

Effects of short chain aliphatic halocarbons on invertebrates of terrestrial and aquatic ecosystems

M. Roth

University of Ulm

Dept. of Ecology and Morphology of Animals

Albert-Einstein-Allee 11, D-89081 Ulm/Donau

Invertebrates are essential components of any ecosystem due to high species numbers and population densities. Changes of the invertebrate animal community, for example by the influence of anthropogenic air pollutants, can therefore result in severe, irreversible functional disturbances on different ecological levels. Short chain aliphatic halocarbons, which contribute substantially to the anthropogenic pollution of the northern hemisphere, showed severe effects on the invertebrate fauna of aquatic and terrestrial ecosystems at fairly high levels:

In aquatic systems most results on the ecotoxicity of chlorocarbons are from laboratory experiments on selected species. Favourite test-organisms among the invertebrates have been crustaceans, such as water fleas or barnacles (larvae). Acute toxicity levels ($LC_{50}/48$ h) on the first instar (nauplius) of barnacles are given in the literature as follows: 20 mg/l for trichloroethene and 7.5 mg/l for trichloroethane. Carbon tetrachloride showed the greatest toxicological effects on water fleas ($LC_{50}/24$ h: 18-22 mg/l). Also in field tests CCl_4 showed significant effects on the dominance structure of the invertebrate coenosis of fresh-water ecosystems. Especially water fleas and rotifers (primary consumers) reacted sensitively on the application of 0.8-1.6 mg CCl_4 /l.

In terrestrial ecosystems (e.g., forests) fairly high levels of short chain aliphatic halocarbons lead to irreversible alterations of the structure and function of the invertebrate animal community, especially of Nematoda, Annelida, Arachnida, Myriapoda and Insecta. As an example, chlorinated hydrocarbons affected the most abundant invertebrate group of forest ecosystems, the nematodes, and important litter decomposers, such as enchytraeids, the larvae of sciarids, cecidomyiids and tipulids. Thus, the application of tetrachloroethene (> 32 mg/m³ soil air), trichloroethene (> 31 mg/m³

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soil air) and chloroform ($> 44 \text{ mg/m}^3$ soil air) caused a significant decrease ($P \leq 0.05$) of the population density of nematodes, which live in a soil depth of 2 - 6 cm. A dramatical reduction of the individual numbers of Enchytraeidae and Diptera (larvae) of a spruce stand was found under the influence of chloroform (CHCl_3 ; 16 mg/m^3 soil air).

In addition secondary products, such as trichloroacetic acid, an atmospheric oxidation product of airborne C_2 -halocarbons, affected the invertebrates of the spruce stand. Compared to the control plot, on areas treated with 100 mg trichloroacetic acid / m^2 soil surface the abundance of nematodes was reduced to one third.