# INFLUENCE OF ORGANIC AND METALLIC POLLUTION ON ANTIOXIDANT ENZYME LEVELS OF THE MEDITERRANEAN MUSSEL *MYTILUS GALLOPROVINCIALIS*

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**Abstract**

The aim of this study was to evaluate the usefulness of antioxidant enzyme levels as a biomarker of exposure to environmental pollutants in Mediterranean mussel, *Mytilus galloprovincialis*. The relation of antioxidant enzymes with contaminant body burden (PAHs, PCBs, DDTs and heavy metals) were determined. The examined biological responses included the activities glutatione reductase (GRx), selenium-dependent glutathione peroxidase (Se-GPx), non-selenium-dependent glutathione peroxidase (total-GPx), catalase (CAT), superoxide dismutase (SOD) and DT-diaphorase (DTD).

*Keywords: Mediterranean Sea, Mytilus galloprovincialis, antioxidant enzymes*

## Introduction

Bivalve molluscs, and in particular mussel, are widely used as sentinels for pollution monitoring in coastal environments. These filter-feeding sedentary species are known to accumulate high levels of contaminants in their tissues.

Several studies have been carried out to identify alterations which could represent useful diagnostic biomarkers of exposure to contaminants or toxicity induced by selected classes of toxicants. In this context, the accumulation of contaminants in mussels tissues could enhance the levels of reactive oxygen species. Specific antioxidant enzymes such as CAT, SOD or DTD function to prevent the formation of oxyradicals, thus protecting the organisms from oxidative stress. This work examines the effects of environmental levels of organic and metallic pollutants on antioxidant enzymes in *Mytilus galloprovincialis*, to support the use of this biochemical responses as biomarkers of exposure in monitoring pollution studies.

## Material and methods

Mussels, *Mytilus galloprovincialis* (3-4 cm) were sampled in May-June 2001 from fifteen sites of the Iberian Mediterranean Coast (Fig. 1). Animals were collected and their digestive glands dissected out for biochemical analysis and frozen in liquid nitrogen.


**Fig. 1. Map of study area and sampling sites.**

Enzyme measurements were carried out on cytosolic fractions prepared by differential centrifugation (1), on five pools constituted by the organs of eight individuals. CAT, SOD, GRx, Se-GPx and total-Se-GPx activities were measured essentially as described by Regoli and Principato (2); DTD activity was assayed as reported by Benson *et al.* (3).

The chemical data (PCBs, PAHs and heavy metals) used for correlation studies were determined in whole mussel tissues and belong to the chemical monitoring study made by IEO.

## Results and discussion

The results of the correlation analysis showed a significant positive correlation between the different enzymatic activities studied (Fig. 2). GRx activity correlated with antioxidant activities SOD, DTD and CAT, while Se-GPx activity showed an important correlation with total-GPx activity. These correlations indicate a similar induction pattern in the different mussel populations.

Comparisons between the chemical and biochemical data were made in order to establish the influence of PAHs, PCBs and metals concentrations on the enzymatic responses (Fig. 2). Zinc was positively correlated to CAT, SOD and GRx activities, while cadmium levels were correlated to SOD activity. However, no significant relationship was observed between Cu and the biochemical responses. By the contrary, several studies with transplanted and Cu-exposed mussels showed a decrease of antioxidant activities in digestive gland (2). This finding suggests that the induction of the antioxidant activities is an adaptation mechanisms in mussels chronically exposed to Zn and Cd.

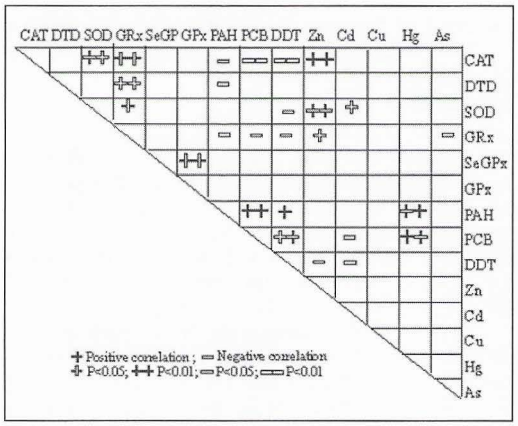


**Fig. 2. Correlation matrix of enzymatic activities, organic contaminants and metals.**

These activities were also markedly influenced by environmental levels of organic pollutants. GRx and CAT activities displayed a negative correlation with PAHs, PCBs and DDTs concentrations, while DTD and SOD activities showed a similar negative correlation with PAHs and DDTs, respectively. These results agree with the decrease on antioxidant enzymes detected in transplanted mussels to areas contaminated by PAHs, PCBs and DDT (4).

## Conclusion

This study shows an important relationship between antioxidant enzymes and exposure to organic contaminants and heavy metals. Whereas Cu and Zn exposure increased some of these enzymatic activities, the accumulation of organic contaminants depressed the antioxidant defences. This general decrease of the antioxidant parameters may reveal a toxic effect on these organisms. Thus, this results support the use of antioxidant enzymes as biomarkers of the biological effects of pollutants in marine environment.

## References

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