

**PHYSIOLOGICAL STUDIES ON IMPROVEMENT
OF FABA BEAN Tolerance TO ABIOTIC STRESS
BY *Agrobacterium* MEDIATED GENETIC
TRANSFORMATION**

By

ABEER FARAG DESOUKY MOHAMED
B.Sc. Agric. Sci. (Biotechnology), Fac. Agric., Cairo Univ., 2009

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ABSTRACT

Legume crops have been the primary targets for improvement by genetic transformation due to their importance for human and animal consumption worldwide. Many of these important legume crops were difficult to genetically engineer especially faba bean crop, mainly due to high phenolics content and their recalcitrance to *in vitro* regeneration. Therefore, a series of experiments were performed in order to evaluate the growth, morphological changes and production of phenolics in the *in vitro* plantlets of five Egyptian faba bean cultivars (Giza 843, Sakha 1, Sakha 3, Nubaria 2 and Nubaria 3). The obtained results revealed that cultivars Nubaria 2 and Sakha 3 had the highest regeneration frequency (85.3% and 78.6%), respectively, and low in total phenols concentration. The effect of different levels of chitosan (0, 2, 4, 8, 15, 30, 60, and 120 mg /l) on shoot regeneration from mature embryo axes of cv. Nubaria 2 were studied The obtained results indicated that high level of chitosan have lethal effect on the development of embryo axes. However, low levels of chitosan (2 mg /l and 4mg /l) in combination with 4.5 mg/l BAP had a positive effect on shoot regeneration. HPLC analysis showed changes in the polyphenols concentrations in faba bean plantlets that exposed to low levels of chitosan (2, 4 and 8 mg /l). The obtained results indicated also that the concentration of GA₃ and ABA were increased in the faba bean plantlets that exposed to the low levels of chitosan. The effect of salt stress imposed by the addition of sea salt at concentrations of 1000, 3000, 5000 and 7000 ppm to the culture media on the selected cultivars was studied .The results revealed that decreasing in plant growth parameters, sugars and phenols concentrations with increasing sea salts concentrations.This was highly pronounced in Sakha 3 cultivar followed by Nubaria2. the effect of antioxidants (DTT , Cystein and Sodium thiosulfate) on the transformation efficiency was studied. The results obtained indicated that the addition of DTT, cysteine and sodium thiosulfate to the culture media had positive effects on increasing the transformation efficiency of faba bean. Overexpression of PR10a gene from potato were studied in transgenic faba bean lines (T2 and T3) cv.Tattoo in comparison with wild type plants using physiological measurements (net photosynthesis rate, stomatal conductance, transpiration rate, chlorophyll fluorescence Fv'/Fm' and electron transport rate ETR).This measurement were recorded using Li-Cor Li6400XT portable photosynthesis system (Licor ,Inc.,Lincoln, NE 68504) at 1200 PAR under drought and salt stress conditions using hydroponic culture system containing 150mM sodium chloride.

Key words: Embryo axes, regeneration frequency, phenols, GA₃, ABA, sugar, DTT, cysteine, sodium thiosulfate, PR10a, LI6400XT, PAR, net photosynthesis rate, stomatal conductance, transpiration rate, chlorophyll fluorescence parameter Fv'/Fm', ETR.

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