

Chapter 14

Ecophysiological Responses of Plants Under Metal/Metalloid Toxicity



Roseline Xalxo, Vibhuti Chandrakar, Meetul Kumar, and S. Keshavkant

Contents

14.1	Introduction.....	394
14.2	Sources of Heavy Metal Pollution in the Environments.....	396
14.3	Heavy Metal/Metalloid Transporters.....	396
14.3.1	Heavy Metal ATPases (HMAs): CPx-Type ATPases.....	397
14.3.2	ATP-Binding Cassette Transporters (ABC Transporters).....	398
14.3.3	Natural Resistance-Associated Macrophage Proteins (Nramps).....	399
14.3.4	Cation Diffusion Facilitator (CDF) Family.....	399
14.3.5	The ZIP Family.....	400
14.4	Potential Threats of Heavy Metals/Metalloids.....	400
14.4.1	Morphological Amendments.....	400
14.4.2	Physiological Effects.....	401
14.4.3	Phytotoxicity of Heavy Metals/Metalloids at Cellular and Molecular Levels.....	408
14.5	Production of Reactive Oxygen Species and Antioxidant Defense Systems: Markers in Ecophysiological Studies.....	410
14.6	Signal Transduction Under Heavy Metal/Metalloid Toxicity.....	412
14.6.1	Calcium Calmodulin System.....	412
14.6.2	Plant Hormones.....	413
14.6.3	Role of Reactive Oxygen Species.....	414
14.6.4	Mitogen-Activated Protein Kinase Cascade.....	415
14.7	Assisting Plant to Survive: Future Directives and Perspectives.....	415
14.8	Conclusions.....	417
	References.....	417

R. Xalxo · V. Chandrakar

School of Studies in Biotechnology, Pt. Ravishankar Shukla University, Raipur, India

M. Kumar

Directorate of International Cooperation, Defence Research and Development Organization, New Delhi, India

S. Keshavkant (✉)

School of Studies in Biotechnology, Pt. Ravishankar Shukla University, Raipur, India

National Center for Natural Resources, Pt. Ravishankar Shukla University, Raipur, India