THE 19S REGULATORY PROTEASOME SUBUNIT DELETED IN SPLIT HAND/SPLIT FOOT 1 PROTEIN SPDSS1 EXHIBITS DIFFERENT REGULATION MODES ON STRESS TOLERANCE INDUCED BY HIGH SALT AND DROUGHT IN SWEET POTATO

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Abstract - In recent year, changes of the extreme climate result in the desertification of cultivated lands and salinization of soil, which severely devastate the agricultural crop production and balance of demand-provision systems. Therefore, "How to improve crop stress tolerance and yield elevation is a world-wide issue." Leaves are the place of photosynthesis. Its longevity and photosynthesis efficiency may affect plant growth and crop yield. Leaf senescence is regulated by both intrinsic and extrinsic factors, including plant hormone ethylene, high salt, and drought stresses. Ubiquitin-proteasome systems (UPS) are widely distributed in higher plants and have been reported in association with plant development and stress response. In this report, sweet potato leaves treated with proteasome inhibitor MG132 delayed ethephon (an ethylene-releasing compound) and salinity stress-induced leaf senescence based on the changes of senescence-associated markers, including morphological leaf yellowing, reduction of chlorophyll and F_v/F_m contents, elevation of NO/H2O2/malondialdehyde (MDA) levels, and enhancement of senescence-associated gene expression, suggesting a role of proteasomes in association with leaf senescence. A 19S regulatory proteasome subunit deleted in split hand/split foot 1 protein SPDSS1 has been cloned from sweet potato leaves. Its open reading frame contains 228 nucleotides and encodes an acid protein with 75 amino acids, which contains three conserved aspartic/glutamic acid-rich domains. Sweet potato SPDSS1 gene expression was enhanced in natural senescent leaves and also highly inducible by ethephon, high salt, and drought stresses. Exogenous application of SPDSS1 fusion proteins to sweet potato mature leaves altered leaf senescence/stress tolerance induced by ethephon, high salt, and drought stresses. It attenuates leaf senescence induced by ethephon and high salt, whereas, promotes leaf senescence mediated by drought stress according to the changes of senescence-associated markers. Based on these data we conclude that proteasomes are associated with leaf senescence/stress tolerance, and the 19S regulatory proteasome subunit deleted in split hand/split foot 1 protein SPDSS1 exhibits different regulation mode on leaf senescence/stress tolerance induced by ethephon, high salt, and drought stresses in sweet potato leaves.

Keywords - Drought, Leaf senescence, Proteasome, Salinity, Sweet potato SPDSS1