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BRINGING TO LIGHT THE EPIGENETIC MEMORY OF STRESS RESPONSE IN MAIZE

FORESTAN C.*, FARINATI S.*, AIESE CIGLIANO R.**, VICELLI B.*, PAVESI G.***, ROSSI V.****, VAROTTO S.*

*) Department of Agronomy Animals Food Natural Resources and Environment (DAFNAE), University of Padova, Viale dell'Università 16, 35020 Legnaro (Italy)
**) Sequentia Biotech SL, Carrer L'Escar 9, 08039 Barcelona (Spain)
***) Department of Biosciences, University of Milan, Via Celoria 26, 20133 Milano (Italy)
****) CRA - Unità di Ricerca per la Maiscoltura, Via Stezzano 24, 24126 Bergamo (Italy)

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In Eukaryotes, chromatin is extensively investigated as an important component of gene expression regulation during development and in response to environmental stimuli. However, chromatin is also the target of epigenetic studies that investigate whether gene expression patterns can be stably maintained during cell division and sexual reproduction, once the triggering stimulus has been removed. Plants are particularly prone to study somatic inheritance both for their sessile nature and their post-embryonic developmental strategy. There is good evidence that chromatin may play a pivotal role in somatic memory phenomena and although many progresses have been made in understanding chromatin modifications implicated in plant response to environmental triggering conditions, we are still far from connecting molecular genetics and developmental data around environment and chromatin.

In order to understand whether environmental memories are created and eventually propagated, we integrated transcriptional and epigenetic data from maize plants subjected to a mild and prolonged drought stress and after the complete recovery from the stress. We observed that extensive transcriptional changes present soon after the stress application were only partially reset after the recovery stage. Concomitantly, ChIP-Seq analyses revealed a direct correlation between transcriptional variation and H3K4me3 or H3K9ac histone modification enrichment at the majority of stress-regulated gene loci. The facultative heterochromatin mark H3K27me3 was instead associated to a few developmentally regulated genes misregulated by the applied stress. In addition, several stress-responsive genes in which histone marks variations persist after the recovery stage were identified, indicating a form of stress memory.

Based on the emerged fundamental role of epigenetic mechanisms in regulating stress response and adaptation we are further evaluating the identified targets in the progeny of the stressed plants and in plants subject to repeated stress pressure.