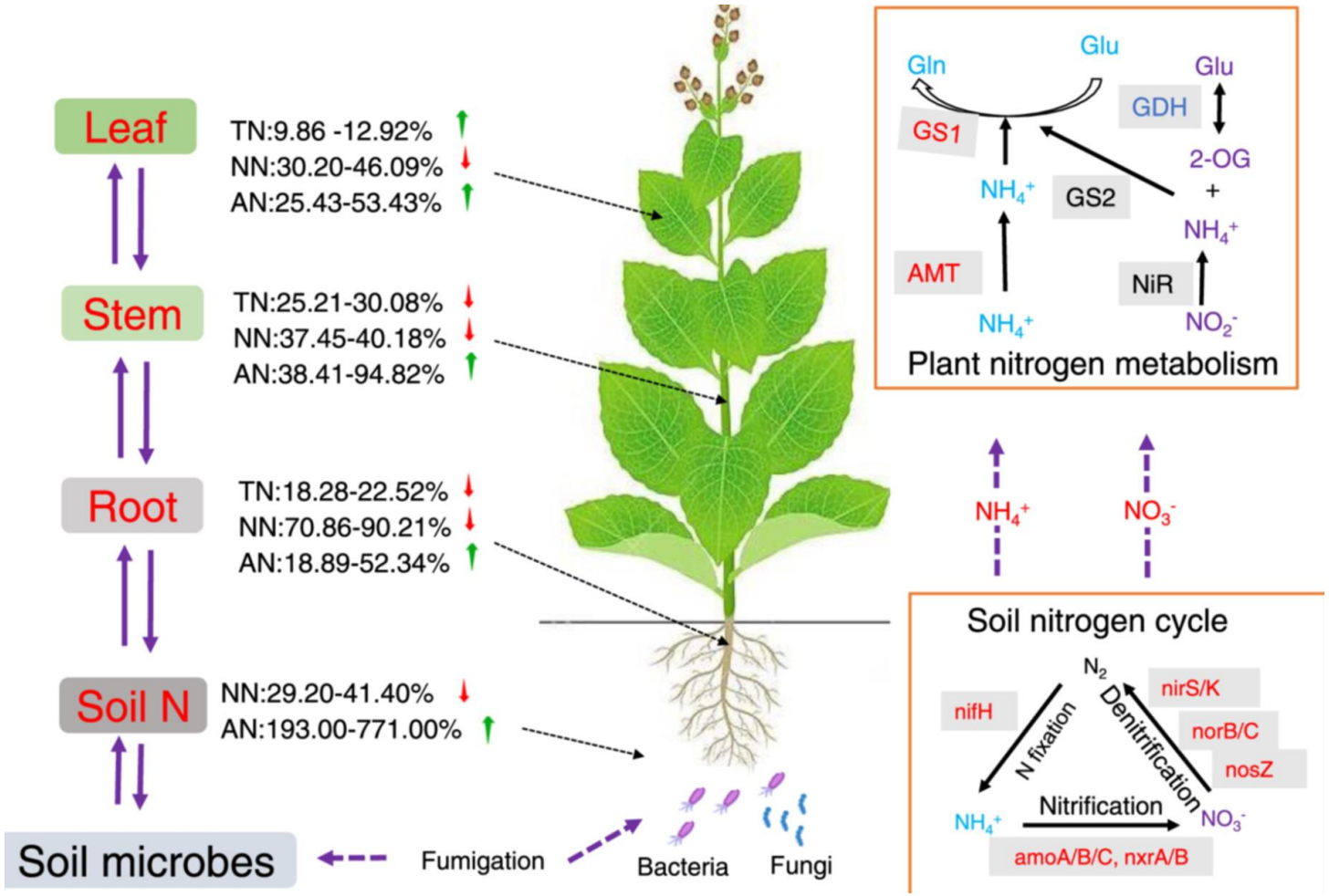
A synthetic community promotes macadamia growth via root-microbe interactions and systemic plant responses

Xiaofang Yao[1, 2], Qiumei Liu[1], Wenlin Wang[3],
Qiujin Tan[3], Chunheng Zhou[3], Dejun Li[1*]

