THE LOW PHYTIC ACID1-241 MAIZE MUTATION ALTERS THE 
ACCUMULATION OF ANTHOCYANINS PIGMENT IN THE KERNEL


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Phytic acid (myo-inositol-1,2,3,4,5,6-hexakisphosphate, or InsP6) is the most plentiful form of phosphate in cereals kernel. Phytic acid is accumulated in the seed, in particular in the scutellum, as a mixed phytate salt of several cations such as potassium, iron, zinc, magnesium, etc. This molecule is degraded by phytase activity during seed germination releasing free phosphate, myo-inositol and cations, for seedling growth. Monogastric animals are not able to digest phytate salts that furthermore exhibit an anti-nutritional activity in the feed. For these reasons several breeding programs are developing cereals with lower level of phytic acid compared to traditional cultivar. Low phytic acid 1 (lpa1) mutants in maize have been described so far as the strongest mutations regarding phytic acid biosynthesis. These mutants don’t modify the total amount of seed P while reduced phytic acid content associated to a proportionally higher level of free phosphate. So the High Inorganic Phosphate phenotype (HIP), easily determined using Chen’s assay, is associated to a lpa1 mutant seeds. Transposon mutagenesis experiments conducted by Shi et al. in 2007 demonstrated that lpa1 gene codified for a Multidrug-Associated-Protein (MRP) named ZmMRP4 (accession number EF586878).

MRP proteins are transmembrane transporters involved in several functions such as organic ions transport, xenobiotic detoxification, oxidative stress tolerance and transpiration control.

In previous studies several mutations have been isolated in this locus causing a reduction of phytic acid content. In particular lpa1-241 mutation causes a reduction until 90% of phytic acid associated to strong pleiotropic effects on the whole plant.

In this work we found that lpa1-241 line, is able to alter the accumulation of anthocyanins in kernel tissues, in genotypes carrying all the genes for anthocyanins biosynthesis.

The anthocyanins are a class of secondary metabolites synthesised exclusively in plants having red coloured tissues, they are water soluble molecules and are present in glycosilated form inside the vacuole where their colour depends in part on the pH of this compart.

In this work we shown that lpa1-241 mutation enhances the accumulation of anthocyanins in the kernel conferring a blue colour of the scutellum in the lpa1-241 strongest mutant. Furthermore here we presented genetic, physiological, hystological and molecular data supporting the hypothesis.
that the change of anthocyanins colour is due by a defect in their transportation in the vacuole, causing the accumulation of these molecules in the cytosol.