

DAFTAR PUSTAKA

- Abedi, T., And Pakniyat, H. 2010. Antioxidant enzyme changes in response to drought stress in ten cultivars of oilseed rape (*Brassica napus* L.). *Czech J. Genet. Plant Breed.* 46: 27–34.
- Abou-Khalifa A.A.B., Misra A.N., Salem A.E.A.K.M. 2008. Effect of leaf cutting on physiological traits and yield of two rice cultivars. *Afr. J Plant Sci.* 2:147–150.
- Adak, M.K., Ghos, N., Dasgupta, D.K., Gupta, S. 2011. Impeded carbohydrate metabolism in rice plants under submergence stress. *Rice Sci.* 18:116-126.
- Adak, M.K., Das Gupta, D.K. 2002. Metabolic activities in some rice varieties under submergence stress. *Ind J Plant Physiol.* 6: 312–316.
- Agarwal, M. and Zhu, J-K., 2005. *Integration of abiotic stress signaling pathways*. pp. 215-237. In M. Jenks and M. Hasegawa (Eds). *Plant abiotic stress*. Blackwell Publishers.
- Agarwal, P.K. and Jha, B. 2010. Transcription factors in plants and ABA dependent and independent abiotic stress signalling. *Biol Planta.* 54: 201-212.
- Ali, K., Gujjar, R.S., Niwas, R, Gopal, M, and Tyagi, A. 2011. A rapid method for estimation of abscisic acid and characterization of ABA regulated gene in response to water stress from rice. *Am. J Plant Physiol.* 6: 144-156.
- Anjum, S.A., Xie, X., Wang, L.C., Saleem, M.F., Man, C., Lei, W. 2011. Morphological, physiological and biochemical responses of plants to drought stress. *Afr. J Agr. Res.* 6: 2026–2032.
- Apel, K. and Hirt, H. 2004. Reactive Oxygen Species: Metabolism, Oxidative Stress, and Signal Transduction, *Annu. Rev. Plant Biol.* 55:373-399
- Apostolova, P., Yordanova, R., Popova, L. 2008. Response of antioxidative defence system to low temperature stress in two wheat cultivars. *Gen. Appl. Plant Physiol.* 34: 281-294
- Arora, A., Sairam, R. K. and Srivastava, G. C. 2002. Oxidative Stress and Antioxidative Systems in Plants. *Curr. Sci.* 82:1227–1238.
- Arunyanark, A., Jogloy, S., Akkasaeng, C., Vorasoot, N., Kesmala, T., Rao, N.R., Wright, C. G. C., Patanothai. A. 2008. Chlorophyll stability is an indicator of drought tolerance in peanut. *J. Agro & Crop Sci.* 194:113–125
- Asada, K. 2006. Production and scavenging of reactive oxygen species in chloroplasts and their functions. *Plant Physiol.* 141: 391–396.
- Asada, K. 1999. The water–water cycle in chloroplasts: scavenging of active oxygens and dissipation of excess photons. *Annu Rev Plant Physiol Plant Mol Biol.* 50:601–639.
- Ashrafa. M., Foolad. M.R. 2007. Roles of glycine betaine and proline in improving plant abiotic stress resistance. *Env. Exp.Bot.* 59: 206–216
- Bai, L.P., Sui, F.G., Ge, T.D., Sun Z.H., Lu Y.Y and Zhou G.S. 2006. Effect of soil drought stress on leaf water status, membrane permeability and enzymatic antioxidant system of maize. *Pedosphere.*16: 326-332.

- Baker, H., Frank, O., De Angelis, B, and Feingold, S. 1980. Plasma tocopherol in man at various times after ingesting free or acetylated tocopherol. *Nutr. Rep. Int.* 21:531-536.
- Balai Besar Penelitian Tanaman Padi. 2009. Deskripsi varietas padi. Badan Penelitian dan Pengembangan Pertanian Departemen Pertanian. Sukamandi.
- Bartels, D., Sunkar. R. 2005. Drought and salt tolerance in plants. *Crit Rev in Plan Sci.* 24:23-58.
- Bartoli, C.G., Simontaeahi, M., Tambussi, E., Beltrano, J., Montaldi, E., Puntarulo, S., 1999. Drought and watering-dependent oxidative stress: effect on antioxidant content in *Triticum aestivum* L. leaves. *J. Exp. Bot.* 50:375-383.
- Bashir, K., Nagasaka, S., Itai, R.N., Kobayashi, T., Takahashi, M., Nakanishi, H., Mori, S., Nishizawa, N.K. 2007. Expression and enzyme activity of *glutathione reductase* is upregulated by Fe-deficiency in graminaceous plants. *Plant Mol. Biol.* 65:277-284.
- Basu, S., Roychoudhury, A., Saha, P, P., Sengupta, D. N. 2010. Differential antioxidative responses of indica rice cultivars to drought stress. *Plant Growth Reg.* 60:51-59
- Baum, J.A. and Scandalios, J.G. 1981. Isolation and characterization of the cytosolic and mitochondrial superoxide dismutase of maize. *Arch. Biochem. Biophys.* 206: 249-264.
- Beauchamp, C. and I. Fridovich. 1971. Superoxide dismutase: improved assays and an assay applicable to acrylamide gels. *Anal. Biochem.* 44: 276-287
- Behnamnia, M., Kalantari, Kh.M., Rezanejad, F. 2009. Exogenous application of brassinosteroid alleviates drought-induced oxidative stress in *Lycopersicon esculentum* L. *Gen. Appl. Plant Physiol.* 35:22-34.
- Beyer, W.F., Fridovich, I. 1987. Assaying for superoxide dismutase activity: some large consequences of minor changes in conditions. *Anal. Biochem.* 161: 559-566.
- Bhattacharjee, S. 2012. The language of reactive oxygen species signaling in plants. *J Bot.* 2012:1-22.
- _____. 2010. *Site of generation and physicochemical basis of formation reactive oxygen species in plant cell.* Pp. 1-30. In S. D Gupta (ed). *Reactive oxygene species and antioxidant in higher plants.* CRC Press. New Hampshire, USA.
- _____. 2005. Reactive oxygen species and oxidative burst: roles in stress, senescence and signal transduction in plant. *Curr. Sci.* 89:1113-1121.
- Birsin, M.A. 2005. Effects of removal of some photosynthetic structures on some yield components in wheat. *Tarim Bilimleri Dergisi. -J Agricul Sci,* 11: 364-367
- Blum, A. 2005. Drought resistance, water-use efficiency, and yield potential- are they compatible, dissonant, or mutually exclusive?. *Aust J Agri. Resc.* 56: 1159-1168

