

# IDENTIFICATION OF QUANTITATIVE TRAIT LOCI FOR SALINITY TOLERANCE TO RICE IN AN ADVANCED BACKCROSS POPULATION DERIVED FROM TWO INDICA VARIETIES, BOILAM AND BRRI DHAN 27.

H.B. Shozib<sup>1</sup>, M.J. Thomson<sup>2</sup>, M. S. Rahman<sup>3</sup>, M.A. Salam<sup>4</sup>, A.M. Ismail<sup>2</sup> and Z.I. Seraj<sup>1\*</sup>

<sup>1</sup>Department of Biochemistry and Molecular Biology, University of Dhaka, Dhaka-1000, Bangladesh. <sup>2</sup>Crop and Environment Science Division (CESD), IRRI, Philippines. <sup>3</sup>Plant Physiology Division, BRRI, Gazipur-1701, Bangladesh <sup>4</sup>Plant Breeding Division, BRRI, Gazipur-1701, Bangladesh. \*Corresponding author: Zeba I. Seraj (Ph.D.) Email & url: zebai@univdhaka.edu; www.univdhaka.edu

Boilam is photoperiod insensitive and early maturing, unlike the salt tolerant rice landrace, Pokkali. Pokkali also shows poor heritability of salt tolerance traits in innumerable breeding efforts in SE Asia. This investigation was designed to identify novel Quantitative Trait Loci (QTL) linked to salt tolerance traits of a Bangladeshi Aus

landrace, Boilam extensively grown in the mid South for possible introgression into modern rice varieties. BC<sub>2</sub>F<sub>2</sub> progenies from a cross between Boilam and farmer popular rice variety BR27 were developed. A total of 200 tolerant and sensitive BC<sub>2</sub>F<sub>2</sub> seedlings were genotyped by 108 SSR markers across the 12 rice chromosomes. QTLs were

identified using single-point analysis and interval mapping using QGene, version 3.0. A total of 4 QTLs were detected on chromosome 1, 9, and 12 using LOD > 3.0 as threshold. The range of R<sup>2</sup> value of the 4 QTLs was 19.57% – 25.81%. Salt tolerant BC<sub>2</sub>F<sub>3</sub> having the background genotype of BR27 will be developed further for release or

use as parents in breeding programs with the help of the markers-linked to the salt tolerance QTLs. QTL analysis for reproductive stage salt tolerance with 200 more BC<sub>2</sub>F<sub>2</sub> is now being conducted. This work should not only help in developing variant salt tolerant rice but also help to establish Boilam as a donor of novel salt tolerance traits.

