

Interspecific hybridization between *O. sativa* L and *Oryza coarctata* (*Roxb*) *tateoka*, the only salt-loving plant from genus *Oryza*, for developing highly salt tolerant Rice

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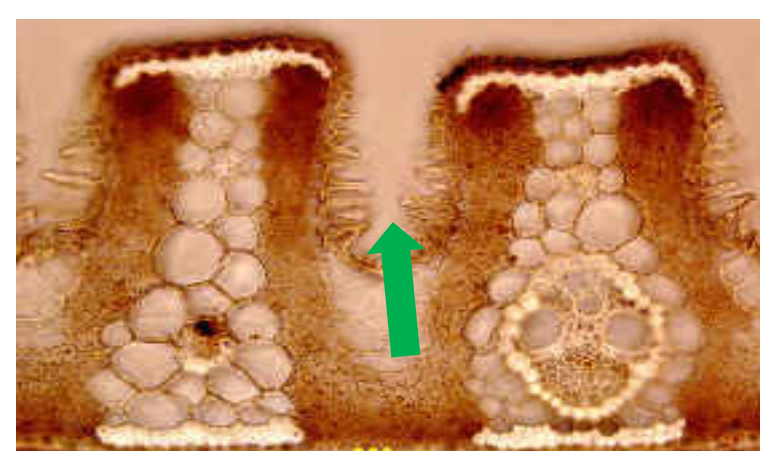
Purpose: To develop rice lines by forcefully transferring some salt tolerance characteristics of wild halophyte *O. coarctata* (Oc) into rice (*O. sativa*) by interspecific hybridization.

Methods: Two major challenges in this hybridization were *O. coarctata* is genetically distant from rice (AA chromosome type vs KKLL) and it is tetraploid (48 chromosomes), while rice is diploid (24 chromosomes). To overcome the ploidy problem, we have used an induced tetraploid (4n) of local rice varieties Latisail (*O. sativa*) as mother, previously produced by our lab.

Results: We have been able to create some partial hybrids with various characteristics like very short in length, no midrib in leaf like *O. coarctata*. The putative hybrids have been backcrossed with *O. coarctata* repeatedly to retain genomic introgression. Two of the best hybrids have been genome sequenced by Illumina and found small introgression from *O. coarctata* in chromosome 3 and 12. The introgression is confirmed by *O. coarctata* genome specific primers and sanger sequencing.

O. coarctata as a unique source for abiotic stress tolerance characteristics

- Happily grows in upto **400 mM salt**, whereas *O. sativa* dies at 80 mM salt
- Leaves contain **salt hairs**.
- **15158 genes** involved with salinity and submergence have been identified (Garg et al. 2011)
- Genome size **665 Mb** (*O. sativa* genome size **466 Mb**).
- Can set **rice like grain**, only few
- Propagate through **Rhizome**.



O. coarctata salt hairs at 300 mm NaCl

Molecular characterization of putative hybrids

Two introgression from *O. coarctata* has been found in hybrids by Illumina genome sequencing at

1. ChrK03:25,427,000-25,449,000
2. ChrK12:1,941,000-1,963,000

Twelve pairs of primers were designed from the introgression regions and two of primers has confirmed the introgressions in two hybrid lines.

