Tropentag 2026, September 16-18, Göttingen, Germany (Hybrid conference)

"Towards multi-functional agro-ecosystems promoting climate-resilient futures"

Deciphering the plant growth promotion potential of rice-associated bacteriomes from Chiang Mai, northern Thailand

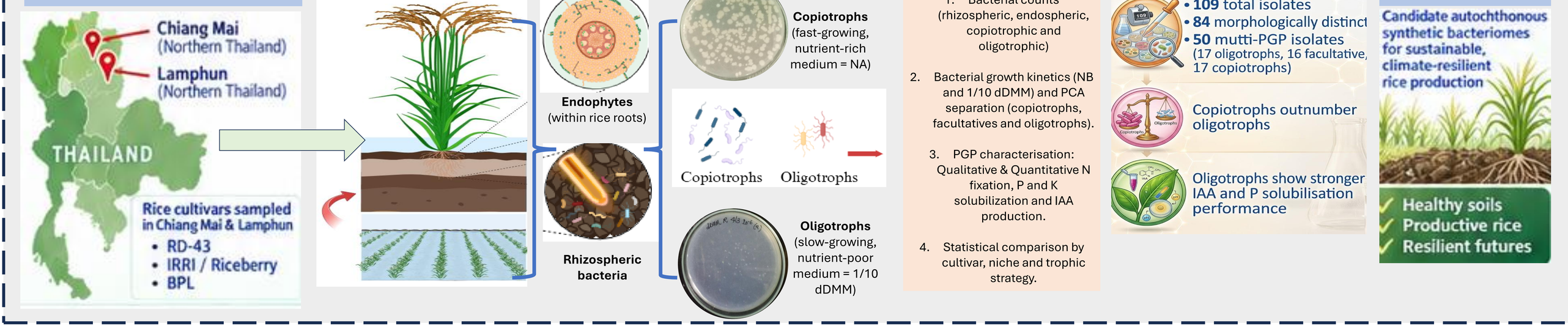
Tropentag 2026
SCIENCE FOR A SUSTAINABLE TOMORROW
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Graphical Abstract



Background

❖**Goals:** Achieving agricultural sustainability and global food security requires improving rice productivity and minimising external chemical fertiliser input.

❖**Tools:** Among the emerging tools for achieving these goals in an eco-friendly manner are synthetically assembled autochthonous bacterial communities (SynComs).

❖**Research Gap:** Locally-adapted biofertiliser candidates comprising isolates from various cultivars, niches and trophic strategy are underexplored reservoirs for SynComs bioprospecting in Thailand.

❖**Objective:** To bioprospect the bacteriome of three rice cultivars across representative agroecological zones in Northern Thailand and compare abundance, trophic strategy, niche distribution and multi-plant growth promotion traits.

Materials and Methods

❖**Research Design:** A bioprospecting study encompassing the bacteriome of three rice cultivars (RD-43, IRRI/Riceberry and BPL) from representative agroecological zones in Chiang Mai and Lamphun, Northern Thailand. Cultivars collected are:

A. RD-43 (from the inorganically fertilised, irrigated, lowland Pak Bong & Mae Raeng fields),
B. IRRI/Riceberry (from the low-hill, peri-urban, chemical fertiliser and pesticide managed, mixed Mae Rim paddies), and
C. BPL (from the organically managed monocropped Chom Thong highlands).

❖**Bacterial Candidates:** The following types of bacteria were enumerated and isolated:

1. Rhizospheric bacteria (from the rhizosphere soil)
2. Endophytes (from rice roots)

These are in turn comprised of:

I. Copiotrophs (fast-growers on nutrient-rich medium = Nutrient Agar) and
II. Oligotrophs (slow-growers on nutrient-poor medium = 1/10 dilution Davis Mineral Medium).

❖**Assayed Parameters:** The measured parameters include:

a. total bacterial counts (for all 4 groups: copiotrophic rhizospheric, oligotrophic rhizospheric, copiotrophic endophytic and oligotrophic endophytic bacteria),
b. oligotroph:copiotroph ratios for the rhizosphere and endosphere of all sampling locations
c. qualitative and quantitative N-fixation, indole acetic acid (IAA) production, P and K-solubilization.

❖**Statistics:** Data for all parameters was compared across bacterial types and rice cultivars.



