PHYSIOLOGICAL BASIS AND ANTIOXIDANT ACTIVITY IN COLD STRESS RECOVER IN SUNFLOWER (HELIANTHUS ANNUS L.)

Ernesta Andrea FABIO [1], ***Exequiel Arturo TOMMASINO*** [2], ***Marcelo CANTARERO*** [3], ***Sergio LUQUE*** [3]

[1] *Facultad De Ciencias Agropecuarias - Universidad Nacional De Cordoba. Argentina*
[2] *Instituto De Fisiología Y Recursos Genéticos Vegetales – Centro De Investigaciones Agropecuarias – Instituto Nacional De Tecnología Agropecuaria. (Ifrgv - Ciap – Inta). Camino A 60 Cuadras Km. 5,5. C.P: X5020ica Córdoba, Argentina*
[3] *Facultad De Ciencias Agropecuarias Universidad Nacional De Córdoba, Argentina*

efabio@agro.unc.edu.ar

ABSTRACT

Tolerance to low temperatures is an important trait, considering that the sunflower production area is expanding to marginal regions with suboptimal growing conditions, and there is an increasing requirement of early sowing to maximize the growing season over Mediterranean areas in countries such as the United States of America, India and Argentina. The present study of the response of sunflower to low temperatures focused on the primary responses on young plants after 96 h under cold treatment at 5°C with the aim of detecting regulatory mechanisms induced at this early stage. Studying the antioxidant activity and physiological bases involved in recovery from cold stress in sunflower seedlings may allow these characteristics to be used in breeding programs aimed at selecting varieties of sunflower adapted to stress from sub-optimal temperatures. The purpose of this research was to establish the recovery from cold stress in terms of the activity of the antioxidant enzymes, superoxide dismutase (SOD) and catalase (CAT), and its relationship with the physiological response of two sunflower hybrids to the contrasting response to cold stress. Prior studies in the Plant Physiology Laboratory identified two sunflower hybrids with contrasting response to cold at the germination stage: sensitive the hybrid *Pampero*(PM) and tolerant the hybrid *Sierra Alto Oleico* (SA). Ten day old seedlings of commercial hybrids PM and SA were placed in cold storage for 96 hours at 5°C, and cold stress recovery was assessed in terms of the following variables: Level of Damage to Cell Membranes through the content of malondialdehyde (MDA), Antioxidant Enzyme Activity: Superoxide Dismutase (SOD) and Catalase (CAT), and Chlorophyll Content at 0, 24, 48 and 72 hours after exposure to cold. In addition, Total Plant Dry Mass and Leaf area were determined per plant. The response to cold stress was greater in the SA than the PM hybrid, suggesting that the former possesses repair mechanisms at the cell level which are activated more quickly in response to low temperature. This coordination and activity levels of the enzymes SOD and CAT found in this study in SA are in accordance with the lower level of cell damage (observed in lower MDA levels), as compared to PM. Higher antioxidant activity and lower MDA levels allow sunflower plants to maintain their photosynthesizing apparatus active, maintaining the functionality of chlorophyll for dry matter production, and leaf area during the early stages of growth, after exposure to cold stress. All the variables described here may be used as criteria for screening cold-stress tolerant sunflower genotypes.

Key Words : sunflowers genotypes, cold stress recover, abiotic stress, physiological traits, oxidative stress, antioxidant defence.