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**Abstract – SY09**

# CHANGES IN TRANSCRIPTION AND METABOLIC FLUXES INDUCED BY COLD AND SALT IN CARDOON CALLI DIFFER WITH STRESS DURATION AND INTENSITY

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Cultivated cardoon (*Cynara cardunculus* L. var *altilis*) is a Mediterranean food crop, member of the Asteraceae family, characterized by a good adaptation to environmental stresses and hence potentially useful in view of climate changes. Thanks to its high production of biomass and secondary metabolites, cardoon tissues and organs have also industrial uses, which range from green chemistry to nutraceutical and pharmaceutical sectors. Biotechnological approaches (i.e. cell cultures) could provide efficient means to obtain stable and continuous production of molecules of industrial interest, also through elicitation to improve the accumulation of relevant metabolites. Moreover, cell cultures represent a valuable model system that mimics, at least in part, the whole plant and can therefore be used to understand the plant responses to environmental stresses. Therefore, in this work we studied the responses of cardoon calli to 14-day cold (6 °C) or 28-day salinity (0, 50, 100, 150 mM NaCl) both in terms of accumulation of valuable compounds and of stress tolerance. We analyzed the ability of cardoon calli of the variety "Spagnolo" to grow under stress and measured the changes in total phenols, proline and antioxidant capability along with transcriptional variations for related biosynthetic genes. All the changes were investigated in relation to growth and damages to membranes, estimated as MDA and H2O2 accumulation. Results showed that cold-treated calli undergo a strong initial growth reduction in the first week, along with accumulation of total phenols, whereas in the second week we observed growth recovery along with decreased polyphenols. Metabolic trends were also confirmed by the transcriptional behavior of biosynthetic genes. As for saline treatment, cardoon calli growth was inversely dependent on the NaCl dose following 14 and 28 days of stress. At moderate stress intensity and duration (50mM NaCl) salt exerted an eliciting effect by stimulating total phenols and antioxidant power without impairing growth, whereas the highest salt stress intensities (100 and 150 mM NaCl) resulted in the strongest growth inhibition and a slight stimulation of phenylpropanoids production, though expression of the investigated biosynthetic genes did not increase. Moreover, conversely to what observed for cold response, intense salt stress induced the accumulation of the oxidative stress markers H2O2 and MDA. These results suggest that, upon perception of abiotic stresses, cardoon increases phenolic metabolites and antioxidant defenses. Following prolonged stress, cardoon is able to recover from the cold stress levels used in this study, as we observed increased growth and return of total phenols to pre-stress levels. On the contrary, the highest NaCl concentration could not be overcome by cardoon calli, and the produced levels of polyphenols could not counteract the resulting oxidative stress, as demonstrated by H2O2 accumulation and membrane damage. Interestingly, a negative correlation between growth, reflecting the primary metabolism, and secondary metabolism was observed in cardoon calli upon abiotic stresses.