ABIOTIC STRESS TOLERANCE MECHANISMS IN *SULLA CORONARIA* (L.) MEDIK.: UNDERSTANDING PLANT RESPONSE TO DROUGHT AND SALINIZATION.

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Land degradation (i.e. reduction or loss of the biological or economic productivity and complexity of land) is an alarming global issue. It is a process triggered and powered by several causes, both natural and anthropogenic, that lead to soils erosion, salinization, organic matter depletion and biodiversity loss. According to the United Nations Convention to Combat Desertification (UNCCD), land degradation in arid, semi-arid, and dry sub-humid areas is known as desertification. Drylands represent about 40% of the Earth's land surface, provide 44% of the world's cultivated systems and 50% of the world's livestock, and are home to more than two billion people. As predicted by a range of climate models, climate change will accelerate desertification processes in various regions of the World, including the Mediterranean basin, wherein it is forecast to have a great impact on agricultural production systems. Drought and soil salinity threaten the sustainability of agriculture by negatively affecting crop and forage production. Therefore, a better understanding of the mechanisms that plants employ to tolerate water deprivation and salt excess is crucial to increase agricultural productivity under these adverse conditions.

Legumes are second, after grasses, in importance to agriculture. Sulla [*Sulla coronaria* (L.) Medik. syn. *Hedysarum coronarium* L.] is a perennial legume native to Mediterranean area, where it is widely grown as a rainfed biennal forage crop in several countries. It has great potential due to its suitability for cultivation in drought-prone and marginal environments and its great forage value (high protein content and condensed tannins concentration). Sulla is able to fix atmospheric nitrogen and improve soil fertility; recently, its possible use in the production of biofuels is assessed.

The long-term goal of the present PhD project is to define a new level of complexity in the study of drought and salt stress tolerance in *S. coronaria*, understanding the mechanisms that make this species so promising for agriculture in arid and semi-arid environments. Responses of plants subjected to three different regimes of salt and drought conditions will be investigated at morphological, physiological, biochemical and molecular level. Drought and salt stress have several similar effects on plants: osmotic imbalance, cell dehydration, photosynthesis inhibition and ROS production, thus resulting in plant growth reduction. Germination tests, biometrical analyses and optical microscopy will allow to monitor seeds vitality, morphometric parameters and anatomical structures, respectively. Efficiency of photosystems and photosynthetic pigments will be assessed by Pulse-Amplitude-Modulation (PAM) fluorometry and spectrophometrical assays. The latter will be useful in estimating content of proline and soluble sugars, osmolytes that mediate osmotic adjustment. Spectrophotometry, in combination with HPLC technique, will be also decisive in determining antiradical secondary metabolites levels. Activity of some endogenous antioxidant enzymes, amount of intracellular reactive species and oxidative damages will be also measured. The expression levels of some key genes will be evaluated using real-time quantitative PCR, to verify activation of stress-signaling pathways, involving transcriptional remodelling, metabolic changes and altered hormonal activity.