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Bioregulators Mediated Alterations in Leaf Anatomy and Chloroplast Ultrastructure under Water Deficit Stress in Chickpea (Cicerarietinum L.)

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Abstract: *Water deficit is undoubtedly one of the most important environmental stresses limiting the productivity of chickpea around the world. Exogenous application of bioregulators has been found to be a novel technology for imparting stress tolerance in crop plants. This study evaluated the changes brought about by two bioregulators viz., thiourea (TU) and thidiazuron (TDZ), under water deficit stress, on chickpea leaf morphology and chloroplast ultrastructure by using light and transmission electron microscopy.The experiment was conducted using Pusa 362 (desitype) chickpea variety. Water deficit stress was imposed at the reproductive stage by withholding water. Just prior to exposure to water stress, plants were pre-treated with thiourea 1000 mg L^{-1} and thidiazuron 10 mg L^{-1}. Under imposed water stress, compact palisade layers of the mesophyll tissue were disrupted and cell size of the mesophyll cells displayed drastic reduction. Chloroplast, under water stress, displayed a number of grana with lose type of thylakoid, large increase in osmiophillic granules, reduction in the amount of starch granules and overall disruption of the thylakoid membrane. Foliar application of bioregulators maintained the compactness of palisade layers of mesophyll tissue and the thylakoid membrane and affected an increase in the number of starch grains in the chloroplast. Overall results conclusively proved that bioregulators maintained the integrity of the chloroplast structure and the mesophyll tissue thereby protecting the crop from the detrimental effects of water deficit stress.*

Keywords: *Bioregulators, Chickpea, Thidiazuron, Thiourea, Water deficit stress, Anatomy, Chloroplast ultrastructure*