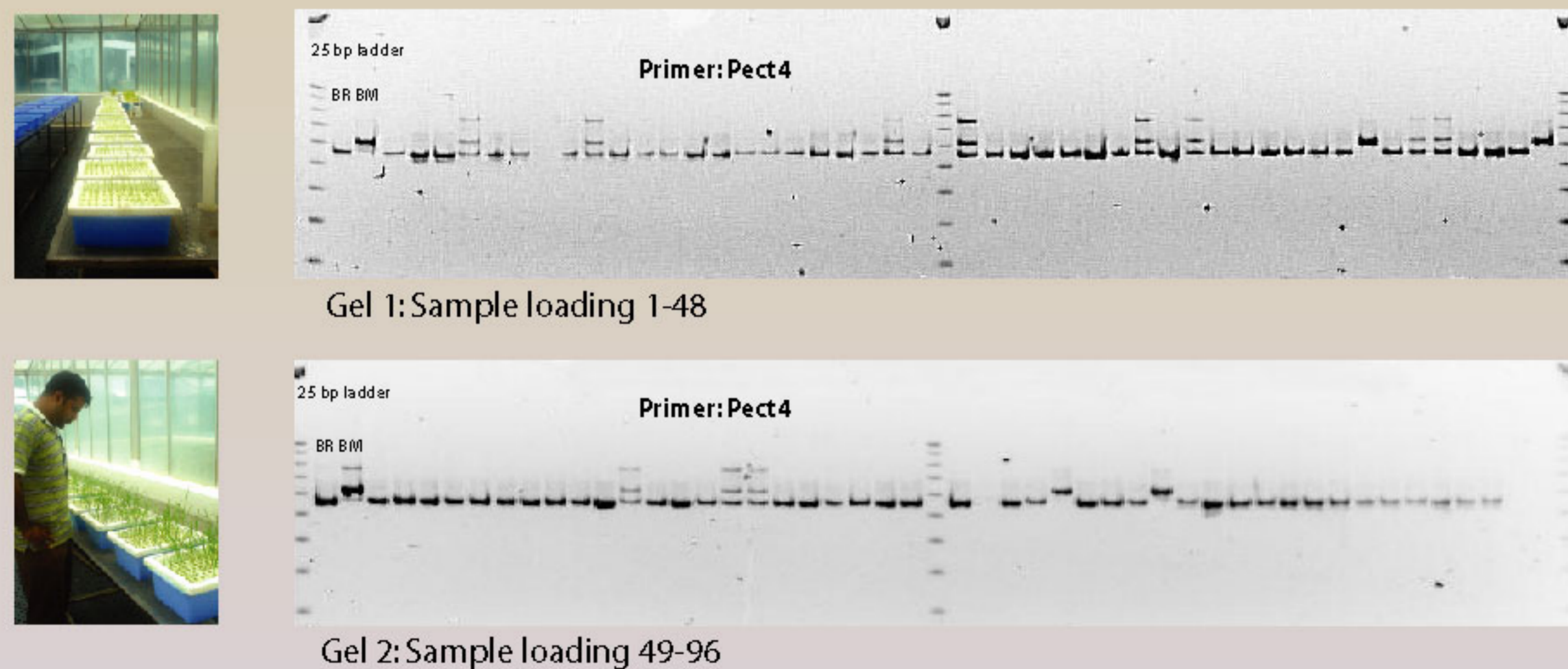
## Objectives

- § Identifying polymorphic SSR markers between BR27 and Boilam.
- § Phenotypic characterization of promising BC<sub>2</sub>F<sub>2</sub> and BC<sub>2</sub>F<sub>3</sub> progeny and genotyping of Boilam X BR27 derived backcross populations.

