



# Validation of cholinesterase inhibition as a biomarker of exposure for earthworms in apple orchards

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Magali Rault-Léonardon, Christophe Mazzia, Renaud Denoyelle, Odile Mascle, Yvan Capowiez. Validation of cholinesterase inhibition as a biomarker of exposure for earthworms in apple orchards. 8. International Symposium on Earthworm Ecology, Sep 2006, Cracovie, France. 1 p. hal-02823642

**HAL Id: hal-02823642**

**<https://hal.inrae.fr/hal-02823642>**

Submitted on 6 Jun 2020

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# THE 8<sup>th</sup> INTERNATIONAL SYMPOSIUM ON EARTHWORM ECOLOGY

The Symposium will be held in Poland in [Kraków](#), at the [Jagiellonian University](#) at the [Institute of Environmental Sciences](#).

From 4<sup>th</sup> to 9<sup>th</sup> of September 2006

**Title:** Validation of cholinesterase inhibition as a biomarker of exposure for earthworms in apple orchards

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## **Abstract:**

Earthworm communities were estimated using mustard in 17 apple orchards at the regional scale in Provence: 5 orchards were in conventional farming, 5 in IPM (Integrated Pest Management), 5 in organic farming and 3 abandoned (since at least 7 years) orchards as control. Conventional and IPM orchards use many organophosphate and carbamate pesticides. *Allolobophora chlorotica* and *Lumbricus terrestris* were very common in these orchards and were chosen for cholinesterase (ChE) characterisation. *L. terrestris* exhibits a two to three-fold higher specific ChE activity than *A. chlorotica*. Based on substrate and inhibitors specificities it is likely that in *L. terrestris*, ChE activity is a true acetylcholinesterase (AChE). Characterization of cholinesterase from *A. chlorotica* is uncertain and cannot be classified as true AChE as an important part of the cholinesterase activity seems to be related to butyrylcholinesterase. To follow ChE activity in natural conditions, ten earthworms of each species were collected in each earthworm in April for *L. terrestris* and in April, May, August and November for *A. chlorotica*. ChE inhibition was observed in *A. chlorotica* at each date in most of the orchards under IPM or conventional protection strategy and never in organic or abandoned orchards. Surprisingly, inhibition was still observed in November, i.e. 2 months after the last pesticide application. For *L. terrestris*, ChE inhibition was only observed in 2 orchards under conventional protection strategy. The difference between the two earthworm species could be due to (i) their different forms of ChE or (ii) to difference in exposure related to difference of behaviour. To gain insight into the duration of ChE inhibition, a laboratory experiment was set up using parathion as a model organophosphate pesticide. We observed that ChE inhibition could last more than two months under laboratory conditions for *A. chlorotica*. This is in agreement with our field observations.

(oral communication)