1. Record Nr. UNINA9910220041303321

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Titolo	Ethylene's Role in Plant Mineral Nutrition
Pubbl/distr/stampa	Frontiers Media SA, 2016
Descrizione fisica	1 online resource (151 p.)
Collana	Frontiers Research Topics
Soggetti	Botany & plant sciences
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia

Sommario/riassunto

Terrestrial plants are sessile organisms that, differently from animals, can not move in searching of the nutrients and water they need. Instead, they have to change continuously their physiology and morphology to adapt to the environmental changes. When plants suffer from a nutrient deficiency, they develop physiological and morphological responses (mainly in their roots) aimed to facilitate the acquisition and mobilization of such a nutrient. Physiological responses include some ones like acidification of the rizhosphere and release of chelating agents into the medium; and morphological responses include others, like changes in root architecture and development of root hairs. The regulation of these responses is not totally known but in the last years different plant hormones and signaling substances, such as auxin, ethylene, cytokinins and nitric oxide, have been involved in their control. Besides hormones, oxidative stress has also been related with most of the nutrient deficiencies. The relationship of ethylene with the regulation of responses to nutrient deficiencies came from the nineties, when some works presented data suggesting its involvement in the regulation of responses to Fe and P deficiency. In the last years, the role of ethylene has been extended to many other nutrient deficiencies, such as K deficiency, Mg deficiency, S deficiency, N deficiency, and others. In most of the cases, it has been found that ethylene production, as well as the expression of ethylene synthesis genes, increases under these nutrient deficiencies. Furthermore, it has

also been found that ethylene controls the expression of genes related to responses to different deficiencies. The involvement of ethylene in so many deficiencies suggests that it should act in conjunction with other signals that would confer nutrient-specificity to the distinct nutrient responses. These other signals could be plant hormones (auxin, cytokinins, etc) as well as other substances (nitric oxide, microRNAs, peptides, glutathione, etc), either originated in the roots or coming from the shoots through the phloem. The role of ethylene in the mineral nutrition of plants is even more complex that the one related to its role in the responses to nutrient deficiencies. Ethylene has also been implicated in the N2 fixation of legume plants; in salt tolerance responses; and in responses to heavy metals, such as Cd toxicity. All these processes are related to ion uptake and, consequently, are related to plant mineral nutrition. We consider a good opportunity to review all this information in a coordinated way. This Research Topic will provide an overview about the role of the plant hormone ethylene on the regulation of physiological and morphological responses to different nutrient deficiencies. In addition, it will cover other aspects of ethylene related to plant nutrition such as its role on salinity, N2 fixation and tolerance to heavy metals.