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The tea plant CsLHT1 and CsLHT6 transporters take up amino acids, as a nitrogen source, from the soil of organic tea plantations

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Title

The tea plant CsLHT1 and CsLHT6 transporters take up amino acids, as a nitrogen source, from the soil of organic tea plantations

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Abstract

Organic tea is more popular than conventional tea that originates from fertilized plants. Amino acids inorganic soils constitute a substantial pool nitrogen (N) available for plants. However, the amino-acid contents in soils of tea plantations and how tea plants take up these amino acids remain largely unknown. In this study, we show that the amino-acid content in the soil of an organic tea plantation is significantly higher than that of a conventional tea plantation. Glutamate, alanine, valine, and leucine were the most abundant amino acids in the soil of this tea plantation. When ¹⁵N-glutamate was fed to tea plants, it was efficiently absorbed and significantly increased the contents of other amino acids in the roots. We cloned seven CsLHT genes encoding amino-acid transporters and found that the expression of CsLHT1, CsLHT2, and CsLHT6 in the roots significantly increased upon glutamate feeding. Moreover, the expression of CsLHT1 or CsLHT6 in a yeast amino-acid uptake-defective mutant, 22Δ10_a, enabled growth on media with amino acids constituting the sole N source. Amino-acid uptake assays indicated that CsLHT1 and CsLHT6 are H⁺-dependent high- and low-affinity amino-acid transporters, respectively. We further demonstrated that CsLHT1 and CsLHT6 are highly expressed in the roots and are localized to the plasma membrane. Moreover, overexpression of CsLHT1 and CsLHT6 in Arabidopsis significantly improved the uptake of exogenously supplied ¹⁵Nglutamate and ¹⁵N-glutamine. Taken together, our findings are consistent with the involvement of CsLHT1 and CsLHT6 in amino-acid uptake from the soil, which is particularly important for tea plants grown inorganic tea plantations.