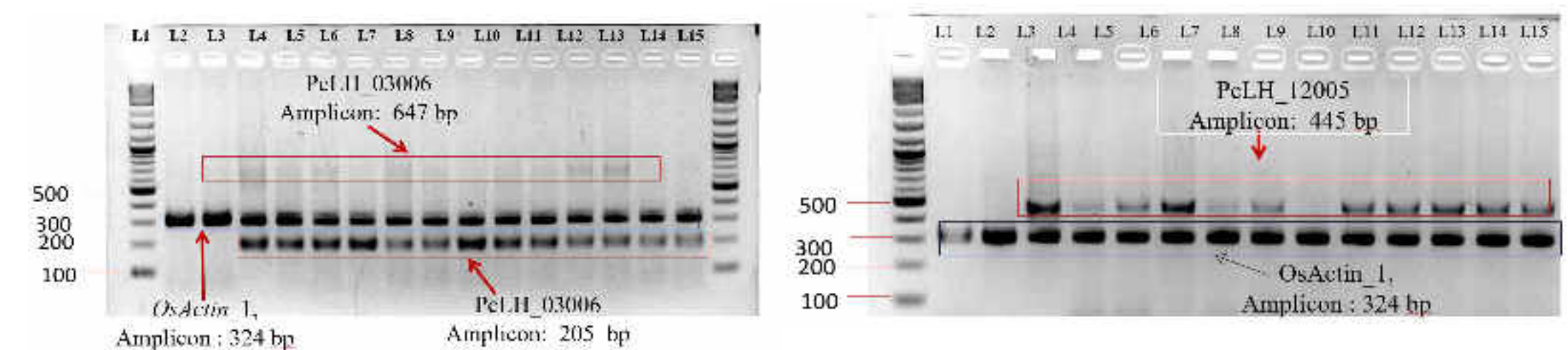
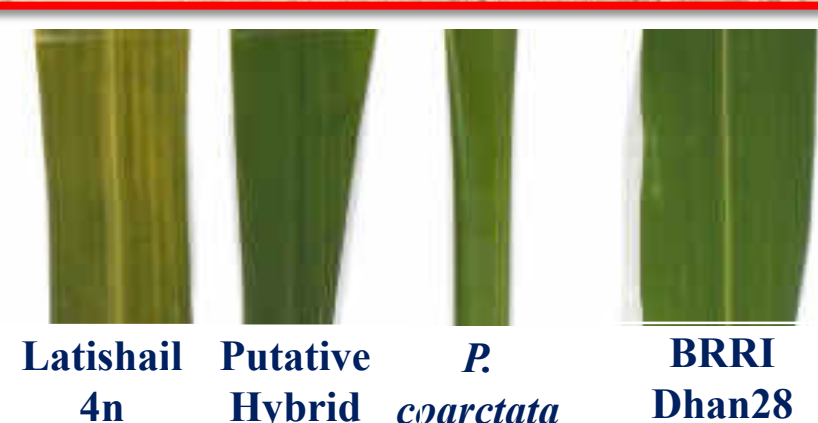
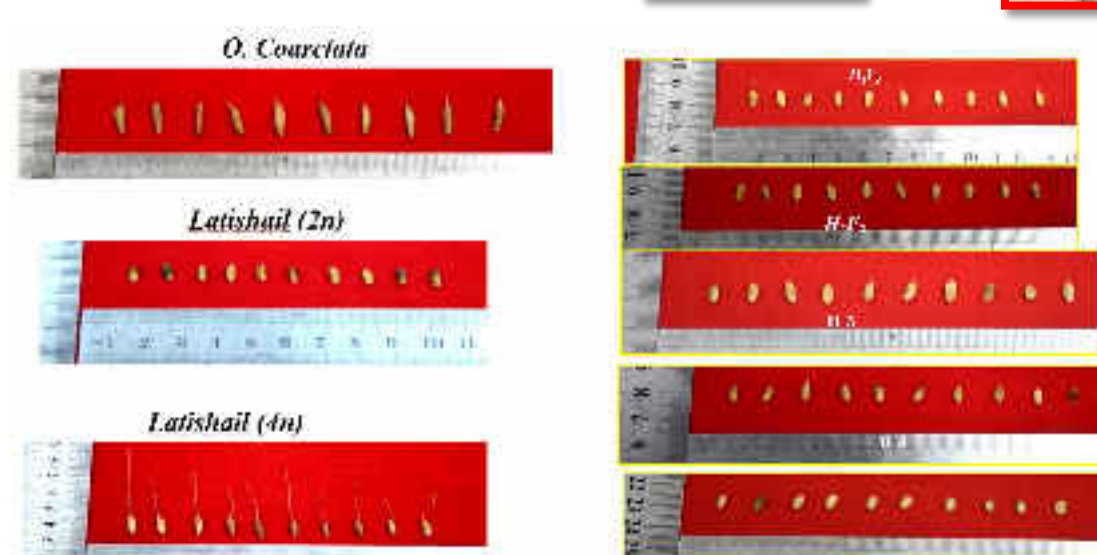
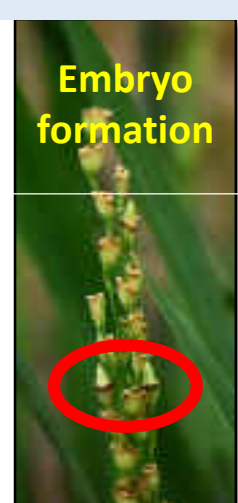


Fig : A) *O. coarctata* chr 03 specific marker PcLH_03006 (band size 647bp and 205bp) B) chr 12 specific marker PcLH_12005 (band size 445bp) amplification in hybrid lines. L1=1Kb+ ladder, L2= Os2n, L3=Os4n, L4= Oc, L5-L14= hybrid lines. OsActin_1 has been used as housekeeping gene for all plants.

