SPESS

U.S. Department of Agriculture **Accomplishments Report AD-421** U.S. Dept. of Agriculture, State Agricultural Experiment Stations and Other Institutions			Date (Month, Day, Year) 03/19/2012
1. Accession 0218250	Agency Identification No. 2. CSREES 3. LA.B	5. Work Unit/Project No. **LAB93984**	6. Status **Annual Report**

7. Title

Genetic Improvement of Native Plant Species for Coastal Restoration in Lousiana

12. Investigator Name(s) (Last Name and Initials)

Subudhi, P. K.

20. Termination Date 05/31/2014	40. Period Covered (mo/da/year): 01/01/2011 TO 12/31/2011

Outputs:

Research of genetic diversity in smooth cordgrass using molecular markers and use of a stress related gene from smooth cordgrass to improve salinity tolerance in rice was presented in ASA-CSSA-SSSA International Annual Meeting, San Antonio, TX, and Plant and Animal Genome XIX conference, San Diego, CA, respectively. One review paper and two book chapters discussed approaches for improving abiotic stress tolerance and the potential of Spartina alterniflora as a source for useful genes for crop improvement.

Outcomes/Impacts:

Forty one rice and Spartina alterniflora microsatellite markers were identified to fingerprint sea oats accessions. A survey of 144 sea oats accessions using these markers revealed that accessions did not cluster according to the state of origin. The role of one salinity up-regulated gene from smooth cordgrass, plasma membrane protein3 (SaPMP3), was evaluated for salt tolerance in the rice variety, Cocodrie. A genetic complementation test using a mutant yeast strain indicated the conserved role of this gene under salinity. Similarly, over expression of SaPMP3 in wild type yeast strains enhanced salt tolerance. The expression of SaPMP3 also conferred salt tolerance in transgenic rice plants. Following a floating leaf disc assay and chlorophyll estimation, the T2 homozygous SaPMP3-rice plants showed less bleaching and retained more chlorophyll than wild-type plants at both 100 mM and 150 mM NaCl. SaPMP3-rice seedlings survived wilting and drying symptoms at 100 mM NaCl in hydroponics. Smooth cordgrass could be a potential source of genes for enhancing salt tolerance in rice and other cereal crops. An ubiquitin-conjugating gene (SaUbq2) from S. alterniflora, whose expression was differentially regulated by salinity, dehydration, cold and exogenously supplied ABA in both root and leaves of S. alterniflora from 30 min to 72 h of stress, was obtained to explore its role in abiotic stress tolerance. Yeast complementation analysis using a yeast UBC mutant, RAD2, indicated the functional conservation of SaUbq2 and RAD2. SaUbq2 was localized into cytosol as well as in nucleus. SaUbq2 was constitutively overexpressed under 35S promoter in Arabidopsis and T3 homozygous transgenic lines expressing SaUbq2 transcripts and was used to further study study salinity and drought tolerance. Arabidopsis plants overexpressing SaUbq2 were more tolerant to salinity and drought stresses compared with wild-type plants. SaUbq2 Arabidopsis plants retained more chlorophyll than the wild-type under both drought and salt stress conditions. Constitutive expression of SaUbq2 increased expressions of selected stress responsive genes in SaUbq2 Arabidopsis under non-stress conditions, whereas the expressions of other stress-responsive genes such as, ABF3 (ABA responsive gene) were not affected. These results suggested the role of SaUbq2 for improved salt and drought stress tolerance in plants is most likely through ABA independent pathway. Application of molecular markers will aid genetics and breeding investigations leading to development of improved coastal plants. Identification and characterization of abiotic stress tolerance genes from Spartina alterniflora will help design crop plants with improved stress tolerance.

Publications:

Subudhi P.K., and N. Baisakh. 2011. Spartina alterniflora Loisel., a halophyte grass model to dissect salt stress tolerance. In Vitro Cell Dev Biol Plant 47:441-457.

Karan, R., and P.K. Subudhi. 2011. Approaches to increasing salt tolerance in crop plants. In: Abiotic stress responses in plants: metabolism to productivity, P. Ahmad and M.N.V. Prasad (eds.), ISBN 978-1-4614-0633-4, Springer Science Business Media, LLC, 233 Spring Street, New York, NY 10013, USA, pp 63-88.

Subudhi, P.K. 2011. Omics Approaches for Abiotic Stress Tolerance in Plants. In: E-book Omics and Plant Abiotic Stress Tolerance (eISBN: 978-1-60805-058-1), N. Tuteja, S.S. Gill and R. Tuteja (eds.). Bentham Science Publishers Ltd. doi:

10.2174/97816080505811110101, pp. 10-38.

Bernaola L, M.Venkata, C. Knott, S. Harrison, M. Materne, P. Subudhi, and N. Baisakh 2011.Genetic diversity of smooth cordgrass (Spartina alterniflora Loisel) collections in Louisiana. ASA-CSSA-SSSA International Annual Meeting, Oct 16-19, 2011, San Antonio, TX, Poster Abstract No. 221-2.

Baisakh N., M.V. Ramana Rao, K. Rajasekaran, P. Subudhi, J. Janda, D. Galbraith, C. Vanier, and A. Pereira. 2011. A vacuolar proton pump (SAVHAc1) from halophyte Spartina alterniflora confers salt-tolerance phenotype in transgenic plants through various physiological adjustments. Plant and Animal Genome XIX, San Diego, CA, Jan 15-19, 2011. Abstract p: 251 (Poster No. 730).

Participants:

P.K. Subudhi (PI), R. Karan, H. Biradar, LSU AgCenter.

Target Audiences:

Coastal restoration managers, Researchers involved in coastal restoration science and abiotic stress tolerance.

Project Modifications:

Nothing significant to report during this reporting period.

Approved (Signature)	Title	Date