L)
- However*
- chronic LOEC parathion *Limnephilus bipunctatus* 0.001 µg/L (Schultz & Liess, 1994)
- 48 → 168 hour  
2.1 → 1.0 µg/L  
(2 times more toxic)

life cycle effects are not predicted by impedance converter technique

chronic effects may occur at low concentrations

## ecological relevance

comparison field situation: river Meuse (Netherlands) 1992-1996

	Meuse (µg/L)		toxicity tests (µg/L)	
<b>copper</b>	max	60	acute effects	454
	average	5	life cycle effects	(17)
<b>diazinon</b>	max	1	acute effects	1
	average	<0.01	life cycle effects	(?)

	laboratory	field conc.
<b>diazinon</b>	acute effects at low conc.	'high' peaks
	<i>incidents limit the distribution of H. angustipennis</i>	
<b>copper</b>	no acute effects at low conc. high influence of exposure time	'low' peaks 'high' average
	<i>average load may limit the distribution of H. angustipennis</i>	

## future

- chronic experiments
- other stress factors (e.g. low oxygen concentrations)
- combinations different stress factors
- other aquatic insects (e.g. other caddisflies / mayflies)