- Bohnert, H.J., Jensen, R.G., 1996. Strategies for engineering water-stress tolerance in plants. *Trends Biotechnol.* 14, 89–97.
- Boo, Y.C. and Jung, J. 1999. Water deficit-induced oxidative stress and antioxidative defenses in rice plants. *J. Plant Physiol.* 155: 255– 261
- Bradford, M.N. 1976. A rapid and sensitive method for the quantitation of microgram quantities of protein utilizing the principle of protein-dye binding. *Anal. Biochem.* 72: 248-254.
- Bueno, P., Piqueras, A., Kurepa, J., Savoure, A., Verbruggen, N., Van Montagu, M. and Inze, D. 1998. Expression of antioxidant enzymes in response to abscisic acid and high osmoticum in tobacco BY-2 cell cultures. *Plant Sci.* 138: 27–34.
- Cakmak, I. 2000. Possible roles of zinc in protecting plant cells from damage by reactive oxygen species. *New Phytol.* 146: 185-205
- Cakmak, I., and Marschner, H. 1992. Magnesium deficiency and high light intensity enhance activities of superoxide dismutase, ascorbate peroxidase and glutathione reductase in bean leaves. *Plant Physiol.* 98: 1222-1227.
- Castrillo, M. 1992. Sucrose metabolism in bean plants under water deficit. *J Exp Bot* 43: 1557-1561.
- Ceccarelli, S. and Grando, S. 1996. Drought as a challenge for the plant breeder. *Plant Growth Reg.* 20: 149-155.
- Chai, T.T., Fadzillah, N.M., Kusnan, M., Mahmood, M. 2005. Water stress-induced oxidative damage and antioxidant responses in micropropagated banana plantlets. *Biol. Plant.* 49:153–156.
- Chakraborty, U., Pradhan, B. 2012. Oxidative stress in five wheat varieties (*Triticum aestivum* L.) exposed to water stress and study of their antioxidant enzyme defense system, water stress responsive metabolites and H₂O₂ accumulation. *Braz. J. Plant Physiol.* 24:117-130.
- Chandrasekar, V., Sairam, R.K., Srivastava, G.C. 2000. Physiological and biochemical responses of hexaploid and tetraploid wheat to drought stress. *J. Agron. Crop Sci.* 185:219-227.
- Chang, M.L., Chen, N.Y., Liao, L.J., Cho, C.L., and Liu, Z-H. 2012. Effect of cadmium on peroxidase isozyme activity in roots of two *Oryza sativa* cultivars. *Bot. Stud.* 53:31-44.
- Chao, Y.Y., Hong, C.Y., Kao, C.H. 2010. The decline in ascorbic acid content is associated with cadmium toxicity of rice seedlings. *Plant Physiol. Bioch.* 48:374-381.
- Cha-um, S. and Kirdmanee, C. 2008. Effect of osmotic stress on proline accumulation, photosynthetic abilities and growth of sugarcane plantlets *Saccharum officinarum* L. *Pak. J. Bot.* 406: 2541-2552.
- Cha-um, S., Nhung N.T.H., Kirdmanee, C. 2010. Effect of mannitol- and salt-induced isoosmotic stress on proline accumulation, photosynthetic abilities and growth characters of rice cultivars (*Oryza sativa* L. spp. indica). *Pak. J. Bot.* 42: 927–941.

- Chávez-Bárcenas, A.T., Valdez-Alarcón, J.J., Martínez-Trujillo., M., Chen, L., Xoconostle-Cázares, B., Lucas, W.J, and Herrera-Estrella, L. 2014. Tissue-specific and developmental pattern of expression of the rice *sps1* gene source: *Plant Physiol*, 124: 641-653
- Chaves, M.M. and Oliveira, M.M. 2004. Mechanisms underlying plant resilience to water deficits: prospects for water-saving agriculture. *J. Exp. Bot.* 55: 2365–2384.
- Chaves, M.M., Maroco, J.P., Pereira, J.S. 2003. Understanding plant responses to drought from genes to the whole plant. *Func. Plant Biol.* 30: 239–264.
- Chew, O., Whelan, J., Millar, H., 2003, Molecular definition of the ascorbate-glutathione cycle in *Arabidopsis* mitochondria reveals dual targeting of antioxidant defenses in plants. *J Biol Chem.* 278:46869–46877.
- Chittoor, J.M., Leach, J.E., White F.F. 1997. Differential induction of a peroxidase gene family during infection of rice by *Xanthomonas oryzae* pv. *Oryzae*. *Mol. Plant Microbe Interact.* 10: 861–871.
- Chugh, V., Kaur, N., Gupta, A.K. 2011. Evaluation of oxidative stress in maize (*Zea mays*) seedling in response to drought stress. *Indian J Bioc & Biophy.* 48:47-53
- Conklin, P.L., Last, R.L., 1995. Differential accumulation of mRNA in *Arabidopsis thaliana* exposed to ozone. *Plant Physiol.* 109: 203–212
- Chutipaijit, S., Cha-um, S., Sompornpailin, K. 2012. An evaluation of water deficit tolerance screening in pigmented indica rice genotypes. *Pak. J. Bot.* 4:65–72.
- DaCosta, M., Huang, B. 2007. Changes in antioxidant enzyme activities and lipid peroxidation for bentgrass species in responses to drought stress. *J. Am. Soc. Hortic. Sci.* 132:319–326.
- Damanik, R.I., Maziah, M., Ismail, M.R., Ahmad, S., Zain, A.M. 2010. Responses of the antioxidative enzymes in Malaysian rice (*Oryza sativa* L.) cultivars under submergence condition. *Acta Physiol. Plant.* 32:739–747
- Del Rio, L.A. and Corpas F.J., Sandalio, L.M., Palma, J.M., Gomez, J.B., and Barroso, M. 2002. Reactive oxygen species, antioxidative systems and nitric oxide in peroxisomes. *J. Exp. Bot.* 53:1255–1272.
- Das, K.K., Panda, D., Nagaraju, M., Sharma, S. G. and Sarkar, R.K. 2004. Antioxidant enzymes and aldehyde releasing capacity of rice cultivars (*Oryza sativa* L.) as determinants of anaerobic seedling establishment capacity. *Bulg. J. Plant Physiol.* 30:34-44.
- Davies, W.J., Zhang, J. 1991. Root signals and the regulation of growth and development of plant in drying soil. *Annu. Rev. Plant Physiol. Plant Mol. Biol.* 42:55–76
- Davletova, S., Schlauch, K., Coutu, J. and Mittler, R. 2005. The zinc finger protein Zat12 plays a central role in reactive oxygen and abiotic stress signaling in *Arabidopsis*. *Plant Physiol.* 139:847–856.
- de Pinto, M., Francis, D., de Gara, L. 1999. The redox state of ascorbate-dehydroascorbate pairs a specific sensor of cell division in tobacco BY-Z cells. *Protoplasma.* 209:90-97.

- de Souza, T.C., Magalha, T.C., de Castro, M., Carneiro, N.P., Padilha, F.A., Gomes Jr. C.C. 2014. ABA application to maize hybrids contrasting for drought tolerance: changes in water parameters and in antioxidant enzyme activity. *Plant Growth Regul.* 73:205-217.
- Dean, B.B. and Kolattukudy, P.E. 1976. Synthesis of suberin during wound healing in jade leaves, tomato fruit, and bean pods. *Plant Physiol.*58:411–416.
- Dercon, G., Clymans, E., Diels, J., R. Merck, R., & Deckers, J. 2006. Differential ¹³C isotopic discrimination in maize at varying water stress and at low to high nitrogen availability. *Plant Soil.* 282:313–326.
- Devi, S.R., Prasad, M.N.V. 2005. Antioxidant capacity of *Brassica juncea* plants exposed to elevated levels of copper. *Russ J. Plant Physiol.*52: 246-73.
- Du. H., Wang, N., Cui, F., Li, X., Xiao, J., Xiong, L. 2010. Characterization of the β -carotene hydroxylase gene DSM2 conferring drought and oxidative stress resistance by increasing xanthophylls and abscisic acid synthesis in rice. *Plant Physiol.* 154, 1304–1318.
- Duan, L., Guan,C., Li, J., Eneji, A. E., Li, Z., Zhai, Z. 2008. Compensative effects of chemical regulation with uniconazole on physiological damages caused by water deficiency during the grain filling stage of wheat. *J. Agro. & Crop Sci.* 194:9-14.
- Efeoğlu, B., Ekmekçi, Y., Çiçek, C. 2009. Physiological responses of three maize cultivars to drought stress and recovery. *Sou Afr. J. Bot.* 75: 34–42
- Ekanayake, I.J., de Datta, S.K., Steponkus, P.L. 1993. Effect of water deficit stress on diffusive tolerance, transpiration, and spikelet desiccation of rice (*Oryza sativa* L.). *Ann. Bot.* 72: 73-80.
- Epron, D. and E. Dreyer, 1993: Long-term effects of drought on photosynthesis of adult oak trees (*Quercus petraea* and *Q. robur*) in a nature stand. *New Phytol.* 125:381–389.
- Fageria, N. K. 2007. Yield physiology of rice. *J Plant Nutri.* 30: 843–879.
- Farooq, M., Kobayashi, N., Ito, O., Wahid, A., Serraj, R. 2010. Broader leaves result in better performance of indica rice under drought stress. *J Plant Physio.* 167:1066–1075.
- Farooq, M., Basra, S.M.A., Wahid, A., Cheema, Z.A., Cheema, M.A & Khaliq, A. 2008. Physiological role of exogenously applied glycinebetaine to improve drought tolerance in fine grain aromatic rice (*Oryza sativa* L.). *J. Agr & Crop Sci.* 194:325–333.
- Farooq, M., Wahid, A., Kokayashi, N., Fujita ,D., Basra, S.M.A. 2009. Plant drought stress: effects, mechanisms and management. *Agron. Sustain Dev.* 29:185–212.
- Faraouk, S. 2011. Ascorbic acid and α -tocopherol minimize salt-induced wheat leaf senescence. *J Stress Physiol. & Bioch.* 7: 58-79.
- Ferrarese, M., Mahmoodi, S.M., Quattrini, E., Schiavi, M., Ferrante, A. 2012. Biofortification of spinach plants applying selenium in the nutrient solution of floating system. *Veg. Crops Res. Bull.* 76:127-136.