[1]Institute of Subtropical Agriculture, Chinese Academy of Sciences
[2]Agricultural Genomics Institute at Shenzhen,
Chinese Academy of Agricultural Sciences
[3]Guangxi South Subtropical Agricultural Science Research Institute,
Guangxi Academy of Agricultural Sciences

Xiaofang Yao, Qiumei Liu, Wenlin Wang, Qiujin Tan, Chunheng Zhou, Dejun Li. 2026.
A synthetic community promotes macadamia growth via root-microbe interactions and systemic plant responses.
iMetaOmics 3: e70122. https://doi.org/10.1002/imo2.70122

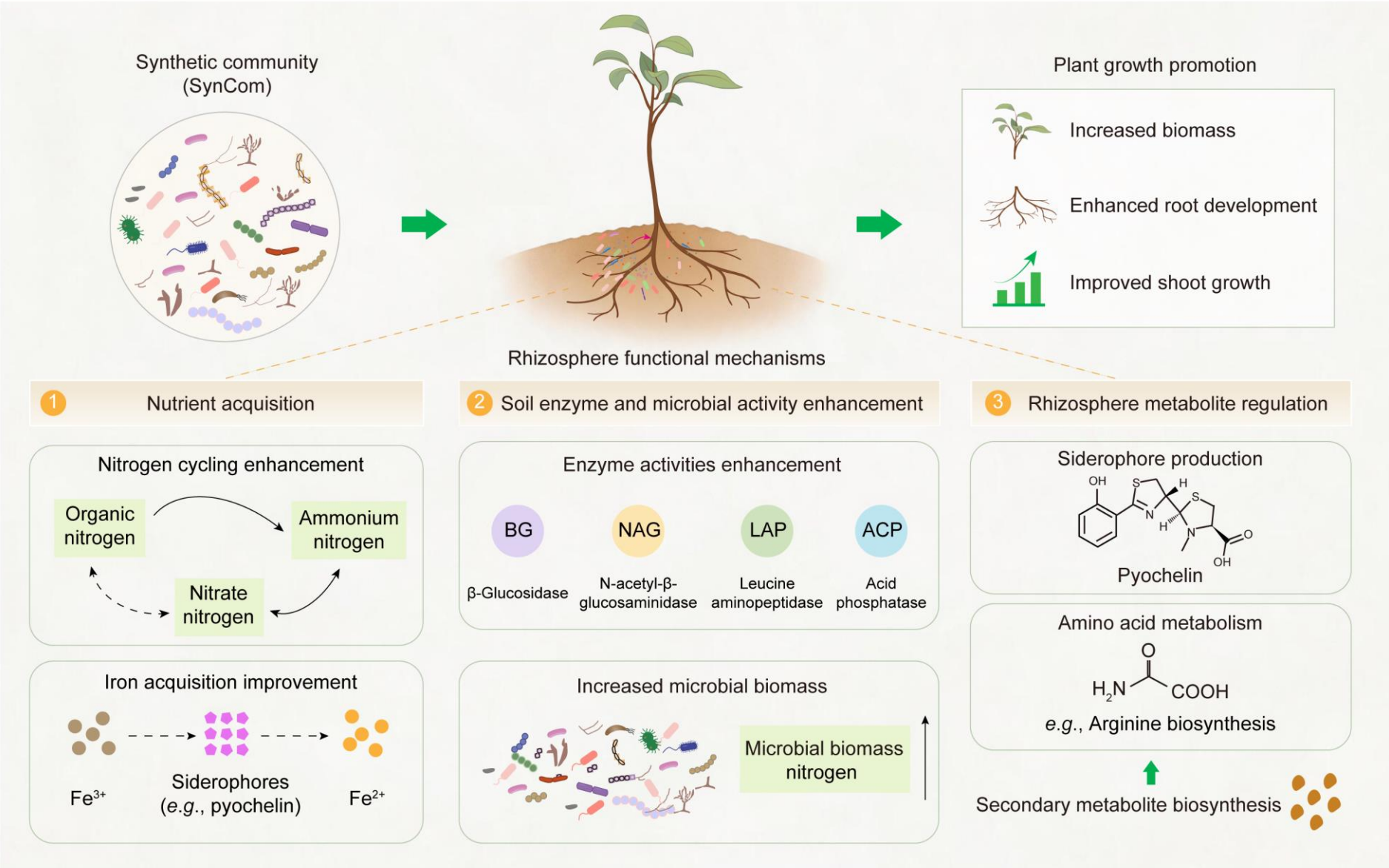
Introduction



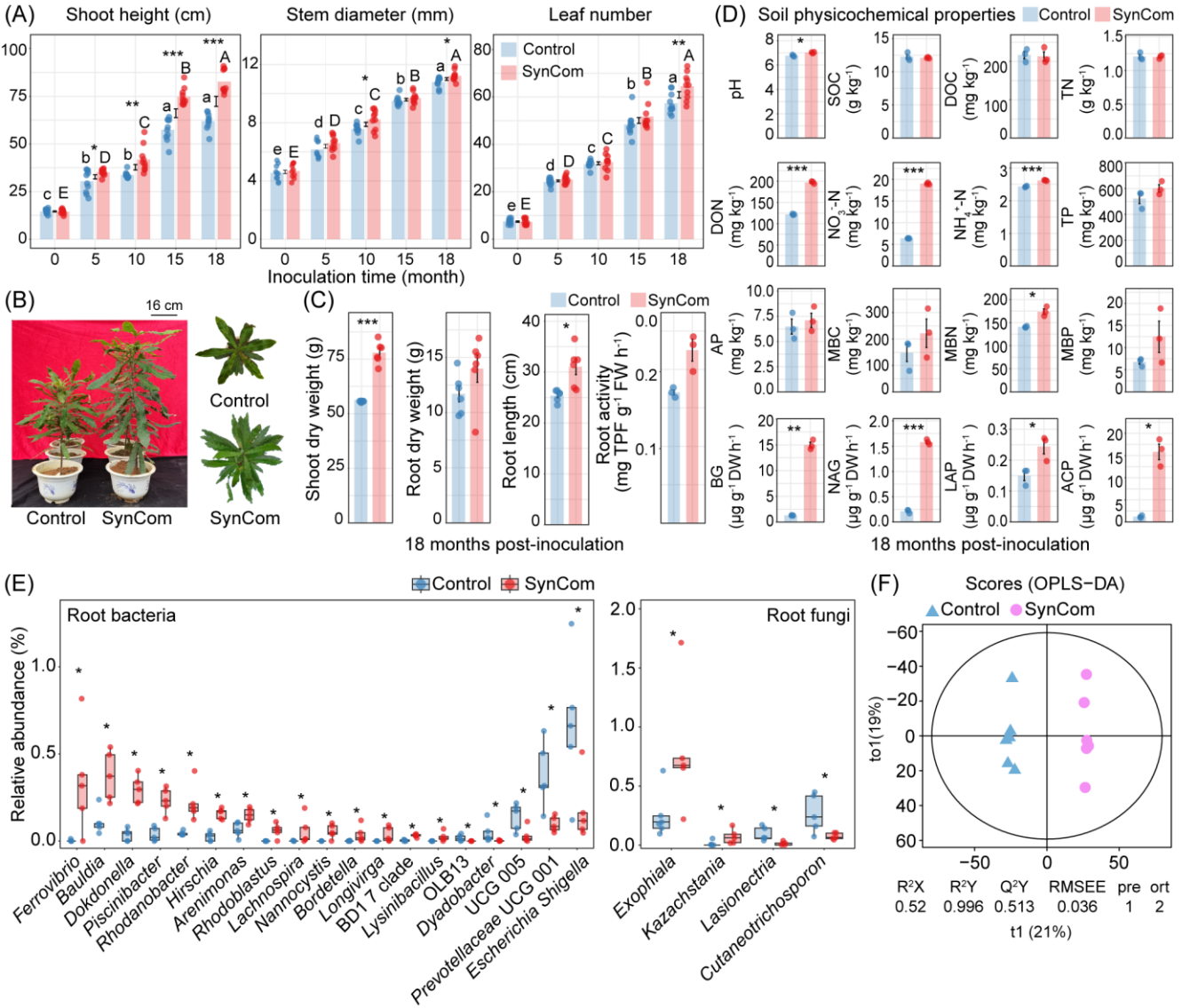
https://onlinelibrary.wiley.com/doi/full/10.1002/imo2.55

- Plant microbiome is the second genome of plants.
- SynComs are a promising strategy for sustainable agriculture.
- However, mechanisms underlying long-term SynCom-host interactions in perennial woody crops remain poorly understood.