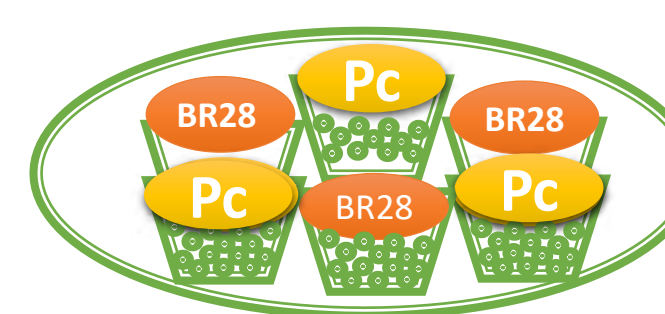
Phenotypic characterization of putative hybrids

O. coarctata pollen brush into mother Os4n



Leaf of putative hybrid is stronger and has no midrib

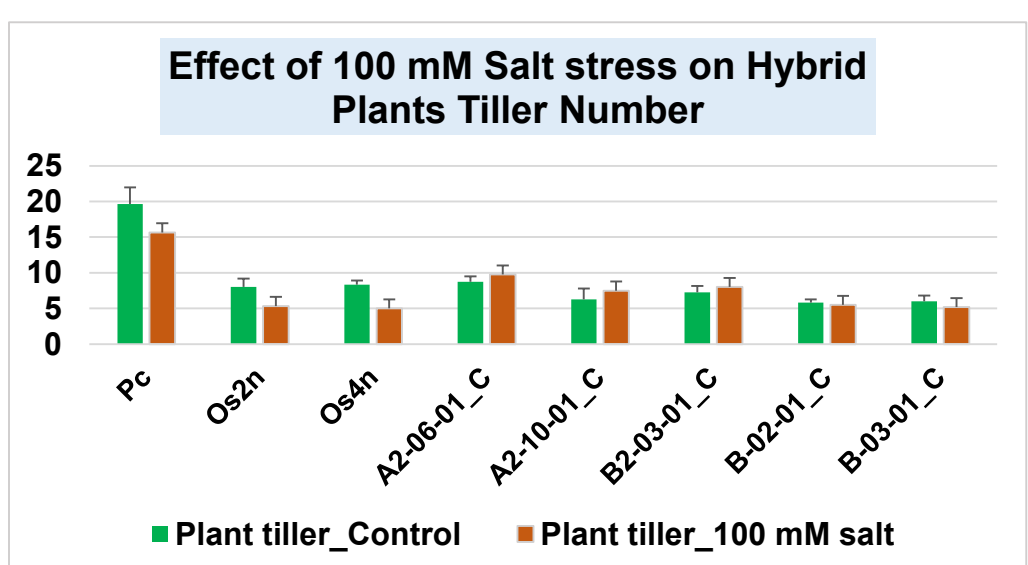
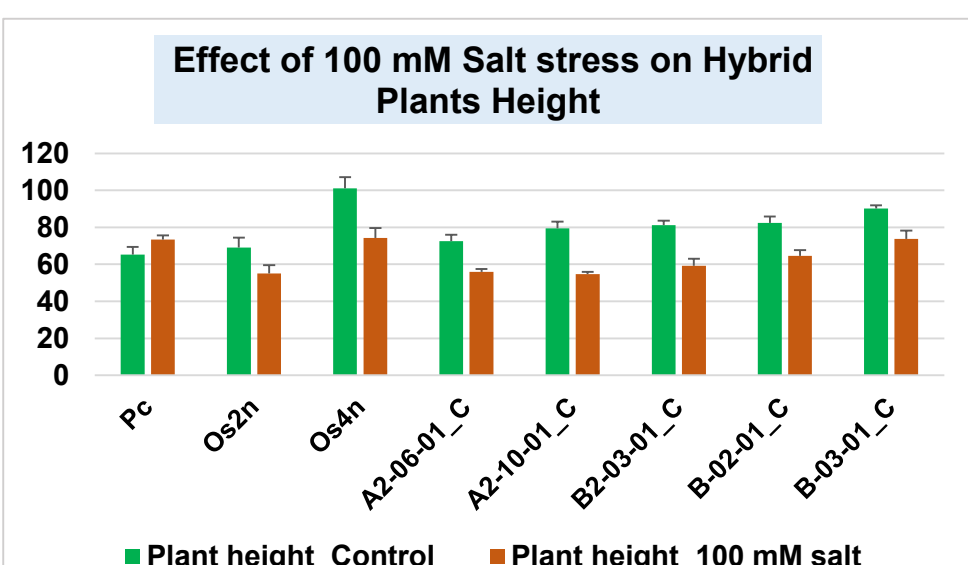
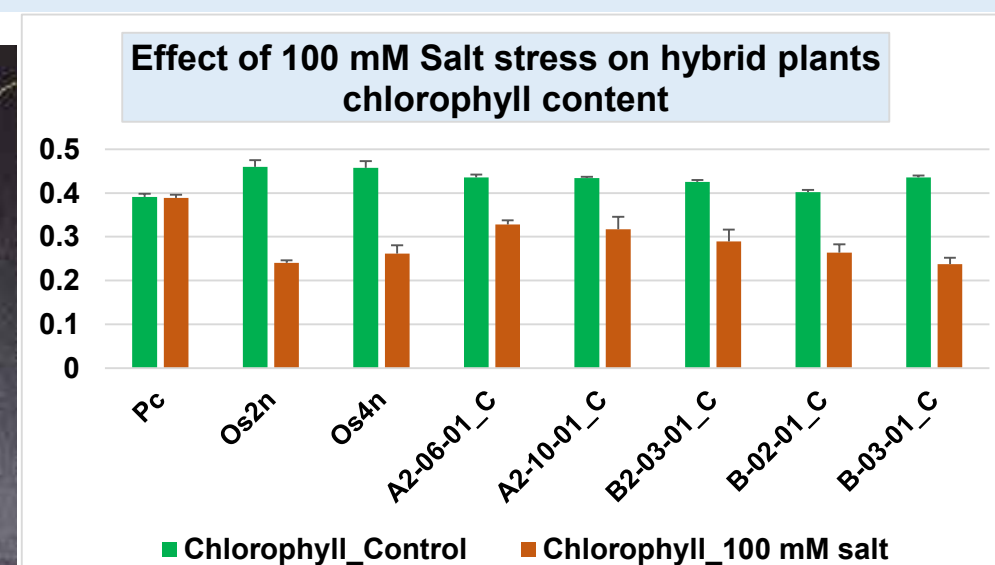
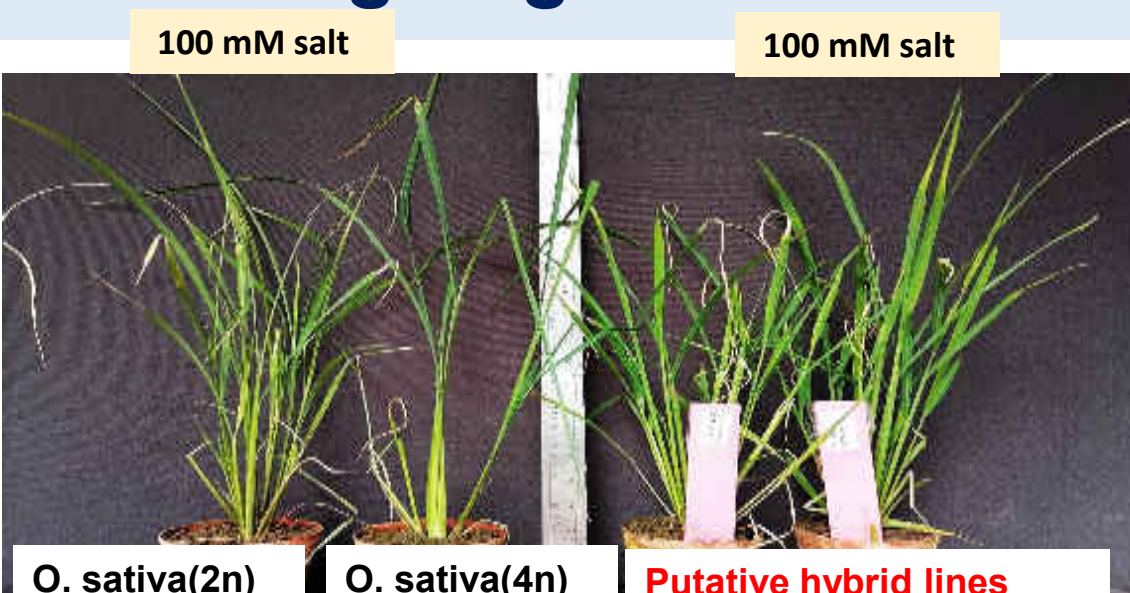
Use of the desalinization ability of *O. coarctata* to grow sensitive BRR1 Dhan 28



Control condition 100 mM salt 100 mM salt



Seedling stage salt-stress screening of putative hybrids



Publications

1. Anatomical and Karyotypic Comparison of Induced tetraploid of *Oryza sativa* var Latisail with the Allotetraploid Halophytic Wild Rice *Oryza coarctata* (*Roxb.*) *Tateoka* (Genetic Resources and Crop Evolution. 2022 Dec 13:1-9.
2. Characterization of Progenies from Intergeneric Hybridization Between *Oryza sativa* L. and *Porteresia coarctata* (*Roxb.*) *Tateoka*, Plant Tissue Culture and Biotech, vol.27(1), pp.63-72, 2017.

Future Prospects

1. The partial hybrids are now under reproductive salt-stress screening.
2. The desalinization ability of *P. coarctata* can be used for our coastal management, which will be helpful to grow any crop. (Field trial is ongoing).

Acknowledgement

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