

**Characterization of insensitive  
acetylcholinesterase in *Helicoverpa  
armigera***

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## Introduction

The cotton bollworm, *Helicoverpa armigera* (Hübner Lepidoptera: Noctuidae) is a highly polyphagous pest of a wide variety of economically important crops, including cotton, tobacco, chickpea and ornamentals. These insects cause direct feeding damage during the caterpillar stage, which can also lead to secondary infections caused by rot. Coupled with their wide geographic distribution and their ability to adapt to diverse feeding habits, these insects have become a pest species of primary importance.

Extensive use of chemicals, such as organophosphates (OPs), carbamates and pyrethroids has been employed as a means to control these insects. Organophosphates and carbamates target the enzyme acetylcholinesterase (AChE EC 3.1.1.7), thus preventing the breakdown of the neurotransmitter acetylcholine (ACh), which results in the continuous firing of the synapse and leads to the eventual death of the organism.

Modifications to AChE that confer insensitivity to OPs and carbamates have been reported in many insect species, resulting in insecticide-resistance and subsequent difficulties in control, or even control failure.

## Experimental procedure

In the work presented here, AChE from individual

*H. armigera* populations collected in Asia and S. Africa were characterized using a range of inhibitors including pirimicarb, methomyl, azamethiphos, paraoxon, phoxim-oxon, clorpyrifos-oxon and dichlorvos. Insensitivities were measured using a fluorometric assay, measuring the hydrolysis of acetylthiocholine iodide by detection of a fluorescent product formed by the reaction of N-(4-(7-diethylamino-4-methylcoumarin-3-yl)phenyl)maleimide (CPM) with the liberated thiocholine, to give a reaction product with an intense blue fluorescence.

## Results and conclusion

When field populations were compared to a laboratory susceptible strain from Germany, all field populations and a laboratory strain (Oxford), previously reported to be susceptible, were found to contain insensitive AChE to all the inhibitors assayed. This would indicate that target-site resistance is prevalent in the field in such diverse regions as S. Africa, Pakistan, India and China. Characterization of the insensitivity profiles of field populations enables an informed choice of appropriate insecticides to be made.