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RESPONSE TO PEG-INDUCED HYDRIC STRESS ON *IN VITRO* GERMINATION OF *PROSTHECHEA VITELLINA* (LINDL.) W. E. HIGGINS (ORCHIDACEAE)

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REFERENCES

Aazami M. A., Torabi M., Jalili E. (2010). *In vitro* response of promising tomato genotypes for tolerance to osmotic stress. African Journal of Biotechnology, 26: 4014-4017.

Abbas S. R., Ahmad S. D., Shah A. H. (2014). Detection of drought tolerant sugarcane genotypes (*Saccharum officinarum*) using lipid peroxidation, antioxidant activity, glycine-betaine and proline contents. Journal of Soil Science and Plant Nutrition, 14: 233-243.

Ahmad S., Ahmad R., Ashraf M. Y., Ashraf M., Waraich E. A. (2009). Sunflower (*Helianthus annus* L.) response to drought stress at germination and growth stages. Pakistan Journal of Botany, 41: 647-654.

Almaghrabi O. A. (2012). Impact of drought stress on germination and seedling growth parameters of some wheat cultivars. Life Science Journal, 9: 590-598.

Baccari S., Chaari-Rkhis A., Chelli-Chaabouni A., Maalej M., Abdallah F. B. (2016). Response of olive (*Olea europea*) seedlings to *in vitro* water stress induced by polyethylen glicol. Journal of New Sciences, 7: 1241-1246.

Bandurska H. (1993). *In vitro* and *in vivo* effect of proline on nitrate reductase activity under osmotic stress in barley. Acta Physiologiae Plantarum, 15: 83-88.

Barbero A. P., Barros F., Silva E. A., Suzuki R. M. (2011). Influência do déficit hídrico na germinação de sementes e no desenvolvimento inicial de três espécies de *Pleurothallidinae* (Orchidaceae). Brazilian Journal of Botany, 34: 593-601.

Barman D., Devadas R. (2013). Climate change on orchid population and conservation strategies: A review. Journal of Crop and Weed, 9: 1-12.

Basha P. O., Sudarsanam G., Reddy M. M. S., Sankar N. S. (2015). Effect of PEG induced water stress on germination and seedling development of tomato germoplasm. International Journal of Recent Scientific Research, 6: 4044-4049.

Bates L., Walden R., Teare I. (1973). Rapid determination of free proline from water stress studies. Plant and Soil, 39: 205-207.

Brugière N., Dubois F., Limami A. M., Lelandais M., Roux Y., Sangwan R. S., Hirel B. (1999). Glutamine synthetase in the phloem plays a major role in controlling proline production. The Plant Cell, 11: 1995-2011.

Compton M. E. (1994). Statistical methods suitable for the analysis of plant tissue culture data. Plant Cell, Tissue and Organ Culture, 37: 217-242.

Daouda-Ousmane S., Mouhamadou-Mounkaila B. (2014). Effect of polyethylene glycol (PEG) 6000 on germination and seeling growth of pearl millet (*Pennisetum glaucum* (L.) R. Br.) and LD50 for *in vitro* screening for drought tolerance. African Journal of Biotechnology, 13: 3742-3747.

Eglal M., Mahmoud R. A., Al-Akshar R., Safwat G. (2015). Drought stress tolerance and enhancement of banana plantlets *in vitro*. Austin Journal of Biotechnology and Bioengineering, 2: 1040-1047.

Giri J. (2011). Glycine betaine and abiotic stress tolerance in plants. Plant Signaling and Behavior, 6: 1746-1751.

Grieve C., Grattan S. (1983). Rapid assay for determination of water soluble quaternary ammonium compounds. Plant and Soil, 70: 303-307.

Hassan N. S., Shaaban L. D., El-Sayed A. H., Saleem E. E. (2004). *In vitro* selection for water stress tolerant callus line of *Helianthus annuus* L. cv. Myak. International Journal of Agricultural and Biological Engineering, 6: 13-18.

Heyser J. W., Nabors M. W. (1981). Growth, water content and solute accumulation of two tobacco cell lines cultured is sodium chloride, dextran and polyethylene glycol. Plant Physiology, 68: 1454-1459.

Karimi P., Qureshi A. S., Bahramloo R. (2012). Reducing carbon emissions through improved irrigation and groundwater management: a case study from Iran. Agricultural Water Management, 108: 52-60.

Kavi-Kishor P. B., Sangam S., Amrutha R. N., Sri-Laxmi P., Naidu K. R., Rao K. R. R. S., Rao S., Reddy K. J., Theriappan P., Sreenivasulu N. (2005). Regulation of proline biosynthesis, degradation, uptake and transport in higher plants: Its implications in plant growth and abiotic stress tolerance. Current Science, 88: 424-438.

