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RESEARCH ARTICLE

Arsenite tolerance in rice (*Oryza sativa* L.) involves coordinated role of metabolic pathways of thiols and amino acids

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Abstract Thiolic ligands and several amino acids (AAs) are known to build up in plants against heavy metal stress. In the present study, alteration of various AAs in rice and its synchronized role with thiolic ligand was explored for arsenic (As) tolerance and detoxification. To understand the mechanism of As tolerance and stress response, rice seedlings of one tolerant (Triguna) and one sensitive (IET-4786) cultivar were exposed to arsenite (0–25 μM) for 7 days for various biochemical analyses using spectrophotometer, HPLC and ICPMS. Tolerant and sensitive cultivars respond differentially in terms of thiol metabolism, essential amino acids (EEAs) and nonessential amino acids (NEEAs) vis-á-vis As accumulation. Thiol biosynthesis-related enzymes were positively correlated to As accumulation in Triguna. Conversely, these enzymes, cysteine content and GSH/GSSG ratio declined significantly in IET-4786 upon As exposure. The level of identified phytochelatin (PC) species (PC_2, PC_3 and PC_4) and phytochelatin synthase activity were also more pronounced in Triguna than IET-4786. Nearly all EAAs were negatively affected by As-induced oxidative stress (except phenylalanine in Triguna), but more significantly in IET-4786 than Triguna. However, most of the stress-responsive NEAAs like glutamic acid, histidine, alanine, glycine, tyrosine, cysteine and proline were enhanced more prominently in Triguna than IET-4786 upon As exposure. The study suggests that IET-4786 appears sensitive to As due to reduction of AAs and thiol metabolic pathway. However, a coordinated response of thiolic ligands and stress-responsive AAs seems to play role for As tolerance in Triguna to achieve the effective complexation of As by PCs.

Keywords Arsenite · Amino acids · *Oryza sativa* · Phytochelatins · Thiol metabolism

Abbreviations

Ala	Alanine
Arg	Arginine
As	Arsenic
As^{III}	Arsenite
Asp	Aspartic acid

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