Coral probiotics promote tissue-specific and putatively beneficial microbiome restructuring in a coral dwelling fish

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INTRODUCTION

Background:

- Coral reefs are facing unprecedented threats (e.g., coral bleaching, diseases, and pollution).
- Beneficial Microorganisms for Corals (BMCs) are probiotics that enhance coral resilience[1].
- Effects on other associated reef organisms, like fish, remain unexplored[2].

Objective:

- Assess how BMCs reshape the microbiome of a coral-associated fish: *Dascyllus abudafur.*

METHODS

1. Experimental Design Workflow

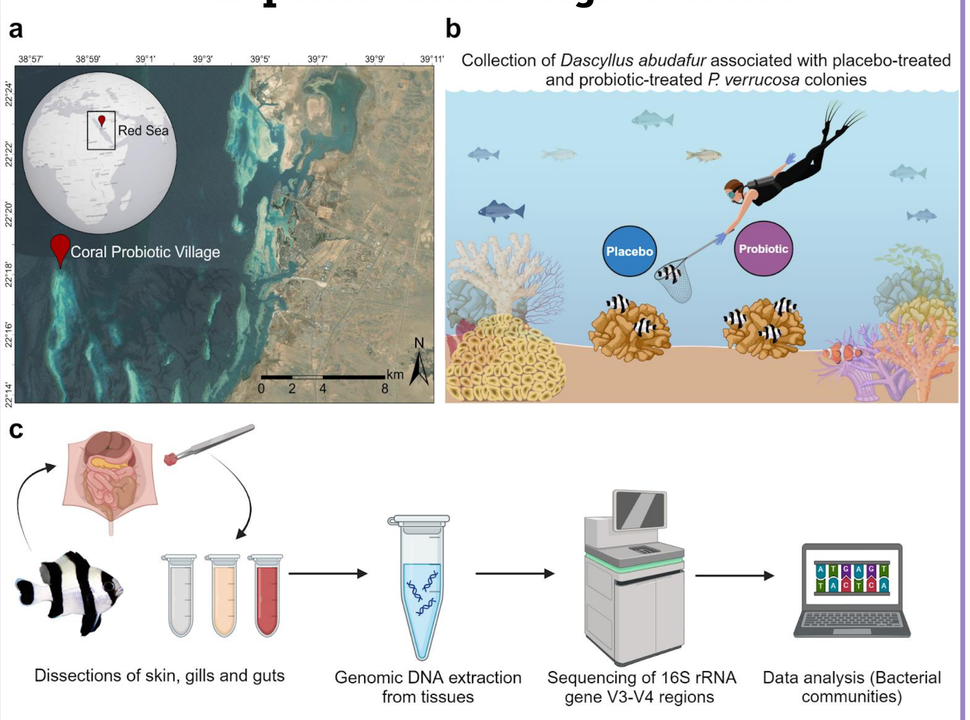

Fig. 1. a) Study location; **b)** *in situ* fish collection procedure; **c)** tissue dissection and bacterial community analysis via DNA extraction and NGS.

a) BMCs applied to *Pocillopora verrucosa* corals in the Coral Probiotics Village, Al Fahal, Red Sea[3].

b) Sampled *D. abudafur* from placebo and probiotic-treated *P. verrucosa* colonies.

c) Dissection of skin, gills, and gut tissues followed by DNA extraction and 16S community analysis.

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REFERENCES

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RESULTS

2. Microbiome Shifts in Fish Tissues

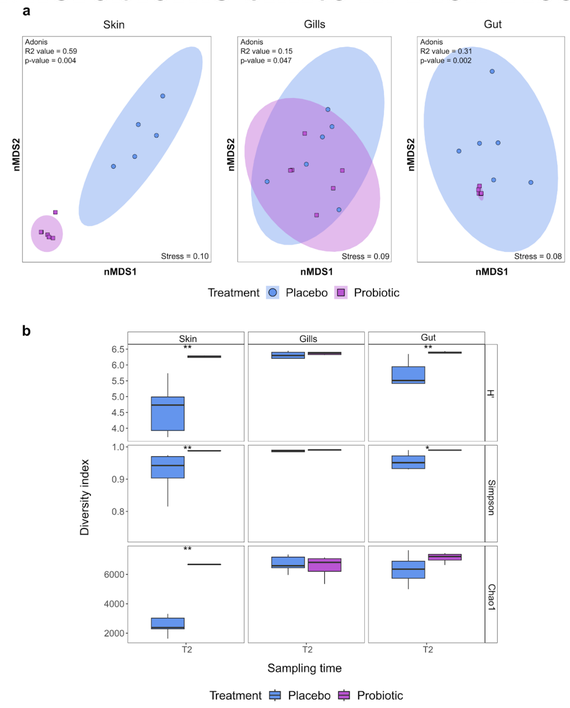

Fig. 2. Bacterial community shifts in *D. abudafur* by tissue type, treatment, and time (T2). **a)** nMDS ordination by treatment. **b)** Alpha diversity metrics. Statistical significance is denoted with * (**, ***).

