Dynamics of Salt Stress in Plants: Effects and Plant Responses

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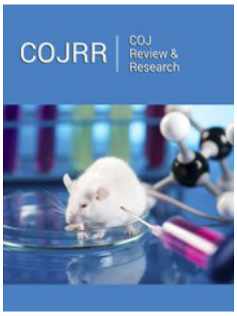

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Abstract

Plants are continuously exposed to various stresses that can prevent them from reaching their full genetic potential. This makes them a key point of study for plant scientists seeking to understand how these stresses influence their metabolism and responses, and how these stresses can put their productivity and food safety at risk. Studies that aim to provide improvements in salinity tolerance for crops using a variety of measures still have a vast amount of open knowledge. Furthermore, new agronomic alternatives have shown efficacy in promoting and sensitizing plant defense mechanisms when exposed to different environmental stresses. However, in order to study these new measures, it is necessary to understand how these high concentrations can affect the plant directly or indirectly, influencing germination, growth, and production. Once the plants present different responses to the salt level, they may present sensitivity or resistance to this factor in the environment. This is because they may present adaptation mechanisms to this condition and maintain survival and productive potential, or even achieve better results. Thus, there is much to be studied to understand the dynamics of salt stress in plants and the metabolic, physiological and morphological responses triggered by salt stress.

Keywords: Abiotic stress; NaCl; Crops

Mini Review

Soil salinity influences directly or indirectly the functioning of the internal mechanisms of plants and processes such as germination to production. These influences and their damages are due to the interactions between soil physicochemical properties and morphological/physiological characteristics of plants [1,2]. The effect of salinity in soil will enable the induction of primary stresses, culminating in the occurrence of oxidative stress [3]. In prolonged stress situations, tissue dehydration may occur, and with this, the plants will suffer osmotic and ionic stress compromising photosynthesis and accelerating leaf senescence [4-7]. When stressed, a reduction in available resources can occur, repressing cell division and expansion, affecting the light collecting complex, stomatal density reduction of internal CO2 concentration; and thus, directly compromising the photosynthetic activity [8-10]. When plants are specifically exposed to salt stress conditions depending on the severity, duration of stress and resistance/adaptation they respond using different mechanisms [11]. Glycophytic plants are mostly represented by agricultural crops, with low salinity tolerance, in which germination, growth, development and production are inhibited (NaCl > 25mM). Halophytes, on the other hand, are plants adapted to salinized environments (optimal growth around NaCl > 200mM), representing about 1% of the entire flora and are able to complete their life cycle by expanding their growth and production. The halophyte plants present physiological and morphological characteristics that differentiate them from the glycophytes [12]. In morphology, it is observed that structures such as salt glands and trichomes allow the salt absorption in specific regions and mechanisms of ionic exclusion and reduction in the number of leaves [13,14]. In physiology, the strategic responses for the plants to survive under salinization conditions include signal transduction pathways involved in processes ranging from salt stress detection to the expression of responsive genes that enable the regulation of various processes [15,16]. At the molecular level, salt tolerance in halophytic plants is due to the regulation of genes that respond to stress from the action of direct or indirect regulation mechanisms by the phytohormones abscisic acid and ethylene [17,18].

References

1. Akbarimoghaddam H, Galavi M, Ghanbari A, Panjehkeh N (2011) Salinity effects on seed germination and seedling growth of bread wheat cultivars. Trakia J Sci 9(1): 43-50.
2. Rogers ME, Craig AD, Munns RE, Colmer TD, Nichols PGH, et al. (2005) The potential for developing fodder plants for the salt-affected areas of southern and eastern Australia: an overview. Austral J Exp Agric 45(4): 301-329.
3. Zhu JK (2002) Salt and drought stress signal transduction in plants. Annu Rev Plant Biol 53: 247-273.
4. Chaves MM, Flexas J, Pinheiro C (2009) Photosynthesis under drought and salt stress: regulation mechanisms from whole plant to cell. Ann Robô 103(4): 551-560.
5. Khan A, Khan AL, Muneer S, Kim Y, AL-Rawahi A, et al. (2019) Silicon and salinity: crosstalk in crop-mediated stress tolerance mechanisms. Frente Plant Sci 10: 1429.
6. Ma Ying, Dias MC, Freitas H (2020) Drought and salinity stress responses and microbe induced tolerance in plants. Frontiers in Plant Science 11: 1750.
7. Sharma A, Shahzad B, Rehman A, Bhardwaj R, Landi M, et al. (2019) Response of phenylpropanoid pathway and the role of polyphenols in plants under abiotic stress. Molecules 24(13): 2452.
8. Demetriou G, Neonaki C, Navakoudis E, Kotzabasis K (2007) Salt stress impact on the molecular structure and function of the photosynthetic apparatus-the protective role of polyamines. Biochim Biophys Acta 1767(4): 272-280.
9. Rahdari P, Hoseini SM, Tavakoli S (2012) Study of the effect of drought stress on germination, proline, sugar, lipids, proteins and chlorophyll content in purslane leaves (*Portulaca oleraceae L.*). J Med Plant Res 6(9): 1539-1547.
10. Van Zelm E, Zhang Y, Testerink C (2020) Salt tolerance mechanisms of plants. Annu Rev Plant Biol 71: 403-433.
11. Zhao S, Zhang Q, Liu M, Zhou H, MA C, et al. (2021) Regulation of plant responses to salt stress. International Journal of Molecular Sciences 22(9): 4609.
12. Silva MHA (2000) Aspectos morfológicos e ecofisiológicos de algumas halófitas do sapal da Ria de Aveiro. Universidade de Aveiro. Departamento de Biologia, pp. 1-182.
13. Costa JC (2001) Tipos de vegetação e adaptações das plantas do litoral de Portugal continental. Homenagem (in honorio) Professor Doutor Soares de Carvalho, pp. 283-299.
14. Parida AK, Das AB (2005) Salt tolerance and salinity effects on plants: a review. Ecotoxicology and Environmental Safety 60(3): 324-349.
15. Gong Z (2021) Plant abiotic stress: new insights into the factors that activate and modulate plant responses. Journal of Integrative Plant Biology 63(3): 429-430.
16. Zhu JK (2002) Salt and drought stress signal transduction in plants. Annu Rev Plant Biol 53: 247-273.
17. Iqbal N, Umar S, Khan NA, Khan Mir (2014) A new perspective of phytohormones in salinity tolerance: regulation of proline metabolism. Environmental and Experimental Botany 100: 34-42.
18. Mishra A, Tanna B (2017) Halophytes: Potential resources for salt stress tolerance genes and promoters. Frontiers in Plant Science 8: 829.