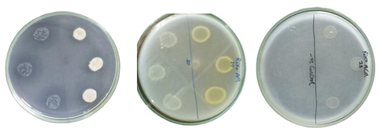
Site A (RD-43 cultivar)



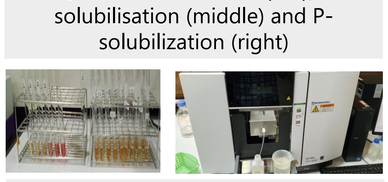
Site B (IRRI/Riceberry cultivar)



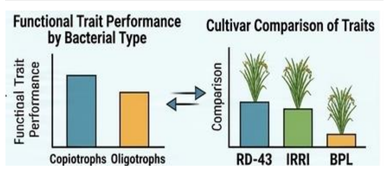
Site C (BPL cultivar)



Qualitative N-fixation (left), K solubilisation (middle) and P-solubilization (right)



Quantitative assays: Left = IAA production using automated spectrophotometry; right = K-solubilization using AAS



Mann-Whitney U, Kruskal-Wallis H, Chi-square and Welch's tests

Results

Table 1: Distribution of morphologically-distinct isolates differs across niche, cultivar, trophic strategy and PGP potential

Isolate Type	Number
Total isolates	109
Morphologically-distinct isolates	84 Endophytes = 39, Rhizospheric = 45; Copiotrophs = 55, Oligotrophs = 29; RD-43 = 38, IRRI = 22, BPL = 24]
Multi-Plant Growth Promoting isolates	50 (N-fixing/IAA-producing = 37, P-solubilizing = 25, K-solubilizing = 2)
Trophic classification	17 copiotrophs, 16 facultative, 17 oligotrophs

Results (continued)

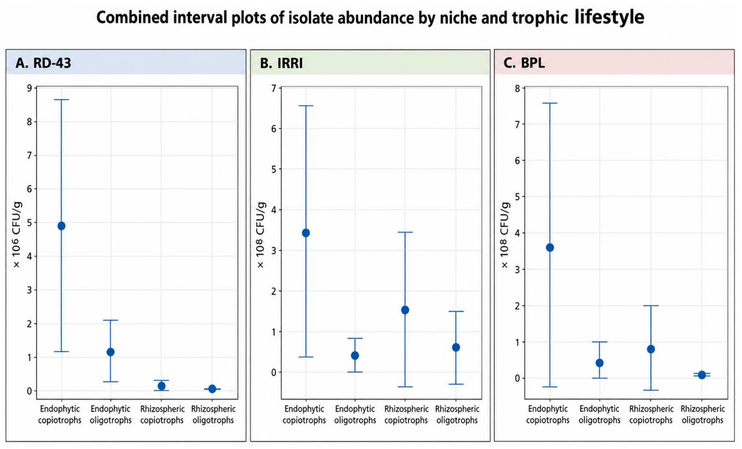


Figure 1: Distirbution of rhizospheric vs endophytic bacteria (Mann-Whitney U: p = 0.16), and copiotrophs vs oligotrophs (Mann-Whitney U: p = 0.037).

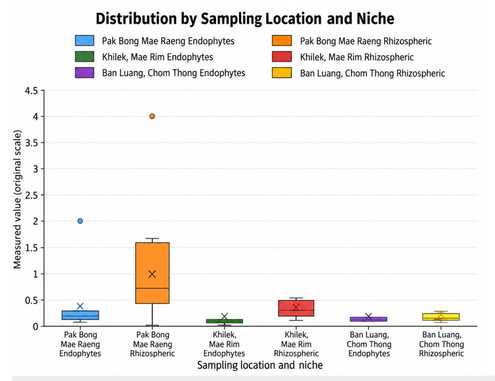


Figure 2: Oligotrophic:copiotrophic bacteria ratios (median range: 0.08–0.25) correlate with agroecology but did not differ significantly by sampling site (Kruskal–Wallis H: p = 0.065).

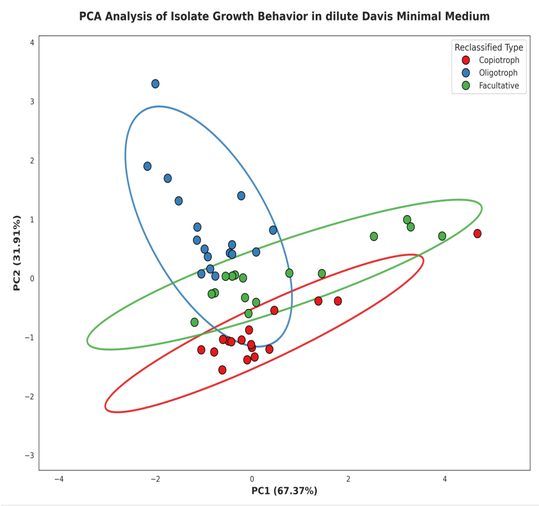


Figure 3: PCA-guided separation of multi-PGP isolates into oligotrophic, facultative/mesotrophic and copiotrophic bacteria similarly distributed among cultivars (Chi-square = 4.43, p = 0.35).

