Chapter 2
Plant Responses to Arsenic Toxicity: Morphology and Physiology

Vibhuti Chandrakar, Neha Pandey, and Sahu Keshavkant

Abstract Arsenic (As) is a naturally occurring toxic metalloid, ubiquitously present in the environment. It enters the environment from both geogenic and anthropogenic sources. Arsenic accumulates to different edible tissues and thereby enters into food chain. Arsenate and arsenite are two main phyto-available forms of As and are popularly reported to cause toxicity symptoms. Roots are foremost sites of As exposure, which slows down/inhibits extension and proliferation of it. From the roots, As gets translocated to the shoot and inhibits plant growth by slowing/arresting cell division/expansion, biomass accumulation, and plant reproductive capacity. Arsenite is more toxic than that of arsenate, since it has relatively high affinity for sulfhydryl groups of proteins and enzymes thereby alters or inhibits their activities. It interferes with the respiration process by binding to thiol groups of some important respiratory enzymes. Morphological and physiological effects of As include reduced germination and growth, root cell plasmolysis, denodulation and discoloration, leaf wilting, necrosis of leaf tips and margins, reduction in number of leaves and leaf area, distortion of chloroplasts membranes, inhibition in the photosynthetic activity, suppression of starch hydrolyzing enzymes, etc. It is well reported that arsenate replaces phosphate of ATP molecule and hence disrupts cellular energy flow. Arsenic disturbs the uptake of water and nutrients through competition for transporters. Cellular membranes are prime targets of As-induced oxidative stress, as it causes disorganization of membrane structures thereby lipid peroxidation and electrolyte leakage. Membrane damage leads to imbalance in the nutrient uptake and disruption in the stomatal conductance and transpiration process. So, plants have evolved defensive mechanisms in order to protect cells from As-induced oxidative stress through enzymatic and nonenzymatic antioxidants. Binding of As to thiol groups of antioxidant enzymes leads to suppression of defensive system of the plants. Hence, it is necessary to alleviate As from the contaminated areas where

V. Chandrakar · N. Pandey
School of Studies in Biotechnology, Pt. Ravishankar Shukla University, Raipur, 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

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