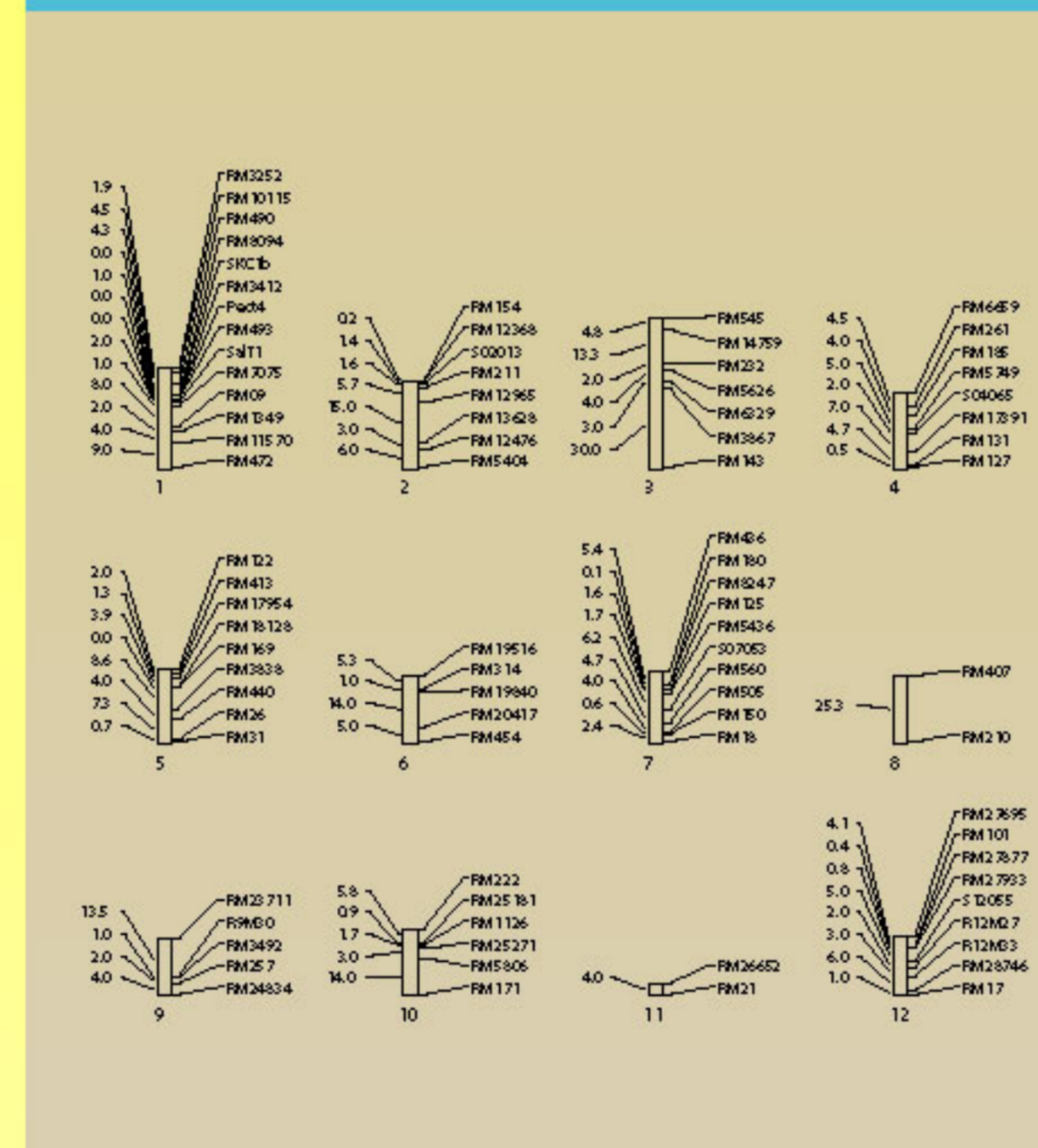
## Materials and Methods

200 BC<sub>2</sub>F<sub>2</sub> plants were evaluated for salinity tolerance under controlled conditions (29/21°C day/night temperature and ~70% RH). Pre-germinated seeds were sown on styrofoam floats with a net bottom suspended on trays filled with distilled water. Salt stress was imposed 14 d after germination by adding NaCl to an EC of 12 dS m<sup>-1</sup> in Yoshida nutrient solution. BRRI dhan27 (sensitive), and Boilam (tolerant) were used as checks. Entries were scored based on visual symptoms using IRRI's Standard Evaluation System (SES) scores. DNA extraction, PCR and PAGE were done. For reproductive screening, 200 BC<sub>2</sub>F<sub>3</sub> progenies are being evaluated for salinity tolerance at 6 dS m<sup>-1</sup> in Yoshida solution imposed before PI stage. Both phenotypic and genotypic studies are in process.

