



Contribution ID : 27

Type : Oral

Investigating the secondary loss of auxin signalling components in duckweed

martedì 29 settembre 2026 16:45 (15)

Evolutionary studies mainly focus on the acquisition of new traits in highly diversified plant lineages, with comparatively few studies showing how these traits have undergone secondary loss. Duckweeds provide a tractable system to address this within angiosperms, as they have gradually lost the ability to grow roots and vasculature. These lost traits are regulated by auxin in other angiosperms. The core auxin signalling network relies on three key protein families: AUXIN RESPONSE FACTORS (ARFs), AUXIN/INDOLE-3 ACETIC ACIDS (AUX/IAAs), and TRANSPORT INHIBITOR 1/AUXIN SIGNALLING F-BOX (TIR1/AFBs). During the evolution of land plants there have been expansions in the number of network components, creating a diverse network with high specificity of response. There have been many studies on how this network has evolved from algae to angiosperms, but no research how components have been lost secondarily. We found that there has been a reduction in the number of components across all duckweeds, however most subclades have been conserved, and that a wide panel of duckweeds respond to exogenous auxin in growth assays. We found that the rootless *Wolffia australiana* responds transcriptionally to auxin, although the genes that are induced are distinct from those induced in rooted duckweeds. This work shows a correlation between the loss of structural complexity and reduction of the auxin signalling network, which is the opposite of what is observed during the evolution of angiosperms. This positions duckweeds as a good model for research into secondary loss and provides a minimal system with low levels of genetic redundancy.

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Scientific Session

Genes, Genomes and Evolution

Keywords

auxin, evolution, secondary loss, transcriptomics

References

None

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Session Classification : Genes, Genomes & Evolution II