Mutated and wild type *Gossypium* universal stress protein-2 (GUSP-2) gene confers resistance to abiotic stresses in transgenic cotton plant

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*Gossypium arboreum* is considered to be a rich source of stress responsive genes and EST data base revealed that mostly of its genes are uncharacterized. The full length *Gossypium universal stress protein-2* (GUSP-2) gene (510bp) was cloned in *E.coli*, *Pichia pastoris* and *Gossypium hirsutum*, characterized and point mutated at three positions separately at 352-354, Lysine-60 to proline (M1-usp-2) and 214-216, aspartic acid-26 to serine (M2-usp-2) & 145-147, Lysine-3 to proline (M3-usp-2) to study its role in abiotic stress tolerance. It was found that heterologus expression of one mutant (M1-usp-2) provided enhanced tolerance against salt and osmotic stresses, recombinant cells have higher growth up to 10-5dilution in spot assay as compared to W-usp-2 (wild type GUSP-2), M2-usp-2 and M3-usp-2 genes. M1-usp-2 in *Pichia pastoris* transcript profiling exhibited significant expression (7.1-fold) to salt and (9.7) and osmotic stresses. M1-usp-2 gene was also found to enhance drought tolerance and significant expression (8.7) in CIM-496-*Gossypium* hirsutum transgenic plants. However, little tolerance against heat and cold stresses both in recombinant yeast and bacterial cells was observed. The results from our study concluded that activity of GUSP-2 was enhanced in M1-usp-2 but wipe out in M2-usp-2 and M3-usp-2 response remained almost parallel to W-usp-2. Further, it was predicted through in silico analysis that M1-usp-2, W-usp-2 and M3-usp-2 may be directly involved in stress tolerance or function as signaling molecule to activate the stress adaptive mechanism.