



Contribution ID : 28

Type : Oral

The Impact of Polyploidy and Hybridization on Gene Expression in Duckweeds

martedì 29 settembre 2026 15:15 (15)

Recent discoveries of extensive ploidy variation and natural hybridization have revealed an unexpected level of genomic diversity within duckweeds, particularly in the genus *Lemna*. Naturally occurring cytotypes include auto-triploids, auto-tetraploids, and diploid, triploid, tetraploid and aneuploid interspecific hybrids. This remarkable diversity provides a unique opportunity to investigate how genome duplication and hybridization shape transcriptional regulation. We first focus on the highly variable *Lemna aequinoctialis x perpusilla* hybrid species complex to examine how differences in ploidy level and subgenome composition influence the transcriptome. A selection of natural hybrid clones spanning multiple ploidy levels was exposed to salt stress for three weeks and subsequently profiled by RNA-sequencing, enabling us to assess how ploidy affects transcriptional responses to environmental stress. In particular, we examine patterns of expression level dominance, homoeolog expression bias, dosage and odd-even ploidy effects and regulatory divergence across hybrids. Complementing the hybrid study, we compare gene expression in diploid and colchicine-induced autotetraploid lineages of *Spirodela polyrrhiza* under a long-term mild salt stress regime, tracking transcriptional changes over many clonal generations. By comparing transcriptional responses at the onset and after prolonged mild salt exposure, we investigate how genome duplication influences the dynamics, stability, and plasticity of gene expression. Together, these studies demonstrate the potential of duckweeds as powerful model systems for investigating the molecular consequences of genome duplication and hybridization, and their roles in shaping plant responses to environmental stress.

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Scientific Session

Genes, Genomes and Evolution

Keywords

polyploidy, hybridization, transcriptome, Alatae, salt

References

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Session Classification : Genes, Genomes & Evolution I