

Levels and trends of pesticides in air, precipitation and soil in Québec, Canada

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INTRODUCTION

Extensive use of persistent organic pollutants worldwide has led to the dispersal of these pollutants throughout the global environment ⁽¹⁻³⁾. Pesticides used in Québec account for up to 3400 tonnes of active agents applied on about 1.6 millions of hectares. A significant part of pesticide use is due to corn cultivation: 2.7 kg/ha of pesticides are applied on crop other than fodder, namely on corn crops. The total corn surface area covers currently ~500 000 hectares ⁽⁴⁾. The second main cultivation which uses large amount of pesticide is soya which made great strides in Québec those last years.

More than 400 tonnes of pesticides are applied on the Yamaska River watershed, so called the "garden of Québec". This involves important environmental issues within this region. Many researches on pesticides are achieved into this watershed by various research groups, namely upon air, water and other ecosystem systems.

It will be presented and discussed results from various research campaigns in Québec since the nineties to recent years. Recent samples were taken on several sites in Québec in the air, precipitations and soil in order to identify the possible presence of a broad range of pesticides used for cultivation.

It is expected that these results will allow determining the compounds mainly detected in Québec and the evolution of the pesticide use during the last decade.

MATERIALS AND METHODS

Details of the sampling methodology and the analytical procedures are given in Poissant et al. ⁽⁵⁾ and elsewhere ^(6,7). It is briefly described hereafter:

For air concentrations, Andersen PS-1 high volume samplers were installed on a platform, 1m above the ground. Particles were collected on a 10.2 cm diameter glass fibre filters whereas vapour phase was collected by polyurethane foam plug and XAD-2 resin.

Water samples coming from precipitation were collected by an automatic MIC (type B) precipitation collector. Water was passed through and XAD-2 resin Teflon columns.

The samples were spiked with a fortified solution containing internal isotopically labelled standard and extraction was then carried out in a soxhlet apparatus with dichloromethane during 24 hours. After volume reduction to 2 ml by evaporation, the samples were cleaned-up and fractionated if needed.

Analyses were performed by different GC-MS and GC-ECD apparatus equipped with HP-5MS or DB5 capillary columns using helium as carrier gas. The instrumental limit of detection varied between 1 µg/L to 80 µg/L depending on samples and pesticides measured.

RESULTS AND DISCUSSION

Some organochlorine pesticides and metabolites (α -HCH, γ -HCH, HCB, γ -Chlordane, DDT, DDE, Mirex) have been

EMG - General - Emerging Contaminants, Phenolic Compounds, Current Use Pesticides

measured in the 1990s. Results have shown that α -HCH, γ -HCH and HCB were generally measured in large amounts at all sites whereas γ -Chlordane, DDT, DDE concentrations were lower and Mirex was undetectable. Most of these compounds had seasonal cycles in air with usually higher concentrations levels during hot spring/summer period (figure 1) except for HCB indicating probable temperature dependence. Origin of these pesticides was investigated in order to determine if sources are from recent applications, transport or surface volatilization.

Recent measurements highlighted the presence of numerous pesticides in the environment in Québec more or less related to corn and Soya cultivations; which represent the two most popular cultures in this province. A part of these pesticides was still detected several months after applications denoting their persistence in the environment and possible harmful effect on the ecosystem. Moreover, some pesticides which have a long atmospheric lifetime may have a transport contribution from USA, prairies regions or from South America.

At last, preliminary Lindane measurements made in surface water wetlands at "Baie Saint-François" have shown that this pesticide could be found in higher concentrations inside the bay. A retention and/or concentration of pesticides by the way of water evaporation may occur in wetlands which may have large incidence on all the living species inside the bay.

Future work will focus on this point in order to determine by which processes the higher concentrations occurs inside the bay and the magnitude of accumulation.

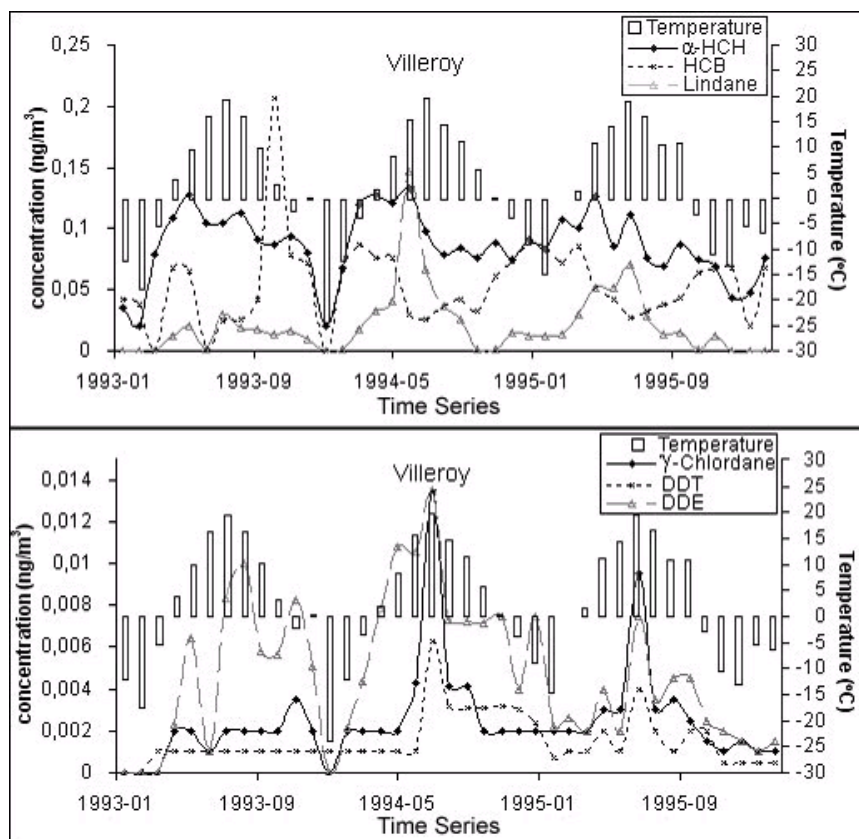


Figure1: Evolution of air pesticide concentrations at Villeroy in Québec during the 1993 to 1996 period.

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