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## Duckweed Nanoparticles Mediate Bioactive Lipid Trafficking

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In the aquatic environment of Lemnaceae (duckweed), the mechanism for transporting hydrophobic bioactive signals through the aqueous medium remains a critical question. While bilayer extracellular vesicles (EVs) are established components in the plant apoplast, in this study, we identified a unique class of secretory nanoparticles (NPs) in duckweed exudate. Structural and omics profiling reveal that this distinct class of NPs represents not passive debris, but a dynamic metabolic hub enriched with lipid-trafficking proteins and enzymes associated with  $\beta$ -oxidation and the glyoxylate cycle. We demonstrate that the NPs' cargo composition is associated with the jasmonate (JA) pathway. Notably, downregulating the JA-biosynthetic gene allene oxide cyclase (AOC) expands the chemical diversity within the NPs, enriching the cargo with bioactive lipids. These NPs sequester approximately 38% of the total exudate lipid diversity, specifically partitioning long-chain triacylglycerols (TAGs) and sphingolipids. Functionally, the duckweed-derived NPs facilitate inter-kingdom crosstalk by promoting the growth of beneficial duckweed-associated bacteria while inhibiting non-beneficial taxa. Together, these findings suggest that non-vesicular NPs are a specialized biochemical strategy for duckweed to target its microbiome and traffic lipids in a complex aquatic rhizosphere.

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### Scientific Session

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Nanoparticles, Secondary metabolites, Rhizosphere

### References

- Acosta, K. et al. Return of the Lemnaceae: duckweed as a model plant system in the genomics and postgenomics era. *Plant Cell* vol. 33 Preprint at <https://doi.org/10.1093/plcell/koab189> (2021).
- Ishizawa, H. et al. Duckweed as an Emerging Model System for Plant–Microbiome Interactions. *Environmental Microbiology* vol. 27 Preprint at <https://doi.org/10.1111/1462-2920.70181> (2025).
- Yu, L., Fan, J., Zhou, C. & Xu, C. Sterols are required for the coordinated assembly of lipid droplets in developing seeds. *Nat. Commun.* 12, (2021).

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