- Finkelstein, .RR., Gampala, S.S.L., Rock, C.D. 2002. Abscisic acid signaling in seeds and seedlings. *Plant Cell*.14:S15–S45
- Forman, H.J. and Boveris, A. 1982. *Superoxide radical and hydrogen peroxide in mitochondria*. pp. 65 – 90. In: W.A. Pryor (ed.). *Free radicals in biology*. Vol. 5, Academic Press NY.
- Foyer, C.H. and Noctor, G. 2003. Redox sensing and signaling associated with reactive oxygen in chloroplast, peroxisome and mitochondria. *Physiol. Plant*. 119: 355–364
- _____.2005a. Redox regulation in photosynthetic organisms: signaling, acclimation, and practical implications, *Anti & Redox. Signal*. 4: 861-889
- _____.2005b.Redox Homeostis and antioxidant signaling: a metabolic interface between stress perception and physiological responses. *Plant Cell*. 17: 1866-1875.
- _____.2009. Redox regulation in photosynthetic organisms: signaling, acclimation, and practical implications. *Anti & Redox Signal*. 11:861-906
- Frei, M., Wissuwa, M., Pariasca-Tanaka, J., Chen, C.P., Sudekum, K.H., Kohno, Y. 2012. Leaf ascorbic acid level- Is it really important for ozone tolerance in rice?. *Plant Physiol Biochem*. 59:63–70.
- Fridovich, I. 1995. Superoxide and superoxide dismutase. *Ann. Rev. Biochem*. 64: 97–112.
- Fu, G.F., Song, J., Li, Y.R., Yue, M.K., Xiong, J., Tao, L.X. 2010. Alteration of panicle antioxidant metabolisme and carbohydrate content and pistil water potential involved in spikelet sterility in rice under water-deficit stress. *Rice Sci*. 17:303-310.
- Gao, J. F. 2000. *Experiment technique of plant physiology*, Xi'an World Books Press Company, Xi'an, China. 196 p.
- Gesch, J.C.V., Vu, K.J., Boote, L., Hartwell Allen, Jr., Bowes, G. 2002. Sucrose-phosphate synthase activity in mature rice leaves following changes in growth CO₂ is unrelated to sucrose pool size. *New Phytol*. 154:77-84
- Ghorbanli, M., M. Gafarabad, T. Amirkian and B. Allahverdi Mamaghani. 2013. 'Investigation of proline, total protein, chlorophyll, ascorbate and dehydro ascorbate changes under drought stress in Akria and Mobil tomato cultivars'. *Iranian J Plant Physiol*. 3:651-658.
- Gill, S.S. and Tuteja, N. 2010. Reactive oxygen species and antioxidant machinery in abiotic stress tolerance in crop plants. *Plant Physiol. Biochem*. 48: 909-930.
- Goldberg, D. M., Spooner, R.J. 1983, Glutathione reductase. *Methods Enzymol*. 3:258–286.
- Gossett, D., Millhollon, E. and Cran-Lucas, M. 1994. Antioxidant response to NaCl stress in salt-tolerant and salt-sensitive cultivars of cotton. *Crop Sci*. 34: 706-714.
- Guan, L., Scadalios, J.G. 1998a Effects of the plant growth regulatorabscisic acid and high osmoticum on the developmental expression of the maize catalase genes. *Physiol Plant*. 104:413–422.

- _____, 1998b. Two structurally similar maize cytosolic superoxide dismutase genes, *Sod4* and *Sod4A*, respond differentially to abscisic acid and high osmoticum. *Plant Physiol.* 117, 217–224.
- Guo, B., Liang, Y.C., Zhu, Y.G. 2009.. Does salicylic acid regulate antioxidant defence system, cell death, cadmium uptake and partitioning to acquire cadmium tolerance in rice? *J Plant Physiol.* 166:20-31
- Guo, Z., Huang, M., Lu, S., Yaqing, Z., Zhong Q. 2007. Differential response to paraquat induced oxidative stress in two rice cultivars on antioxidants and chlorophyll a fluorescence. *Act. Physiol. Plant* 29: 39-46
- Guo, Z., Ou, W., Lu, S., Zhong, Q. 2006. Differential respons of antioxidative system to chilling and drought in for rice cultivars differeing in sensivity. *Plant Physiol Biochem.* 44:828–836.
- Guo, Z., Tan, H., Zhu, Z., Lu, S., Zhou, B. 2005. Effect of intermediates on ascorbic acid and oxalate biosynthesis of rice and in relation to its stress resistance. *Plant Physiol Biochem.* 43:955-952
- Halliwell, B., J. Gutteridge, 2002. *Free radicals in biology and medicine.* 3rd ed, Oxford Univ. Press. 22 p.
- Halliwell, B., 2006. Reactive species and antioxidants. Redox biology a fundamental theme of aerobic life. *Plant. Physiol.* 141:312-322.
- Hasegawa, P.M., Bressan, R.A., Zhu J.K. and Bohnert, H.J. 2000. Plant cellular and molecular responses to high salinity. *Annu. Rev. Plant Physiol. Plant Mol. Biol.* 51: 463–499.
- Hasthanasombut, S., Ntui, V., Supaibulwatana, K., Mii, M., Nakamura, I. 2010. Expression of indica rice *OsBADH1* gene under salinity stress in transgenic tobacco. *Plant Biotech Rep.* 4:75-83.
- Haupt-Herting, S., Fock, H.P. 2002. Oxygen exchange in relation to carbon assimilation in water-stressed leaves during photosynthesis. *Ann Bot.* 89:851–859.
- He, H., Serraj, R., Yang, Q. 2009. Changes in OsXTH gene expression, ABA content, and peduncle elongation in rice subjected to drought at the reproductive stage. *Acta Physiol Plant.* 31:749–756.
- Heinemann, A. B., Stone, L. F., Fageria, N. K. 2011. Transpiration rate response to water deficit during vegetative and reproductive phases of upland rice cultivars. *Sci. Agric.* 68: 24-30.
- Held, H-W and Piechulla, B. 2011. *Plant Biochemistry.* Elsevier Inc
- Hiraga, S., Yamamoto, K., Ito, H., Sasaki, K., Matsui, H., Honma, M., Nagamura, Y., Sasaki, T. and Ohashi, Y. 2000. Diverse expression profiles of 21 rice peroxidase genes. *FEBS Lett.* 471:245–250.
- Hirose, T., Scofield, G.N., Terao, T. 2008. An expression analysis profile for the entire sucrose synthase gene family in rice. *Plant Sci.* 174: 534–543.
- Hoang, T. B. and Kobata, T. 2009. Stay-Green in Rice (*Oryza sativa* L.) of Drought-Prone Areas in Desiccated Soils. *Plant Prod. Sci.* 12: 397-408.

