【Workshop 2】Crop Production under Heat Stress

Physiological and Molecular Approaches to Address Heat Tolerance during Anthesis in Rice

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In future climates, frequency of critical high temperatures coinciding with sensitive developmental stages like anthesis will increase in rice. To identify heat tolerant donors for future breeding programs 18 and 8 parents of existing major mapping populations with N22 as check were screened for heat tolerance at anthesis during 2004 and 2005, respectively using a novel spikelet marking protocol. N22 was consistently heat tolerant (71% spikelet fertility), IR64 moderately tolerant (48%) with Moroberekan being highly sensitive (18%). Different physiological processes including anther dehiscence, pollen germination on the stigma and in vivo rate of pollen tube length and both male and female reproductive organ morphologies in the above three genotypes were studied.

Anthers from all three genotypes were extracted from heat stressed and control spikelets and used for 2D gel electrophoresis. Proteins were separated on 3-10 and 4-7pH IPG strips and candidate genes responsible for significantly higher heat tolerance in N22 were compared to the other two genotypes. Some interesting proteins identified using in silico analysis included dirigent like protein, cold shock protein, serine protease along with heat shock proteins and 6 unknown proteins. However the protein sequences identified were from Nipponbare genome and hence complete sequences obtained from N22 are presently being used in in-depth allelic analysis of both the significant and unknown genes. These genes are targeted for transformation to know the level of contribution to heat tolerance and to identify the novel functions of the unknown genes which could play an important role in the existing pathways or to reveal new heat tolerance pathways.