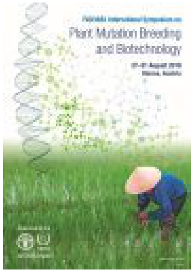

Contribution ID: **84** Type: **Oral**

THE BARLEY CHLOROPLAST MUTATOR (CPM) MUTANT IS AN EXTRAORDINARY SOURCE OF PLASTOME VARIABILITY

The plastome is usually considered a highly conserved genome. Its current variability is scarce and artificial induction of its variation is not yet sufficiently exploited. Compared to the nuclear genome, it is small and behaves under different genetic rules. Plastome genes have been little used in breeding and their functionalities have been difficult to investigate. Through different molecular methods (TILLING, candidate genes sequencing, amplicons massive sequencing and plastome re-sequencing) applied on barley chloroplast mutator (cpm) seedlings, we detected more than 60 polymorphisms affecting a wide variety of plastid genes and several intergenic regions. The genes affected belonged mostly to the plastid genetic machinery and the photosynthetic apparatus, but there were also genes like matK, whose functions are so far not clearly established. Among mutants, we found the first infA gene mutant in higher plants, two mutants in ycf3 locus and the first psbA gene mutant in barley. The latter is used at present to breed barley cultivars tolerant to PSII toxic herbicides. Most of the molecular changes were substitutions, and small indels located in microsatellites, which apparently originated in mutations. However, particular combinations of polymorphisms observed in rpl23 gene and pseudogene suggest that, besides an increased rate of mutations, an augmented rate of illegitimate recombination also occurred. Although a few substitutions were so far observed in the mitochondria of cpm plants, we have not yet determined the implications of the cpm in mitochondria stability. The spectrum of plastome polymorphisms highly suggests that the cpm gene is involved in plastid DNA repair, more precisely taking part of the mismatch repair system. All results show the cpm mutant as an extraordinary source of plastome variability for plant research and/or plant breeding. Besides, it looks as an interesting experimental material to investigate the mechanisms responsible for maintaining plastid stability.

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Track Classification: Enhancing agricultural biodiversity through new mutation induction techniques