- Significant shifts in skin and gut microbiomes post-probiotic treatment.
- Higher alpha diversity in probiotic-treated skin and gut.

3. Compositional Changes in Dominant Bacterial Families

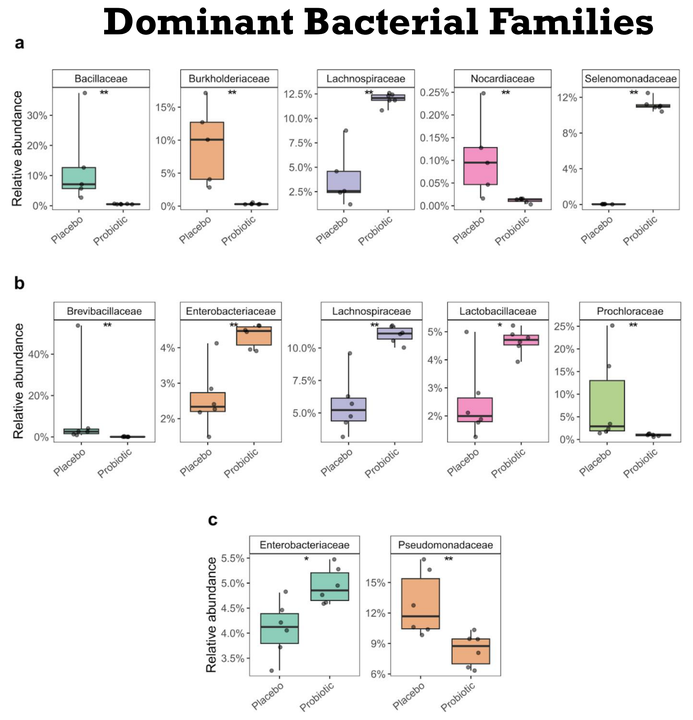

Fig. 3. Changes in top 10 bacterial families in *D. abudafur* tissues post-probiotics (T2). Significant differences between placebo and probiotic-treated corals in the **a)** skin, **b)** gut, and **c)** gills tissue are marked: **p < 0.01; ***p < 0.001.

- Enrichment of beneficial families (*Lachnospiraceae*, *Lactobacillaceae*) in skin and gut.
- Decrease in potential pathogens (*Bacillaceae*, *Burkholderiaceae*).

4. Differentially Abundant ASVs

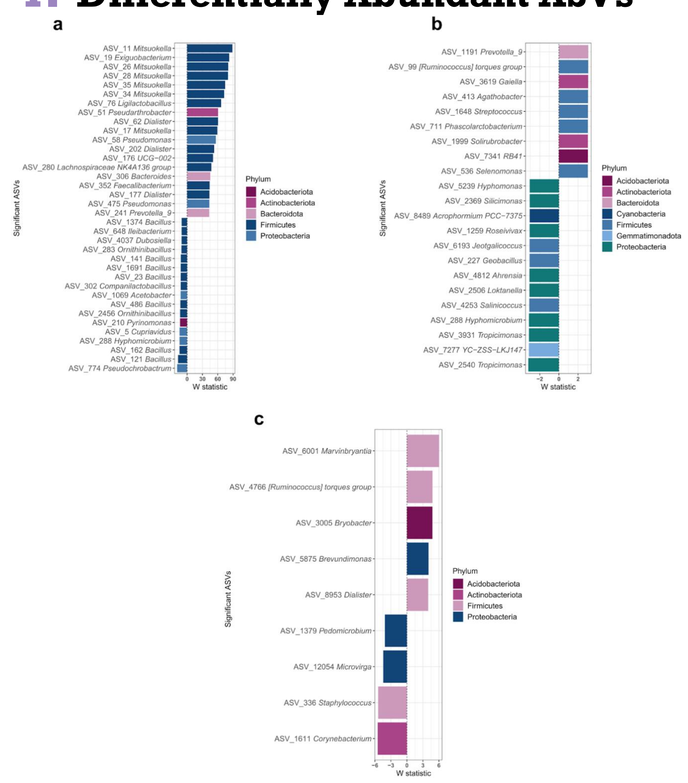

Fig. 4. ANCOM-BC2 differentially abundant bacteria in *D. abudafur* **a)** skin; **b)** gut; **c)** and gills after probiotic treatment. Positive or negative W statistics indicate increased or decreased of bacterial taxa in treated fish.

- Significant increase in potentially beneficial bacteria across tissues.

5. ANCOM-BC2 Skin Pathogen ASVs

Fig. 5. ANCOM-BC2 differentially abundant ASVs in the skin microbiome linked to potential fish pathogens. Color-coded by genus, with W statistic indicating decreased or enriched taxa in probiotic-treated fish.

- Reduced ASVs of potential pathogens (*Vibrio*, *Photobacterium*, *Serratia*).

CONCLUSION

- Microbiome Restructuring: Probiotic treatment for corals (BMCs) positively reshaped the microbiome of *D. abudafur*, particularly in skin and gut tissues.
- Ecosystem Benefit: The reduction in potential pathogens suggests probiotics' broader protective effect on reef health, aligning with the "One Health" concept.

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