Kaydan D., Yagmur M. (2008). Germination, seedling growth and relative water content of shoot in different seed sizes of tricale under osmotic stress of water and NaCl. African Journal of Biotechnology, 7: 2862-2868.

Maftuchah M. P., Zainundin A. (2015). *In vitro* selection of *Jatropha curcas* Linn. hybrids using polyethylene glycol to obtain drought tolerance character. Procedia Chemistry, 14: 239-245.

Mahmood I., Razzaq A., Ashraf M., Hafiz I. A., Kaleem S., Qayyum A., Ahmad M. (2012). *In vitro* selection of tissue culture induced

somaclonal variants of wheat for drought tolerance. Journal of Agricultural Research, 50: 177-188.
Muscolo A., Sidari M., Anastasi U., Santonoceto C., Maggio A. (2013). Effect of PEG-induced drought stress on seed germination of four lentil genotypes. Journal of Plant Interactions, 9: 354-363.
Murashige T., Skoog F. (1962). A revised medium for rapid growth and bioassays with tobacco tissue cultures. Physiologia Plantarum, 15: 473-497.
Nayer M., Heidari R. (2008). Drought-induced accumulation of soluble sugars and proline in two maize varieties. World Applied Sciences Journal, 3: 448-453.
Ning J., Li X., Hicks L. M., Xiong L. (2010). A raf-like MAPKKK gene DSM1 mediates drought resistance through reactive oxygen species scavenging in rice. Plant Physiology, 152: 876-890.
Patakas A., Nikolaou N., Zioziou E., Radoglou K., Noitsakis B. (2002). The role of organic solute and ion accumulation in osmotic adjustment in drought stressed grapevines. Plant Science, 163: 361-367.
Qayyum A., Razzaq A., Ahmad M., Jenks M. (2011). Water stress causes differential effects on germination indices, total soluble sugar and proline content in wheat. African Journal of Biotechnology, 10: 14038-14045.
Rhodes D., Hanson A. (1993). Quaternary ammonium and tertiary sulfonium compounds in higher plants. Annual Review of Plant Physiology and Plant Molecular Biology, 44: 367-384.
Said E. M., Mahmoud R. A., Al-Akshar R., Safwat G. (2015). Drought stress tolerance and enhancement of banana plantlets *in vitro*. Austin Journal of Biotechnology and Bioengineering, 2: 1032-1040.
SEMARNAT (2010). Norma Oficial Mexicana NOM-059- SEMARNAT-2010. Protección ambiental-especies nativas de México de flora y fauna silvestres-categorías de riesgo y especificaciones para su inclusión, exclusión o cambio- lista de especies en riesgo. Diario oficial de la Federación. México, D.F. http://dof.gob.mx/nota_detalle.php?codigo=5173091&fecha=30/12/2010.
Sharp R. E., Hsiao T. H., Silk W. K. (1990). Growth of the maize primary root at low water potentials. II. Role of growth and deposition of hexose and potasium in osmotic adjustment. Plant Physiology, 93: 1337-1346.
Soleymani A., Hesam M., Shahrajabian H. (2012). Study of cold stress on the germination and seedling stage and determination of recovery in rice varieties. International Journal of Biology, 4: 23-30.
Soni P., Rizwan M., Bhatt K. V., Mohapatra T., Singh G. (2011). *In vitro* response of *Vigna aconotifolia* to drought stress induced by PEG-6000. Journal of Stress Physiology and Biochemistry, 7: 108-121.
Suwarsi E., Sudasorno S. (2015). *In vitro* selection of drought tolerant peanut embryogenic calli on medium containing polyethylene glycol and regeneration of drought tolerant plants. Emirates Journal of Food and Agriculture, 27: 475-487.
Swarts N., Dixon K. (2009). Perspectives on orchid conservation in botanic gardens. Trends in Plant Science, 14: 590-598.
Tsago Y., Andargie M., Takele A. (2014). *In vitro* selection of sorghum (*Sorghum bicolor* (L.) Moench) for polyethylene glycol (PEG) induced drought stress. Plant Science Today, 1: 62-68.
Vinocur B., Altman A. (2005). Recent advances in engineering plant tolerance to abiotic stress: achievements and limitations. Current Opinion in Biotechnology, 16: 123-132.
Zahra N., Hattab A. L., Wajida K., Qaudhy A. L., Razaq A. A., Al Kaaby A., Al Ani J. A. (2015). *In vitro* regeneration of tomato (*Lycopersicon esculentum*) plants under drought stress. International Journal of Multidisciplinary and Current Research, 3: 1194-1198.