Environ Sci Pollut Res
DOI 10.1007/s11356-015-5024-3

RESEARCH ARTICLE

Antioxidant-enzyme reaction to the oxidative stress due to alpha-cypermethrin, chlorpyriphos, and pirimicarb in tomato (*Lycopersicon esculentum* Mill.)

Karim Chahid[1,2] · **Amin Laglaoui**[2] · **Said Zantar**[3] · **Abdeslam Ennabili**[1]

Received: 5 April 2015 / Accepted: 2 July 2015

Abstract Tomato (*Lycopersicon esculentum* Mill.) becomes one of the world's foremost vegetables, and its world production and consumption have increased fairly quickly. The capacity to induce oxidative stress in tomato plant, exposed to three xenobiotics such as alpha-cypermethrin, chlorpyriphos, and pirimicarb, was investigated by the evaluation of lipid peroxidation by measuring malondialdehyde (MDA) rate; also, we studied the response of tomato to this stress by assessing the response of superoxide dismutase (SOD), catalase (CAT), peroxidase (POD), ascorbate peroxidase (APX), glutathione-*s*-transferase (GST), and glutathione reductase (GR). The effect of the insecticides was observed using four concentrations (25, 50, 75, and 100 %) for germinating seeds and only the recommended concentration in agriculture (100 %) for growing plants. Our results show an important accumulation of MDA, demonstrating the increase of lipid peroxidation in consequence of the excessive reactive oxygen species (ROS) production due to insecticide treatment. In response to this oxidative stress in tomato seedlings and plants, the activities of antioxidant-enzyme system were generally enhanced. The electrophoretic analysis showed also the apparition of new isoenzymes as the case for CAT and POD.

Responsible editor: Philippe Garrigues

✉ Karim Chahid
karimchahid@yahoo.fr

[1] INPMA, Sidi Mohamed Ben Abdellah University, Fes, Morocco

[2] ERBGB, Science and Technology Faculty, Abdelmalek Essaâdi University, Tangier, Morocco

[3] INRA, Regional Center of Agricultural Research, Tangier, Morocco

Keywords Tomato · Insecticides · Oxidative stress · MDA · SOD · POD · CAT · APX · GST · GR

Abbreviations

APX	Ascorbate peroxidase
CAT	Catalase
GR	Glutathione reductase
GST	Glutathione-*s*-transferase
MDA	Malondialdehyde
POD	Peroxidase
SOD	Superoxide dismutase

Introduction

Application of pesticides is an important practice for control of plant growth in modern agriculture. However, the use of pesticides obtained by chemical synthesis represents the major cause of the contamination occurring in agriculture. Even if they are correctly applied, pesticides may present important risks because of their persistence, bioavailability, and mobility (Arias-Estévez et al. 2008).

Moreover, there is growing evidence indicating that pollutants such as pesticides and other organic toxic substances in the environment are able to induce the intracellular overproduction of reactive oxygen species (ROS), damaging then the plant cells (Peixoto et al. 2006; Song et al. 2006; Wang and Zhou 2006).

Plants have evolved various protective mechanisms to eliminate or reduce ROS caused by damages and stresses. The enzymatic antioxidant system is a protective mechanism, which operates with the sequential and simultaneous actions of enzymes including superoxide dismutase (SOD), peroxidase (POD), ascorbate peroxidase (APX), and catalase

Published online: 16 July 2015