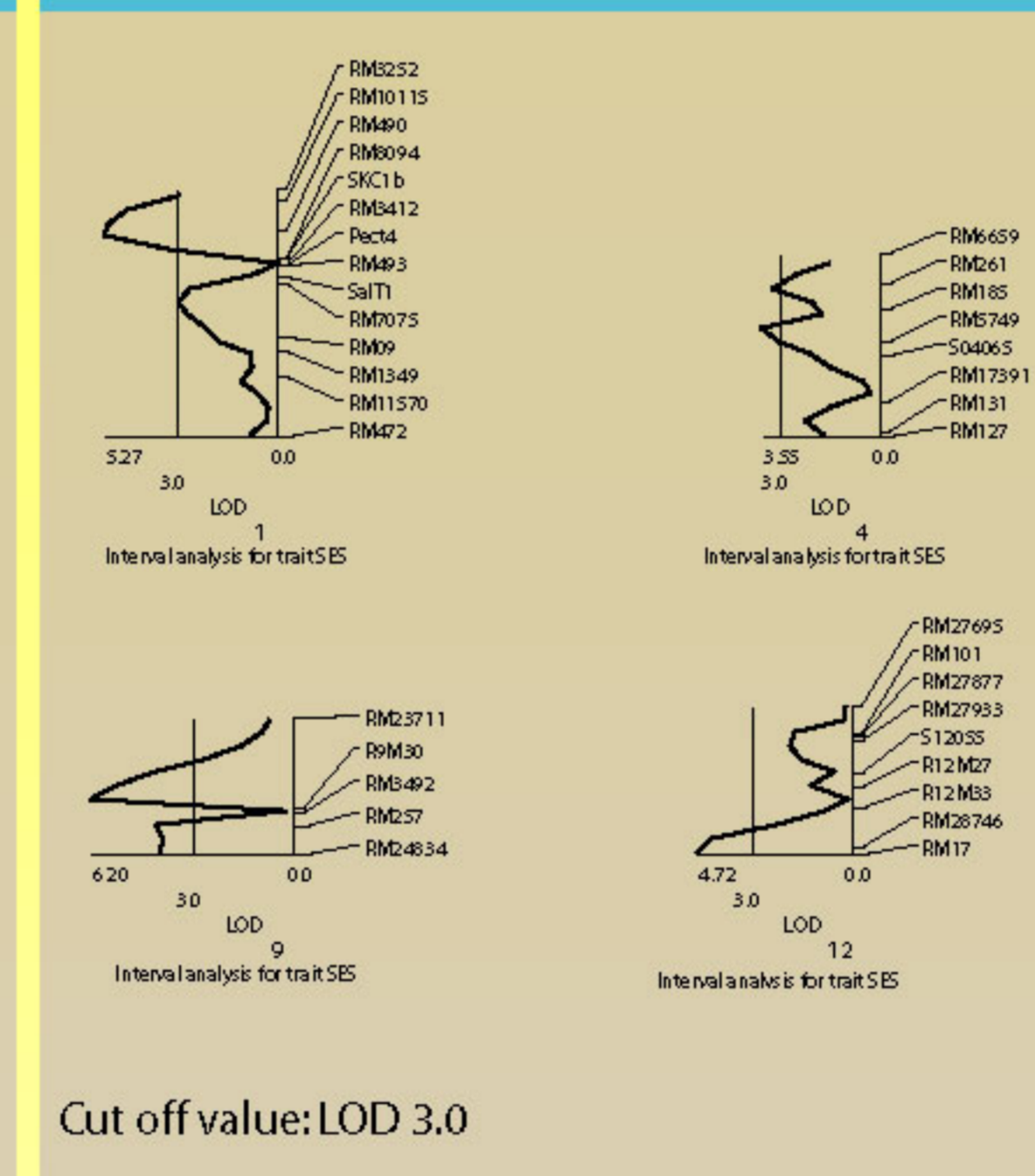
## Phenotyping and Genotyping of BC<sub>2</sub>F<sub>2</sub> at seedling stage



## Genetic Linkage Map of the population



## Identified QTLs at seedling stage



## Phenotyping of BC<sub>2</sub>F<sub>3</sub> at reproductive stage



Figure: Experiment setup for reproductive stage screening (Top row) 1: Seedlings at styrofoam 2: Seedlings at water bucket 3: Fencing support 4: 6 dS/m Salt stress at reproductive stage. Effects of salt stress during seed set (Bottom row) 5-6: Black seed 7-8: Degenerated spikelets.



## LOD statistic for trait SES Single-marker analysis by QGene

Marker	Chrom	F	RSq	LOD	P
R9M30	9	16.01	25.81	6.16	0
RM490	1	12.31	21.67	4.88	0
RM17	12	11.82	20.26	4.72	0
RM28746	12	11.31	19.57	4.54	0
RM257	9	10.46	18.36	4.23	0.0001
RM8094	1	9.24	16.58	3.78	0.0002
RM27877	12	9.24	16.58	3.78	0.0002
RM5749	4	7.2	13.4	3	0.0012

N.B. P-value significant at 0.1% level

## Work in progress

Results showed that the Boilam allele increases the tolerance to salinity during seedling stage at all detected QTLs. QTL analysis for reproductive stage salt tolerance with 200 more BC<sub>2</sub>F<sub>3</sub> is now being conducted. Salt tolerant BC<sub>2</sub>F<sub>3</sub> having the background genotype of BRRI dhan27 will be developed further for release or use as parents in breeding programs with the help of the markers-linked to the salt tolerance QTLs.