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SILICON DIFFERENTIALLY MODULATES PHENOLIC METABOLISM AND ANTIOXIDANT CAPACITY OF BARLEY CULTIVARS SUBJECTED TO PHOSPHORUS DEFICIENCY †

Paula Cartes [1,2], Isis Vega [1] and Sofia Pontigo [1,2,*]

[1] Center of Plant, Soil Interaction and Natural Resources Biotechnology, Scientific and Technological Bioresource Nucleus (BIOREN-UFRO);
[2] Departamento de Ciencias Químicas y Recursos Naturales, Facultad de Ingeniería y Ciencias Universidad de La Frontera, Temuco, Chile
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Abstract: Current evidence shows that silicon (Si) can alleviate multiple plant stresses by inducing the antioxidant defense and phenolic metabolism of plants. Nevertheless, the mechanisms underlying these responses remains unclear. We investigated the Si effect on the phenolic metabolism of two barley cultivars differing in their tolerance to phosphorus (P) deficiency (cv. Sebastian, P-deficiency tolerant and cv. Traveler, P-deficiency sensitive). Plants were hydroponically grown with P (0, 0.01 or 0.1 mM P; applied as Na_2HPO_4) in combination with Si (0, 1 or 2 mM Si; applied as Na_2SiO_3). At harvest, total phenols, antioxidant capacity, individual phenolics and the gene expression of enzymes involved in the synthesis of soluble phenolic compounds including phenylalanine ammonia lyase (*HvPAL*) and chalcone synthase (*HvCHS*) were analyzed in shoots. In cv. Sebastian grown without P, Si reduced both total phenols and antioxidant capacity to levels comparable to plants supplied with an optimal P dose. In contrast, increasing Si doses triggered an enhancement of total phenols and antioxidant ability in cv. Traveler cultivated in absence of P. Seven flavonoids were identified, being the most relevant the derivatives of apigenin and lutonarin. Although we did not observe clear effect of Si on the content of individual phenolics in cv. Sebastian exposed to P stress, an increment in the concentration of apigenin-pentoxide-hexoside was detected in cv. Traveler as a consequence of Si application to P-deficient plants. Differential expression of genes associated with the synthesis of phenolics was also induced by Si under P-stress. The transcript level of *HvPAL* diminished in cv. Sebastian and augmented in cv. Traveler due to Si supply under P limitation. Likewise, Si decreased *HvCHS* expression in cv. Sebastian grown without P, whereas an up-regulation of *HvCHS* was observed when Si was applied to cv. Traveler grown with low P. Acknowledgments. FONDECYT Regular Project N°1201257.

Keywords: Silicon; P stress; antioxidant phenols; phenylalanine ammonia lyase gene; chalcone synthase gene; barley