- Hochachka, P. W., Somero, G.N. 2001. Biochemical adaptation: mechanism and process in physiological evolution. Oxford University Press.
- Hong C.W., Chao Y.Y., Yang M.Y., Cho, S.C., Kao, C. H. 2009. Na⁺ but not Cl⁻ or osmotic stress is involved in NaCl-induced expression of glutathione reductase in roots of rice seedlings. *J Plant Physiol* .166:1598-1606.
- Hosseini, S.M., Hasanloo, T., Saeed Mohammadi, S. 2014. Physiological characteristics, antioxidant enzyme activities, and gene expression in 2 spring canola (*Brassica napus* L.) cultivars under drought stress conditions. *Turk J Agric For*, 38:1-8.
- Hsu, Y.T. and Kao, C.H. 2003. Role of abscisic acid in cadmium tolerance of rice (*Oryza sativa* L.) seedlings. *Plant, Cell Environ*. 6: 867–875.
- Hu, X.L., Jiang, M., Zhang, A., Lu, J. 2005. Abscisic acid-induced apoplastic H₂O₂ accumulation up-regulates the activities of chloroplastic and cytosolic antioxidant enzymes in maize leaves. *Planta*. 223:57–68.
- Huang, C., He, W., Guo, J, Chang., X., Su, P., Zhang, L. 2005. Increased sensitivity to salt stress in an ascorbate-deficient Arabidopsis mutant. *J. Exp. Bot*. 56:3041-3049
- Huang, M. and Guo, Z. 2005. Responses of antioxidative system to chilling stress in two rice cultivars differing in sensitivity. *Biol. Plant*. 49: 81-84.
- Huber, S.C., Huber, J.L., 1996. Role and regulation of sucrose-phosphate synthase in higher plants. *Annu Rev Plant Physiol Plant Mol Biol*. 47:431–444
- Hung K.T. and Kao C.H. 2003. Nitric oxide counteracts the senescence of rice leaves induced by abscisic acid. *J. Plant Physiol*. 160: 871–879.
- Ingram, J., Bartels, D. 1996. The molecular basis of dehydration tolerance in plants. *Annu. Rev. Plant Physiol. Plant mol. Biol*. 47:377-403.
- Inoue, T., Inanaga, S., Sugimoto, Y., An, P., and Eneji, A.E. 2004. Effect of drought on ear and flag leaf photosynthesis of two wheat cultivars differing in drought resistance. *Photosynthetica* 42: 559-565.
- Inze, J. and Montagu, M.V. 2002. Oxidative stress in plants. TJ International Ltd, Padstow, Carnawell. Great Britain. p 321
- IPCC (*Intergovernmental Panel on Climate Change*). 2007. Fourth assessment report of the intergovernmental panel on climate change: The Impacts, adaptation and vulnerability (Working Group III). Cambridge University Press, United Kingdom and New York, NY, USA
- Isopp, H., Frehner, M., Long, S.P., Nosberger, J. 2000. Sucrose-phosphate synthase responds differently to source-sink relations and photosynthetic rates: *Lolium perenne* L. growing at elevated in the field. *Plant Cell Environ*. 23:597– 607.
- Iwamoto, M., Maekawa, M., Saito, A., Higo, H., Higo, K. 1998. Evolutionary relationship of plant catalase genes inferred from exon-intron structures: isozyme divergence after the separation of monocots and dicots. *Theor. Appl. Genet*. 97:9–19.
- Iwamoto, M., Higo, H. and Higo, K. 2000. Differential diurnal expression of rice catalase genes: the 50-flanking region of CatA is not sufficient for circadian control. *Plant*

*Sci.*151:39–46.

- Jaleel, C.A., Manivannan, P., Wahid, A., Farooq, M., Somasundaram, R., and Panneerselvam, R. 2009. Drought stress in plants: a review on morphological characteristics and pigments composition. *Int. J. Agric. Biol.* 11:100–105.
- Jeng, T.L., Wang, C.S., Chen, C.L., Sung, J.M. 2007. Expression of granule bound starch synthase in developing rice grain. *J Sci Food & Agri.* 87: 2456–2463.
- Ji, K., Wang, Y., Weining, S., Qiaojun, L., Hanwei, M., Shihua, S., Hui, C. 2012. Drought-responsive mechanisms in rice genotypes with contrasting drought tolerance during *J Plant Physiol.* 169 336–344.
- Jiang, M., Zhang, J. 2001. Effects of abscisic acid on active oxygen species, antioxidative defence system and oxidative damage in leaves of maize seedling, *Plant Cell Physiol.* 42: 1265–1273.
- _____. 2002. Role of abscisic acid in water stress induced antioxidant defense in leaves of maize seedlings. *Free Radical Res.* 36: 1001-1015.
- _____. 2003. Cross-talk between calcium and reactive oxygen species originated from NADPH oxidase in abscisic acid-induced antioxidant defence in leaves of maize seedlings. *Plant Cell Envi.* 26: 929–939
- Jiang, Y., Huang, B. 2001. Drought and heat stress injury to two cool-season turfgrasses in relation to antioxidant metabolisms and lipid peroxidation. *Crop Sci.* 41:436–442.
- Jin, J., Shan, N., Ma, N., Bai, J., Gao, J. 2005. Regulation of ascorbate peroxidase at the transcript level is involved in tolerance to postharvest water deficit stress in the cut rose (*Rosa hybrida* L.) cv. Samantha. *Posthar. Biol. Tech.* 40: 236–243.
- Kar, M.E., Mishra, D. 1976. Catalase, peroxidase and polyphenoloxidase activities during rice leaf senescence. *Plant Physiol.* 57:315–319.
- Keleo, Y. and Unyayar, S. 2004. Responses of antioxidant defense system of *Helianthus annuus* to abscisic acid treatment under drought and waterlogging. *Acta Physiol. Plant.* 26: 149-156.
- Kaminaka, H., Morita, S., Tokumoto, M., Yokoyama, H., Masumura, T., Tanaka, K. 1999. Molecular cloning and characterization of a cDNA for an iron-superoxide dismutase in rice (*Oryza sativa* L.). *Biosci. Biotech. Biochem.* 63:302–308.
- Kaminaka, H., Morita, S., Nakajima, M., Masumura, T., Tanaka, K. 1998. Gene cloning and expression of cytosolic *glutathione reductase* in rice (*Oryza sativa* L.). *Plant Cell Physiol* 39:1269–1280.
- Kawakami, S., Matsumoto, Y., Matsunaga, A., Mayama, S., Mizuno, M. 2002. Molecular cloning of ascorbate peroxidase in potato tubers and its response during storage at low temperature. *Plant Sci.* 163: 829–836.
- Kim, J.H., Chung, B.Y., Kim, J.S., Wi, S.G, Yang, D.Y., Lee, C.H. and Chul Lee, M.C. 2004. Construction of gene-specific primers for various antioxidant isoenzyme genes and their expressions in rice (*Oryza sativa* L.) seedlings obtained from gamma-irradiated seeds. *J Photosci.* 11:115-120.