Highlights

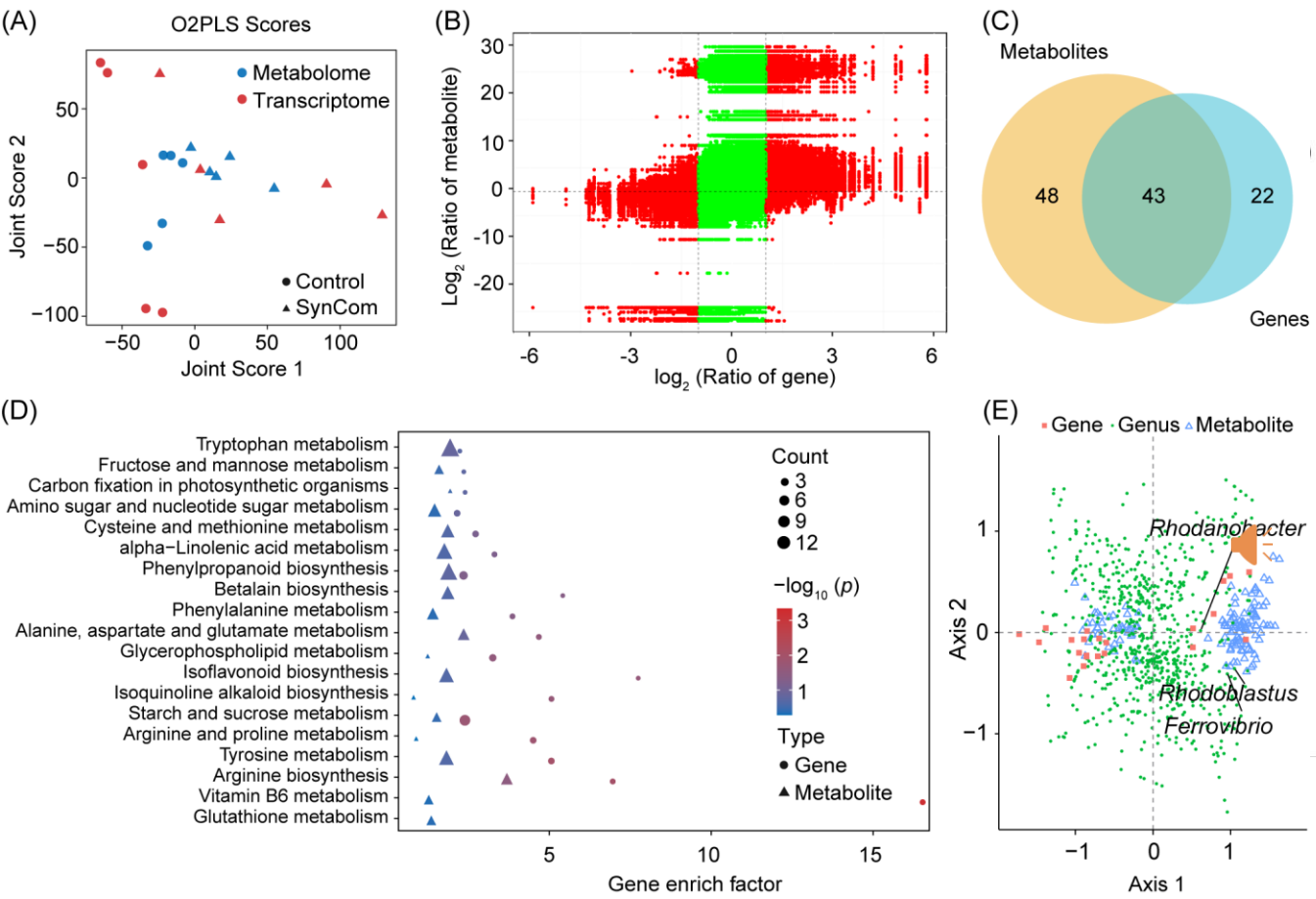

Synthetic community
(SynCom)
Plant growth promotion
Increased biomass
Enhanced root development
Improved shoot growth
Rhizosphere functional mechanisms
1 Nutrient acquisition
2 Soil enzyme and microbial activity enhancement
3 Rhizosphere metabolite regulation
Nitrogen cycling enhancement
Organic nitrogen
Ammonium nitrogen
Nitrate nitrogen
Enzyme activities enhancement
BG
NAG
LAP
ACP
β-Glucosidase
N-acetyl-β-glucosaminidase
Leucine aminopeptidase
Acid phosphatase
Siderophore production
Pyochelin
Iron acquisition improvement