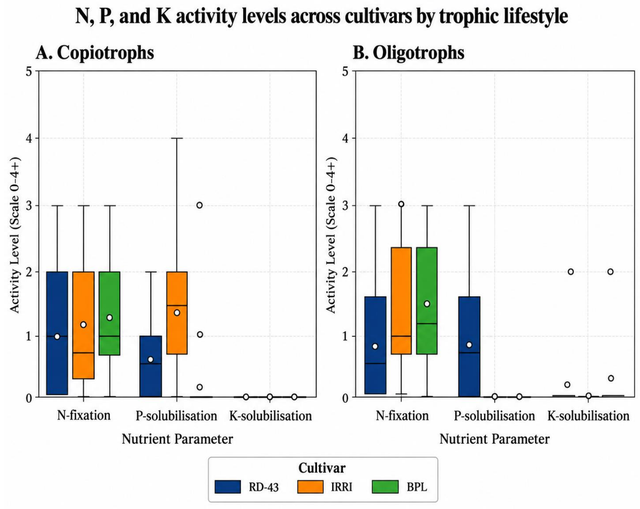


Figure 4: Oligotrophs match copiotrophs in qualitative plant growth promotion traits (pooled average: 1.36 vs 1.71, Welch's test: p = 0.35).

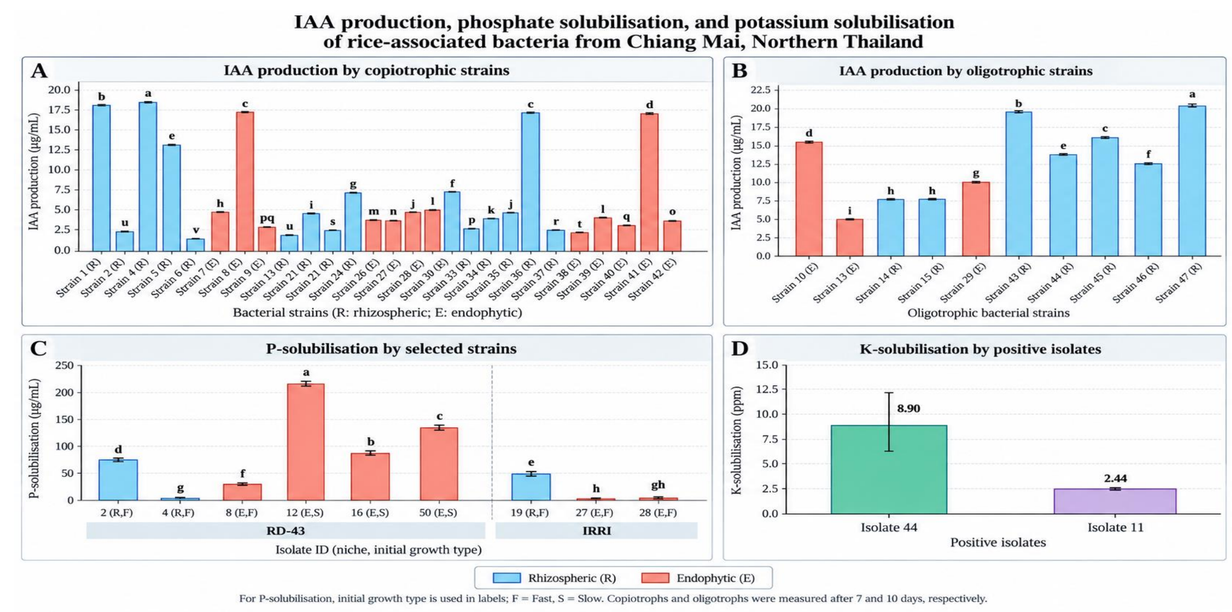


Figure 5: Oligotrophs produced higher IAA than copiotrophs (average: 12.95 vs 7.16 µg/mL, T-test: p = 0.00); and also solubilized more P (mean: 145.80 vs 26.32 µg/mL, T-test: p = 0.006).

Conclusion and Recommendation

❑Trophic strategy (copiotrophy vs oligotrophy) structures the plant growth potential of the rice bacteriome in the study area better than niche (rhizosphere vs endosphere) and cultivar (RD-43, IRRI, BPL).

❑Screenings, molecular assays, laboratory and field trials are envisioned to fully unravel the biofertilisation potential of carefully engineered synthetic bacterial communities from these isolates on rice in the study area.

Acknowledgements

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