Proceedings of the XLVIII Italian Society of Agricultural Genetics – SIFV-SIGA Joint Meeting
Lecce, Italy – 15/18 September, 2004
ISBN **88-900622-5-8**

Poster Abstract - D.49

TRANSCRIPTIONAL REGULATION OF RICE GSTs BY HERBICIDES AND SAFENERS

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Glutathione S-transferases, herbicides, rice, transcriptional profiling, Real Time RT-PCR

Glutathione S-transferases are multifunctional proteins encoded by large gene families, involved in xenobiotic detoxification and cell protection against a wide range of abiotic and biotic stresses. Plant GSTs belong to four main phylogenetic classes: Phi, Tau, Zeta and Theta. Phi class GSTs are well known for their protective action against herbicide toxicity, while the main role attributed to Tau class GSTs is to counteract oxidative stress damage.

We have recently isolated and characterized (Soranzo et al 2004, Mol. Genet. Genomics, DOI: 10.1007/s00438-004-1006-8) the entire rice GST gene family, consisting of 59 genes and 2 psudogenes: 39 Tau, 16 Phi, 3 Zeta, 2 Theta and 1 microsomal. So far only a few rice GSTs, all Phi type (Wu et al 1999, Physiol Plantarum 105: 102-108; Deng & Hatzios 2002, Pestic Biochem Physiol 72: 24-39; Deng et al 2003, Pesti Biochem Physiol 75: 25-37), have been characterized for their response to herbicides and safeners (compounds used to increase crops herbicide tolerance), and nothing is known about the vast majority of other family members, in particular it is uncertain if the most abundant class, the Tau, may have a role in herbicide detoxification.

To answer these questions we have undertaken a large scale analysis of the transcriptional response of rice GSTs to the herbicide Pretilachlor and its safener Fenclorim, which are routinely used in rice culture. 44 genes (14 Phi, 26 Tau, 2 Zeta, 1 Theta and the microsomal) were transcriptionally profiled, initially by DNA-macroarrays and subsequently by Real Time RT-PCR analysis. This second approach resulted less laborious and time consuming than DNA-macroarrays, and also yielded more consistent results. Seeds were germinated and seedlings grown hydroponically in controlled conditions for about 8 days prior to treatments (1 and 24 hours) with 15 micromolar Pretilachlor alone, 10 micromolar Fenclorim alone and an association of the two. The main findings are:

The transcription levels of a good number of both Phi and Tau, but not Zeta and Theta, GSTs are modulated by Pretilachlor and/or Fenclorim. 2) The association of herbicide and safener often results in a significantly stronger effect with respect to the single compounds, indicating a synergic rather than additive effect.

These results point to an important role in herbicide detoxification also for Tau GSTs, and suggest a molecular mechanism by which safeners may improve crop tolerance to several classes of herbicides.