Fe3+
Siderophores
(e.g., pyochelin)
Fe2+
Increased microbial biomass
Microbial biomass nitrogen
Amino acid metabolism
e.g., Arginine biosynthesis
Secondary metabolite biosynthesis

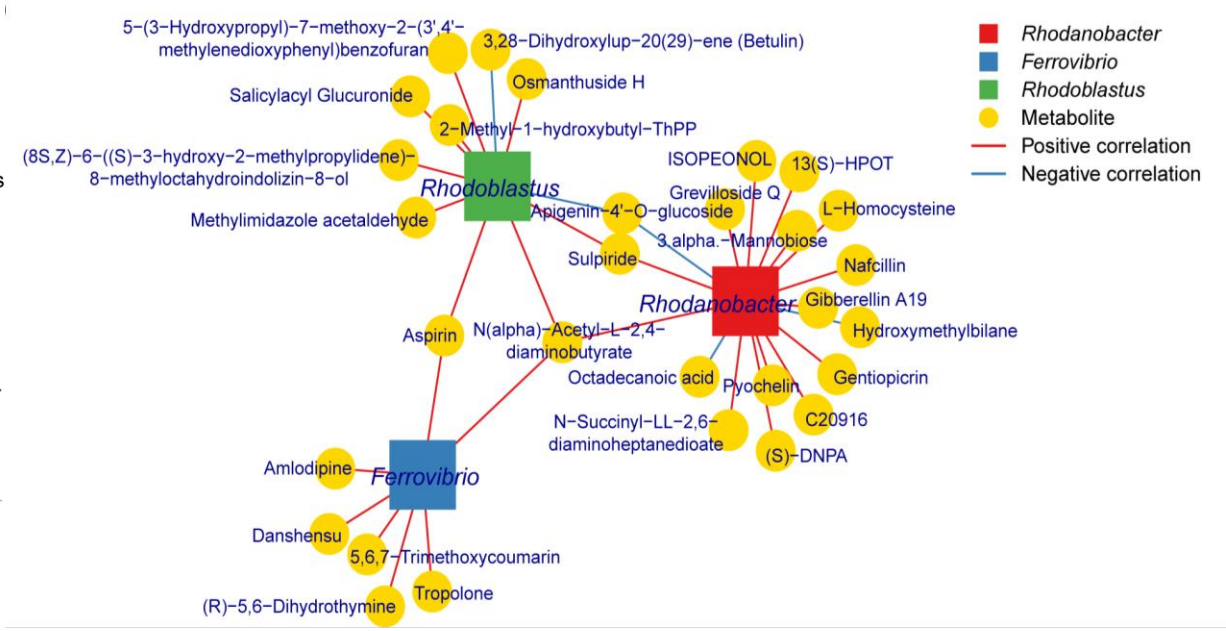
SynCom shapes macadamia growth, microbiome, and metabolome



- Promoting growth and nutrient cycling
- Reshaping microbial community
- Enhancing rhizosphere metabolic response

Multi-omics reveals host metabolism and transcription





- Integrated metabolomic and transcriptomic analysis
- Integrated microbiome, metabolomic and transcriptomic analysis