- Kliebenstein, D.J., Monde, R.A. and Last, R.L. 1998. Superoxide dismutase in *Arabidopsis*: an eclectic enzyme family with disparate regulation and protein localization. *Plant Physiol.* 115:637-650.
- Kohler J., Komor, E., Thom, M. and Maretzki, A. 1988. Activity of sucrose-phosphate synthase in sugarcane leaves. *Phytochem.* 27:1605 -1608.
- Kumar, R., Sarawagi, A.K., Ramos, C., Amarante, S.T., Ismail, A.M. 2006. Partitioning of dry matter during drought stress in rainfed lowland rice. *Field Crop Res.* 8:1-11.
- Kumari, S. 2010. Cellular changes and their relationship to morphology, abscisic acid accumulation and yield in wheat (*Triticum aestivum*) cultivars under water stress. *Am. J. Plant Physiol.* 5: 257-277
- Lagrimini, L.M., Gingas, V., Finger, F., Rothstein, S. and Liu, T. 1997. Characterization of antisense transformed plants deficient in the tobacco anionic peroxidase. *Plant Physiol.* 114:1187-1196.
- Lascano, H. R., Antonicelli, G.E., Luna, C.M., Melchiorre, M.N., Gomez, L.D., Racca, R.W., Trippi, V.S., Casano, L.M. 2001. Antioxidant system response of different wheat cultivars under drought: field and *in vitro* studies, *Aust. J. Plant Physiol.* 28:1095-1102.
- Law, M.Y., Charles. S.A., Halliwell, B. 1983. Glutathione and ascorbic acid in spinach (*Spinacia oleracea*) chloroplasts. The effect of hydrogen peroxide and paraquat. *Biochem J.* 210:899-903.
- Lee, D.H., Kim, Y.S., Lee, C.B. 2001. The inductive responses of the antioxidant enzymes by salt stress in the rice (*Oryza sativa* L.). *J Plant Physiol.* 158:737-48.
- Levitt, J. 1980. Responses of plants to environmental stresses. Academic Press, New York.
- Li, J.M., Jin, H. 2007. Regulation of brassinosteroid signaling. *Trends in Plant Sci.* 12: 37-41
- Liang, H.L., Yu, X., Lane, D., Sun, W.N., Tang, Z.C., and Su, W.A. 2006. Upland rice and lowland rice exhibited different PIP expression under water deficit and ABA treatment. *Cell Res.* 16: 651-660.
- Liang, Y.C., Hu, F., Yang, M.C., Zhu, X.L., Wang G.P. and Wang, Y.L. 1999. Mechanisms of high yield and irrigation water use efficiency of rice in plastic film mulched dryland, *Sci. Agric. Sin.* 32: 26-32.
- Lichtenthaler, H., Wellburn, A.R. 1983. Determination of total carotenoids and chlorophyll a and chlorophyll b leaf extracts in different solvents. *Biochem. Soc. Trans.* 603:591-592.
- Lilley, J.M., Fukai, S. 1994. Effect of timing and severity of water deficit on four diverse rice cultivars iii. phenological development, crop growth and grain yield. *Field Crops Res.* 37: 225-234.
- Lilley, J.M., Ludlow, M.M. 1996. Expression of osmotic adjustment and dehydration tolerance in diverse rice lines. *Field Crops Res.* 48:185-197.
- Lima, A.L.S., DaMatta, F.M., Pinheiro, H.A., Totola, M.R., Loureiro. M.E. 2002. Photochemical responses and oxidative stress in two clones of *Coffea canephora*

- under water deficit conditions. *Environ. Exp. Bot.* 47:239–247.
- Liu, C.L., Chen, H.P., Liu, E., Peng, X.X., Lu, S.Y., Guo, Z.F. 2003. Multiple tolerance of rice to abiotic stresses and its relationship with ABA accumulation. *Acta Agron. Sin.* 29:725–729.
- Lo Gullo, M., Nardini, A., Trifilo, P., Salleo, S. 2003. Changes in leaf hydraulics and stomatal conductance following drought stress and irrigation in *Ceratonia siliqua* (Carob tree). *Physiol Plant.* 117:186–94.
- Lu, S.Y., Chen, S. M., Chen, S. P. and Guo, Z. F. 2003. Effects of ABA, paclobutrazol and uniconazole on the drought resistance of bermudagrass. *Acta Prata. Sin.* 12: 100–104.
- Madhava Rao, K.V. and Sresty, T.V.S. 2000. Antioxidative parameters in the seedlings of pigeonpea (*Cajanus cajan* L. Millspaugh) in response to Zn and Ni stresses. *Plant Sci.* 157: 113–128.
- Mae, T. 1997. Physiological nitrogen efficiency in rice Nitrogen utilization photosynthesis and yield potential. *Plant and Soil.* 106: 201-210.
- Maleki, M., Ebrahimzade, H., Gholami, Z. and Niknam, V. 2011. The effect of drought stress and exogenous abscisic acid on growth, protein content and antioxidative enzyme activity in saffron (*Crocus sativus* L.) *Afri. J Biotech.* 10:9068-9075.
- Martínez-Ferri, E., Manrique, E., Valladares, F., Balaguer, L. 2004. Winter photoinhibition in the field involves different processes in four co-occurring Mediterranean tree species. *Tree Physiol.* 24:981–990.
- Medrano, H., Escalona, J.M., Bota, J., Gulías, J., Flexas, J. 2002. Regulation of photosynthesis of C₃ plants in response to progressive drought: stomatal conductance as a reference parameter. *Ann Bot.* 89:895–905.
- Menezes-Benavente, L., Teixeira, F.K., Kamei, C.L.A., Margis-Pinheiro, M. 2004. Salt stress induces altered expression of genes encoding antioxidant enzymes in seedlings of a Brazilian indica rice (*Oryza sativa* L.). *Plant Sci.* 166:323–331.
- Miller, G., Shulaev, V. and Mittler, R. 2008. Reactive oxygen signaling and abiotic stress. *Physiol. Plant.* 133: 481–489.
- Miller, G., Suzuki, N., Ciftci-Yilmaz, S., Mittler, R. 2010. Reactive oxygen species homeostasis and signalling during drought and salinity stresses. *Plant Cell Environ.* 33:453–467.
- Mishra, P., Bhoomika, K. and Dubey, R.S. 2011, Differential responses of antioxidative defense system to prolonged salinity stress in salt-tolerant and salt-sensitive Indica rice (*Oryza sativa* L.) seedlings. *Protoplasma.* 248:565–577.
- Mittler, G., Suzuki, N., Cifti-Yilmaz, S. and Mittler, R. 2009. Reactive oxygen species homeostasis and signalling during drought and salinity stresses. *Plant Cell Environ.* 33:453–467.
- Mittler, R., van der Auwerra, S., Gollery, M. and Breusegem, F. V. 2004. Reactive oxygen gene network of plants. *Trends Plant Sci.* 10:490–498.
- Mittler, R. 2002. Oxidative stress, antioxidants and stress tolerance. *Trends Plant Sci.* 7,

405–410.

- Mittler, R., Zilinskas, B.A. 1993. Detection of ascorbate peroxidase activity in native gels by inhibition of the ascorbate dependent reduction of nitroblue tetrazolium. *Anal. Biochem.* 212:540-546.
- _____. 1994. Regulation of pea cytosolic ascorbate peroxidase and other antioxidant enzymes during the progression of drought stress and following recovery from drought. *Plant J.* 5: 397–405.
- Moradi, F. and Ismail, A.M. 2007. Responses of photosynthesis, chlorophyll fluorescence and ROS-scavenging systems to salt stress during seedling and reproductive stages in rice. *Ann. Bot.* 99:1161 –1173.
- Morita, S., Kaminaka, H., Masummura, T., Tanaka, K. 1999. Induction of rice cytosolic ascorbate peroxidase mRNA by oxidative stress: the involvement of hydrogen peroxidase in oxidative stress signaling. *Plant Cell Physiol.* 40: 417–422.
- Morita, S., Nakatani, S., Koshihara, T., Masumura, T., Ogihara, Y., Tanaka, K. 2011. Differential expression of two cytosolic *ascorbate peroxidases* and two *superoxide dismutase* genes in response to abiotic stress in rice. *Rice Sci.* 18: 157–166.
- Mukherjee, S.P., Choudhuri, M.A. 1983. Implications of water stress-induced changes in the levels of endogenous ascorbic acid and hydrogen peroxide in *Vigna* seedlings. *Physiol Planta.* 58:166–170.
- Mahajan, S., Tuteja, N., 2005. Cold, salinity and drought stress: an overview. *Arch. Biochem and Biophys.* 444, 139–158.
- Munné-Bosch, S. and J. Peñuelas. 2003. Photo-and antioxidative protection, and a role for salicylic acid during drought and recovery in field-grown *Phillyrea angustifolia* plants. *Planta.* 217: 758-766.
- Munné-Bosch S, Shikanai T, Asada K. 2005. Enhanced ferredoxin-dependent cyclic electron flow around photosystem I and alpha-tocopherol quinone accumulation in water-stressed *ndhB*-inactivated tobacco mutants. *Planta* 222, 502-511
- Murgia, I., Tarantino, D., Vannini, C., Bracale, M., Carrabvieri, S., Soave, C. 2004. *Arabidopsis thaliana* plants overexpressing thylakoidal ascorbate peroxidase show resistance to paraquat-induced photooxidative stress and to nitric oxide-induced cell death. *Plant J.* 38:940–995.
- Nagarajan, S. and Nagarajan, S. 2010. *Abiotic stress adaptation in plants.* pp. 1-11. In Pareek, A., Sopory, S. K., Bohnert, H. I Govindjee (eds). *Physiological, molecular and genomic foundation.* Springer, The Netherlands
- Nakamura, Y., Yuki, K. 1992. Changes in enzyme activities associated with carbohydrate metabolism during development of rice endosperm. *Plant Sci.* 82:15–20
- Nakano, Y. and Asada, K. 1981. Hydrogen peroxide is scavenged by ascorbate peroxidase in spinach chloroplast. *Plant Cell Physiol.* 22:867–880.
- Nguyen, G. N., Hailstones, D. L., Wilkes, M. & Sutton, B. G. 2009. Drought-induced oxidative conditions in rice anthers leading to a programmed cell death and pollen abortion. *J Agro & Crop Sci.* 195:157–164.