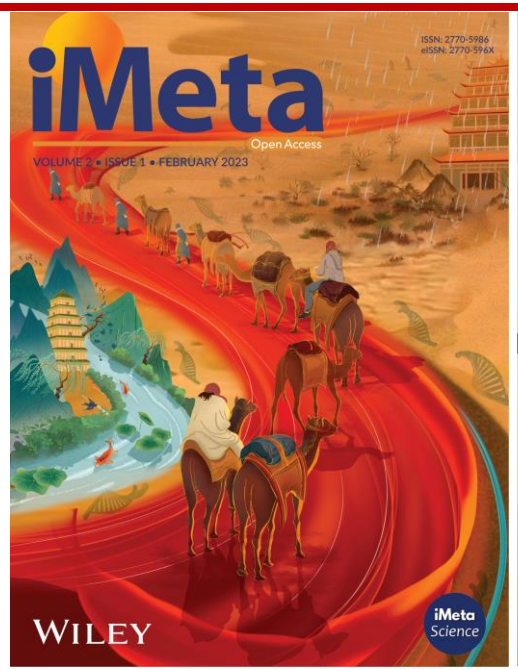
Summary

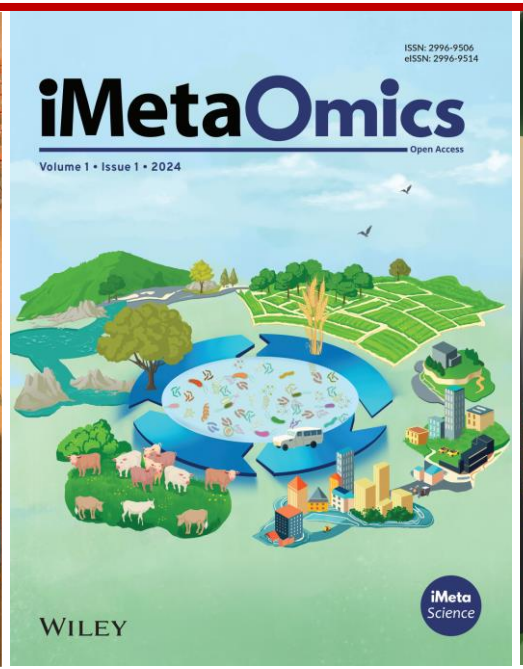
- In an 18-month pot experiment synthetic community (SynCom) enriched *Rhodanobacter*, *Ferrovibrio*, and *Rhodoblastus* in the root compartment.
- SynCom promoted the accumulation of rhizosphere metabolites such as the microbial siderophore pyochelin, and drove the co-enrichment of transcriptomic and metabolomic pathways, notably the arginine biosynthesis pathway.
- This coordinated response may have stimulated nitrogen and iron cycling in the soil and promoted the healthy growth of macadamia.

Xiaofang Yao, Qiumei Liu, Wenlin Wang, Qiujin Tan, Chunheng Zhou, Dejun Li. 2026.
A synthetic community promotes macadamia growth via root-microbe interactions and systemic plant responses.
iMetaOmics 3: e70122. https://doi.org/10.1002/imo2.70122

iMeta: Biology and Medicine in Info and Meta Era

WILEY





"***iMeta***" launched in 2022 by iMeta Science Society, impact factor (IF) **44.4**, ranking top 47/22643 in the world. It aims to publish innovative and high-quality papers with broad and diverse audiences. Its scope is similar to *Cell*, *Nature* and *Science*. Its unique features include video abstract, bilingual publication, and social media with 800,000 followers. Indexed by **SCIE/ESI**, **PubMed**, **Google Scholar** etc.

"***iMetaOmics***" launched in 2024, indexed by **ESCI**, **PubMed**, **Google Scholar**, with a **target IF>15, and its scope is similar to** *Nature Communications*, *Science Advances*, *Advanced Science*, *Nucleic Acids Research*, etc.

"***iMetaMed***" launched in 2025, with a target IF>15, similar to *Med, Cell Reports Medicine, eBioMedicine, eClinicalMedicine* etc.

Society: http://www.imeta.science
Publisher: https://wileyonlinelibrary.com/journal/imeta
iMeta: https://wiley.atyponrex.com/journal/IMT2
Submission: iMetaOmics: https://wiley.atyponrex.com/journal/IMO2
iMetaMed: https://wiley.atyponrex.com/journal/IMM3

iMetaScience
iMetaScience

office@imeta.science
imetaomics@imeta.science

Promotion Video

Update
2026/6/17