- _____. 2010. Role of carbohydrate metabolism in drought-induced male sterility in rice anthers. *J Agro. & Crop Sci.* 196:346-357.
- Nguyen, G.N., Sutton, B.G., 2009. Water deficit reduced fertility of young microspores resulting in a decline of viable mature pollen and grain set in rice. *J Agro & Crop Sci.* 195:11-18.
- Ni, F.T., Chu, L.Y., Shao, H.B. and Liu Z.H. 2009. Gene expression and regulation of higher plants under soil water stress. *Curr. Genom.* 10:269-280.
- Noctor, G., Foyer, C.H. 1998. Ascorbate and glutathione: keeping active oxygen under control. *Annu Rev Plant Physiol Plant Mol Biol.* 49:249-79.
- Nounjan, N., Nghia, P. T., Theerakulpisut, P. 2012. Exogenous proline and trehalose promote recover of rice seedlings from salt-stress and differentially modulate antioxidant enzymes and expression of related genes. *J Plant Physiol, in the press*
- Nunes, C., Araújo S.S., da Silva J.M., Fevereiro M.P.S. and da Silva. A.B. 2008. Physiological, responses of the legume model *Medicago truncatula* cv. Jemalong to water deficit. *Environ. Exp. Bot.* 63:289-296.
- Okamura, M., Aoki, N, Hirose, T., Yonekura, M., Ohtoc, C., Oshugi, R. 2011. Tissue specificity and diurnal change gene expression of the sucrose phosphate synthase gene family in rice. *Plant Sci.* 181:159-166.
- Osipova, S.V., Permyakov, A.V., Permyakova, M.D., Pshenichnikova, T.A., Bo`rner, A. 2011. Leaf dehydroascorbate reductase and catalase activity is associated with soil drought tolerance in bread wheat. *Acta Physiol Plant,* 33:2169-2177
- Passardi, F., D. Longet, C. Penel, and C. Dunand. 2004. The class III peroxidase multigenic family in rice and its evolution in land plants. *Phytochem.* 65:1879-1893.
- Pastori, G.M., Trippi, V.S. 1992. Oxidative stress induces high rate of glutathione reductase synthesis in a drought-resistant maize strain. *Plant Cell Physiol.* 33:957-961.
- _____. 1993. Cross resistance between water and oxidative stress in wheat leaves. *J. agri. Sci.* 120:289-294.
- Patel, P.K., Hemantaranjan, A., Sarma, B.K. and Singh, R. 2011. Growth and antioxidant system under drought stress in Chickpea (*Cicer arietinum* L.) as sustained by salicylic acid. *J Stress Physiol & Bioch.* 7:130-144.
- Pei, Z.M., Murata, Y., Benning G., Thomine, S., Klusener, B., Allen G.J., Grill, E. and Schroeder, J.I. 2000. Calcium channel activated by hydrogen peroxide mediated abscisic signaling in guard cells. *Nature.* 406:731-734
- Peng, S., Cassman, K.G., Virmani, S.S., Sheehy, J., Khush, G.S. 1999. Yield potential trends of tropical rice since release of IR8 and the challenge of increasing rice yield potential. *Crop Sci.* 39:1552-1559
- Pham, J. and Desikan, R. 2009. *Reactive oxygen species signaling in stomata.* pp 55-72, In R. Poppo (ed). *Reactive oxygen species in plant signaling.* Springer Verlag.

- Pheloung, P.C., Siddique, K.H.M. 1991. Contribution of stem dry matter to grain yield in wheat cultivars. *Aust. J Plant Physiol.* 18:53–64.
- Pieters, A.J., Souki, S. E. 2005. Effects of drought during grain filling on PS II activity in rice, *J Plant Physiol*, 162, 903 - 911.
- Pignocchi, C. and Foyer, C.H. 2003. Apoplastic ascorbate metabolism and its role in the regulation of cell signalling. *Curr. Opi. Plant Biol.* 6:379–389.
- Pitzschke, A., Forzani, C, and Hirt, H. 2006. Reactive oxygen species signaling in plants. *Antiox. Red. Signal.* 8:1757-1764.
- Pospíšilová, J., Synková, H., Haisel, D. Bařková, P. 2009. Effect of abscisic acid on photosynthetic parameters during *ex vitro* transfer of micropropagated tobacco plantlets. *Biol. Plant.* 53:11-20.
- Prabu, G., Kavar, P.G., Pagariya, M.C., Prasad, D.T., 2011. Identification of water deficit stress upregulated genes in sugarcane. *Plant Mol Biol Rep.* 29:291–304.
- Preiss, J., 1988. Biosynthesis of starch and its degradation. *In Biochemistry of plants.* (eds) by J Preiss. Academic Press, San Diego.
- Price, A.H., Hendry, G.A.F., 1991. Iron-catalysed oxygen radical formation and its possible contribution to drought in nine native grasses and three cereals. *Plant Cell Environ.* 14:477–84.
- Quiroga, M., Guerrero, C., Botella, M.A., Barceló, A., Amaya, I., Medina, M.I., Alonso, F.J., de Forchetti, S.M., Tigier, H. and Valpuesta, V. 2000. A tomato peroxidase involved in the synthesis of lignin and suberin. *Plant Physiol.* 122:1119–1127.
- Rakwal, R., Agrawal, G.K., Tamogami, S., Yonekura, M., Agrawal, VP., Iwahashi, H. 2003. Novel insight into kinetin-inducible stress responses in rice seedlings. *Plant Physiol. Biochem.* 41: 453-457.
- Rao, S.D., 1997. Flag Leaf a Selection Criterion for Exploiting Potential Yields in Rice. *Indian. J. Plant. Physiol*, 25: 265-268.
- Ray, S., Mondal, A., Choudhuri, M.A. 1983. Regulation of leaf senescence, grain-filling and yield of rice by kinetin and abscisic acid. *Physiol. Plant.* 59:343-346.
- Reddy, A R, Chaitanya, K.V., Vivekanandan, M. 2004. Drought-induced responses of photosynthesis and antioxidant metabolism in higher plants. *J. Plant Physiol.* 161:1189–1202.
- Ribeiro, C., Cambraia, J., Peixoto, P.H.P. and Fonseca Jr, Élcio Meira da. 2012. Antioxidant system response induced by aluminum in two rice cultivars. *Braz. J. Plant Physiol.* 24:107-116.
- Rhodes, D., Hanson, A.D. 1993. Quaternary ammonium and tertiary sulfonium compounds in higher-plants. *Annu. Rev. Plant Physiol. Plant Mol. Biol.* 44: 357–384.
- Rise, M., Cojocar, M., Gottlieb, H.E., Goldshmidt, E.E. 1989. Accumulation of α -tocopherol in senescing organs as related to chlorophyll degradation. *Plant Physiol.* 89:1028–1030.

- Rosa, S.B., Caverzan, A., Teixeira, F.K., Lazzarotto, F., Silveira, J.A.G., Ferreira-Silva, S.L., Abreu-Neto, J., Margis, R., Margis-Pinheiro, M. 2010. Cytosolic APX knockdown indicates an ambiguous redox responses in rice. *Phytochem.* 71:548–558.
- Saedipour, S., 2011. Salinity tolerance of rice lines related to endogenous abscisic acid (ABA) level synthesis under stress. *Afri. J Plant Sci.* 5:628-633.
- Saini, H.S., Westgate, M.E. 2000. Reproductive development in grain crops during drought. *Adv in Agro.* 68:59–95.
- Sairam, R.K., Tyagi, A. 2004. Physiology and molecular biology of salinity stress tolerance in plants. *Curr Sci.* 86:407–420
- Sasaki, K., Iwai, T, Hiraga, S., Kuroda, K., Seo, S., Mitsuhara, I., Miyasaka, A., Iwano., M., Hiroyuki Ito, H., Matsui, H. and Ohashi, Y. 2004. Ten rice peroxidases redundantly respond to multiple stresses including infection with rice blast fungus. *Plant Cell Physiol.* 45:1442–1452.
- Sattler, S.E., Gilliland, L.U., Magallanes-Lundback. M., Pollard, M. and DellaPenna, D., 2004. Vitamin E is essential for seed longevity, and for preventing lipid peroxidation during germination. *The Plant Cel.* 16:1419–1432.
- Scandalios, J.G. 2002. The rise of ROS. *Trends Biochem Sci.* 27:483–486.
- Schnyder, H. 1993. The role of carbohydrate storage and redistribution in the source-sink relations of wheat and barley during grain filling – a review. *New Phytol.* 123:233–245.
- Selote, D.S. and Khanna-Chopra, R. 2004. Drought-induced spikelet sterility is associated with an inefficient antioxidant defence in rice panicles. *Physiol Plant.* 121:462–471.
- Servaites, J. C., Torisky, R. S. and Chao, S. F. 1984. Diurnal changes in ribulose-1,5-bisphosphate carboxylase activity and activation state in the leaves of field grown soybean. *Plant Sci. Lett.* 35:115-121.
- Shalata, A and Neumann., P.M. 2001. Exogenous ascorbic acid (vitamin C) increases resistance to salt stress and reduces lipid peroxidation. *J. Exp. Bot.* 52:2207-2211.
- Shao, H.B., Guo, Q. J., Chu, L.Y. 2007. Understanding molecular mechanism of higher plant plasticity under abiotic stress. *Biointerfaces* 54:37–45.
- Shao H.B., Chu L.Y., Shao, M.A., Cheruth, A.J., Mi H.M. 2008. Plant antioxidants and redox signaling under environmental stresses. *Biologies.* 331:433–441.
- Sharma, P. and Dubey, S.D. 2005. Drought induce oxidative stress and enhances the activities of antioxidant enzymes in growing rice seedlings. *Plant Growth Regul.* 46:209-221.
- Sharoni, A. M., Nuruzzaman, M., Satoh, K., Moumeni. A., Attia, K., Venuprasad, R., Serraj, R., Kumar., A., Leung, H., ul Islam, A. K. M. R., Kikuchi, S. 2012. Comparative transcriptome analysis of AP2/EREBP gene family under normal and hormone treatments, and under two drought stresses in NILs setup by Aday Selection and IR64. *Mol Genet Genomics.* 287:1–19

- Sheoran, I. S. and Saini, H. S. 1996. Drought-induced male sterility in rice changes in carbohydrate levels and enzyme activities associated with the inhibition of starch accumulation in pollen. *Sex. Plant Reprod.* 9:161–169.
- Shigeoka, S., Ishikawa, T., Tamoi, M., Miyagawa, Y., Takeda, T., Yabuta, Y., Yoshimura, K. 2002. Regulation and function of ascorbate peroxidase isoenzymes. *J. Exp. Bot.* 53:1305–1319.
- Shinozaki, K. and Yamaguchi-Shinozaki, K. 1997. Gene expression and signal transduction in water-stress response. *Plant Physiol.* 25:327-334.
- Singh, M.P., Singh, D.K. and Rai. 2007. Assesment of growth, physiological and biochemical parameter and activities od antioxidative enzymes in salinity tolerant and sensitivive rice varieties. *J Agro Crop Sci.* 193: 398-412.
- Smirnoff, N. 1993. The role of active oxygen in the response of plants to water deficit and desiccation. *New Phytol.* 125:27–58.
- Smirnoff, N., Cumbes, Q.J. 1989. Hydroxyl radical scavenging activity of compatible solutes. *Phytochem.* 28:1057–1060.
- Smirnoff, N., Pallanca, J.E. 1996. Ascorbate metabolism in relation to oxidative stress. *Biochem Soc Trans.* 4:472–478.
- Song, X., Agata, W. and Kawamitsu, Y. 1990. Studies on dry matter and grain production of F₁ hybrid rice in China. II. Characteristics of grain production. *Jpn. J. Crop Sci.* 59:29-33.
- Sofa, A., Dichio, B., Xiloyannis, C., Masia, A. 2005. Antioxidant defences in olive trees during drought stress: changes in activity of some antioxidant enzymes. *Funct. Plant Biol.* 32: 45–53.
- Sujatha, K.B., Uprety, D.C., Nageswara Rao, D., Raghuvver Rao, P., Dwivedi, N. 2008. Up-regulation of photosynthesis and sucrose-P synthase in rice under elevated carbon dioxide and temperature conditions. *Plant Soil Environ.* 54: 155–162.
- Sweetlove, L.J., Lytovchenko, A., Morgan, M., Nunes-Nesi, A., Taylor, N.L., Baxter, C.J., Eickmeier, I., Fernie, A.R. 2006. Mitochondrial uncoupling protein is required for efficient photosynthesis. *Proc Natl Acad Sci USA* 103:19587–19592.
- Tabaeizadeh, Z. 1998, Drought-induced responses in plant cells. *Int Rev Cytol.* 182:193–247.
- Tausz, M., Hietz, P., Brione,s O. 2001. The significance of carotenoids and tocopherols in photoprotection of seven epiphytic fern species of a Mexican cloud forest. *Aust J Plant Physiol.* 28:775–83.
- Teixeira, F.K., Menezes-Benavente, L., Galvao, V.C., Margis, R., Margis Pinheiro, M., 2006. Rice ascorbate peroxidase gene family encodes functionally diverse isoforms localized in different subcellular compartments. *Planta.* 224:300–314
- Teixeira, F.K., Menezes-Benavente, L., Margis, R., Margis-Pinheiro, M. 2004. Analysis of the molecular evolutionary history of the ascorbate peroxidase gene family: inferences from the rice genome. *J Mol Evol* 59:761–770.
- Tezara, W., Mitchel, V.J., Driscoll, S.P., Lawlor, D.W. 1999, Water stress inhibits plant

- photosynthesis by decreasing coupling factor and ATP. *Nature*. 401:914–7.
- Tsai, Y.C., Hong, C.Y., Liu, L.F., Kao, C. H. 2005. Expression of ascorbate peroxidase and glutathione reductase in roots of rice seedlings in response to NaCl and H₂O₂. *J. Physiol*. 162:291–299
- Tsai, Y.C., Kao, C. H. 2004. The involvement of hydrogen peroxide in abscisic acid-induced activities of ascorbate peroxidase and glutathione reductase in rice roots. *Plant Growth Reg.* 43:207–212.
- Tuna, A.L., C. Kaya, and M. Ashraf. 2010. Potassium sulfate improves water deficit tolerance in melon plants grown under glasshouse conditions. *J. Plant Nutri.* 33:1276-1286.
- Tyagi, A., Santha, I.M. and Mehta, S.L. 1999. Effect of water stress on proline content and transcript levels in *Lathyrus sativus*. *Ind. J Biochem. Biophys.* 36:207-210.
- Uchida, A., Jagendorf, A.T., Hibino T., Takabe, T., Takabe. T. 2002. Effects of hydrogen peroxide and nitric oxide on both salt and heat stress tolerance in rice. *Plant Sci.* 163: 515-523.
- Vassey, T.L., Quick ,W.P., Sharkey, T.D., Stitt, M. 1991. Water stress, carbon dioxide, and light effects on sucrose-phosphate synthase activity in *Phaseolus vulgaris*. *Physiol Plant.* 81:37-44
- Vassey, T.L., and Sharkey, T.D. 1989. Mild water stress of *Phaseolus vulgaris* plants leads to reduced starch synthesis and exacerbate sucrose phosphate synthase activity. *Plant Physiol.* 89:1066–70.
- Vergara, B. S., 1994. A farmer's primer on growing rice. 2nd ed. The International Rice Research Institute. Los Banos, Philipipines, 1–219 p
- Vartanian, N. 1981. Some aspects of structural and functional modifications induced by drought in root systems. *Plant and Soil* 63: 83-92.
- Vignols, F., Lund, G., Pammi., S, Tremousaygue, D., Grellet, F. 1994. Characterization of a rice gene coding for a lipid transfer protein. *Gene.* 142:265–270.
- Vranova, E., Inze, D., Van Breusegem, F. 2002. Signal transduction during oxidative stress. *J. Exp. Bot.* 53:1227-1236.
- Vu, J.C.V. and Allen, L.H., 2009. Growth at elevated CO₂ delays the adverse effects of drought stress on leaf photosynthesis of the C₄ sugarcane. *J Plant Physiol*, 166: 107-116.
- Vu, J.C.V., Baker, J.T., Pennanen, A.H., Allen, L.H., Bowes, G, Boote, K.J. 1998. Elevated CO₂ and water deficit effects on photosynthesis, ribulose biphosphate carboxylase-oxygenase and carbohydrate metabolism in rice. *Physiol Plant.* 103:327–39.
- Walker-Simmons, M. 1987. ABA levels and sensitivity in developing wheat embryos of sprouting resistant and susceptible cultivars. *Plant Physiol* 84: 61– 66.
- Wang, F.Z., Wang, Q.B, Kwon, S.Y, Kwak, S.S., Su, W.A. 2005. Enhanced drought tolerance of transgenic rice plants expressing a pea manganese superoxide dismutase. *Plant Physiol.* 162:465–472.

- Wang, S.X., Xia, S.T., Peng, K.Q., Kuang, F.C., Cao, Y. Xiao, L.T. 2007. Effects of formulated fertilizer synergist on abscisic acid accumulation, proline content and photosynthetic characteristics of rice under drought. *Rice Sci.*, 14: 42-48
- Wang, H.Z., Zhang, L.H., Ma,J., Li, X.L., Li, Y., Zhang, R.P. and Wang, R.Q. 2010. Effects of water stress on reactive oxygen species generation and protection system in rice during grain-filling stage. *Agri. Sci. in China.* 9: 633-641.
- Wang, W., Vinocur, B., Altman, A. 2003. Plant respons to drought, salinity, extreme temperature: towards genetic engineering for stress tolerance. *Planta.* 218: 1-14.
- Wardlaw, I.F, Willenbrink, J. 1994. Carbohydrate storage and mobilization by the culm of wheat between heading and grain maturity: the relation to sucrose synthase and sucrose-phosphate synthase. *Aust. J. Plant Physiol.* 21: 255–271.
- Wilkinson, S., Davies, W.J. 2002. ABA-based chemical signalling: the co-ordination of responses to stress in plants. *Plant Cell Enviro.* 25:195–210.
- Woodbury, W., Spencer, A.K., Stahmann, M.A. 1971. An improved procedure using ferricyanide for detecting catalase isozymes. *Anal. Biochem.* 44: 301–305
- Wu, G., Wei, Z.K., Shao, H.B. 2007. The mutual responses of higher plants to environment: physiological and microbiological aspects. *Biointerfaces* 59: 113-119
- Xiang, Y., Tang, N., Du, H., Ye, H., Xiong, L. 2008. Characterization of OsZIP23 as a key player of the basic leucine zipper transcription factor family for conferring abscisic acid sensitivity and salinity and drought tolerance in rice. *Plant Physiol.* 148:1938–1952.
- Xing, Y., Jia, W.S. and Zhang, J.H. 2008. AtMKK1 mediates ABA-induced CAT₁ expression and H₂O₂ produced via AtMPK6-coupled signaling in *Arabidopsis*. *Plant J.*54:440–451.
- Yang, C., Li, A.L., Zhao, Y.L., Zhang, Z.L., Zhu, Y.F., Tan, X.M., Geng, S.F., Guo, H.Z., Zhang, X.Y., Kang, Z.S., Mao, L. 2011. Overexpression of a wheat *CCaMK* gene reduces ABA sensitivity of *Arabidopsis thaliana* during seed germination and seedling growth. *Plant Mol Biol Rep.* 29:681–692.
- Yang, J., J. Zhang, Z. Wang, Q. Zhu and W. Wang. 2001. Remobilization of carbon reserves in response to water deficit during grain filling of rice. *Field Crops Res.* 71: 47-55.
- Yang, W.-J., Rich, P.J., Axtell, J.D., Wood, K.V., Bonham, C.C., Ejeta, G., Mickelbart, M.V., Rhodes, D. 2003. Genotypic variation for glycine betaine in sorghum. *Crop Sci.* 43:162–169
- Ye, N., Jia, L., Zhang, J., 2012. ABA signal in rice under stress conditions. *Rice.* 5:1–9.
- Ye, N., Zhu, G., Liu, Y., Li, Y and Zhang, J., 2011. ABA Controls H₂O₂ Accumulation Through the Induction of *OsCATB* in Rice Leaves Under Water Stress . *Plant Cell Physiol.* 52: 689–698.
- Yeo, A. 1998. Molecular bology of salt tolerancein the content of whole-plant physiology. *J. Exp Bot.* 49: 913-929.
- Yemm, E. and Willis A., 1954. The estimation of carbohydrates in plant extracts by

- anthrone. *Biochem J.* 57:5.08–514.
- Yoshida, S., 1981. *Physiological analysis of rice yield*. Los Banos, Philipipines. IRRI. pp. 231-251
- Yuan, L.P. 1998. *Hybrid rice breeding in China*. In S.S Virmani., E.A Siddiq., K. Muralidharan (eds). *Advances in hybrid rice technology*. Proceedings of the Third International Symposium on Hybrid Rice, Hyderabad, India, 14 –16 November 1996. Los Baños, the Philippines: IRRI, pp 27–33.
- Zhang, J., X. Sui, B. Li, J. and Zhou, D. 1998: An improved water-use efficiency of winter wheat grown under reduced irrigation. *Field Crops Res.* 59 91–98.
- Zhu, D., Scandalios, J.G. 1994. Differential accumulation of manganese-superoxide dismutase transcripts in maize in response to abscisic acid and high osmoticum. *PlantPhysiol.* 106:173–178.
- Zhu, J. K. 2002: Salt and drought stress signal transduction in plants. *Annu. Rev. Plant Biol.* 53:247–273.
- Zhu, G., Ye, N. and Zhang, J. 2009. Glucose-induced delay of seed germination in rice is mediated by the suppression of ABA catabolism rather than an enhancement of ABA biosynthesis. *Plant Cell Physiol.* 50:644–651.
- Zhu, Q., Zhang, Z., Yang, J., Wang, Z. 1997. Source-sink characteristics related to the yield of inter-subspecific hybrid rice. *Sci. Agr. Sin.* 30:52–59.
- Zhu, T., Budworth, P., Chen, W., Provart ,N., Chang, H.S., Guimil, S., Su, W., Estes, B., Zou, G., Wang, X. 2003. Transcriptional control of nutrient partitioning during rice grain filling. *Plant Biotechnol J.* 1:59–70.
- Zhang, J., Jia, W., Yang, J., Ismail A.M. 2006: Role of ABA in integrating plant responses to drought and salt stresses. *Field Crops Res.* 97: 111–119.
- Zhang J, Kirkham MB.1996. Antioxidant responses to drought in sunflower and sorghum seedlings. *New Phytol.* 132: 361–373.