

**Integrated bioremediation of copper-contaminated soil using *Bacillus paramycoides* NT001 and its biosurfactant**

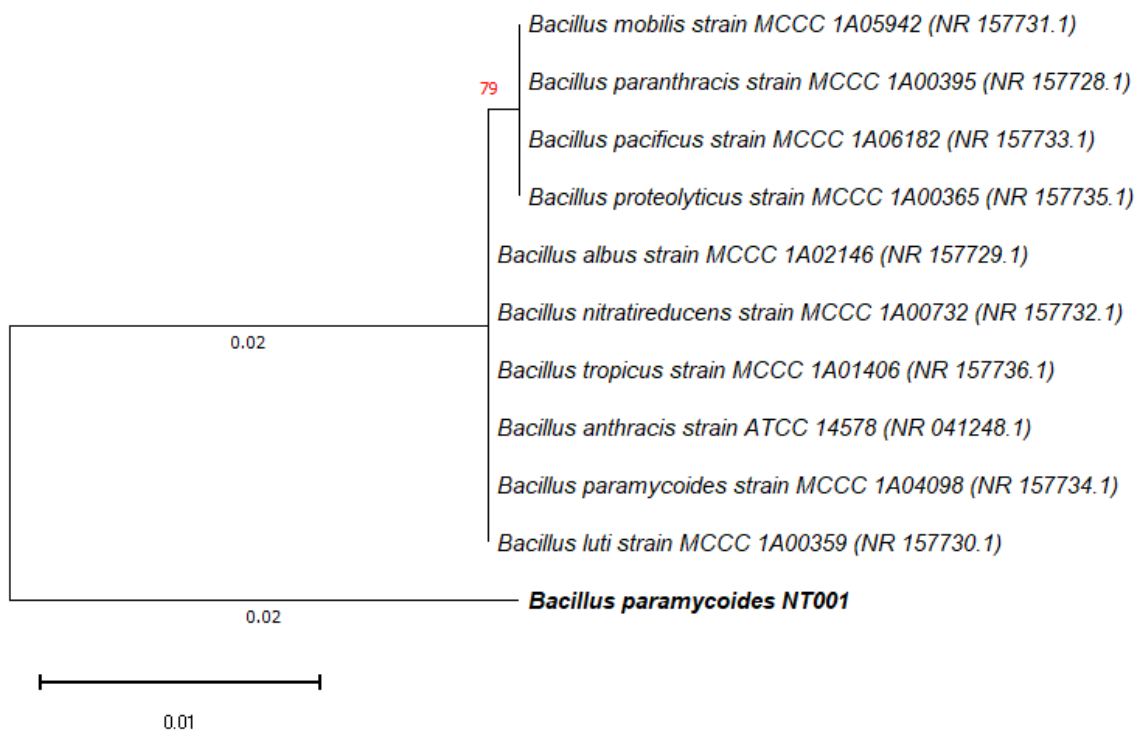
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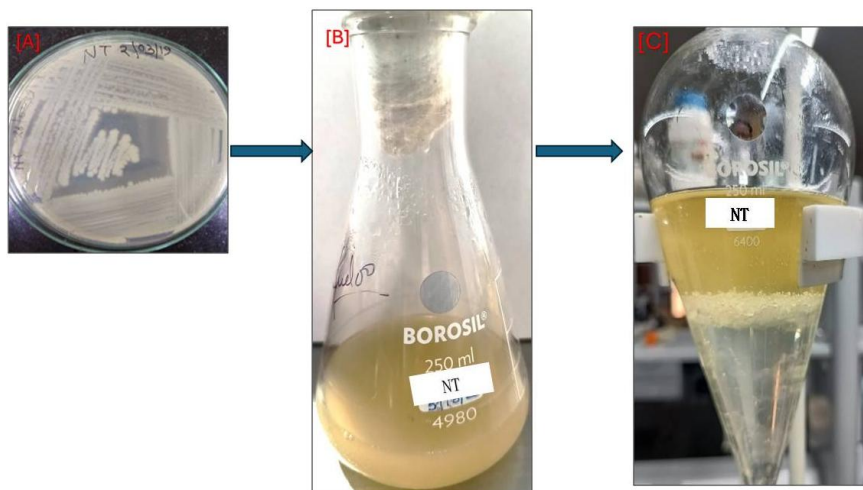
Doi: <http://doi.org/10.7324/JABB.2026.284686>

**Supplementary Material**

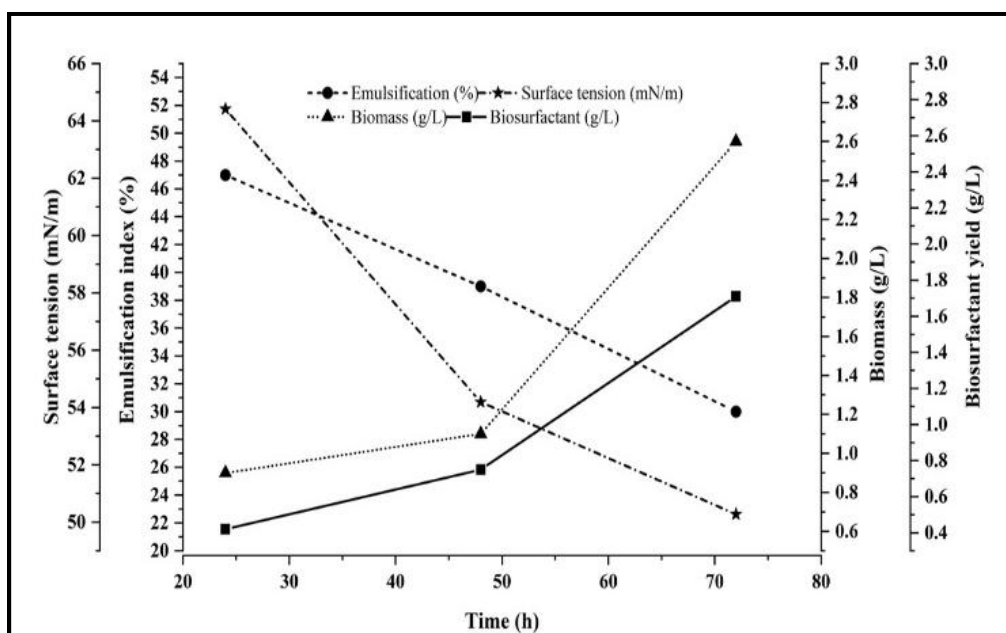
**Appendix 1: Supplementary files**



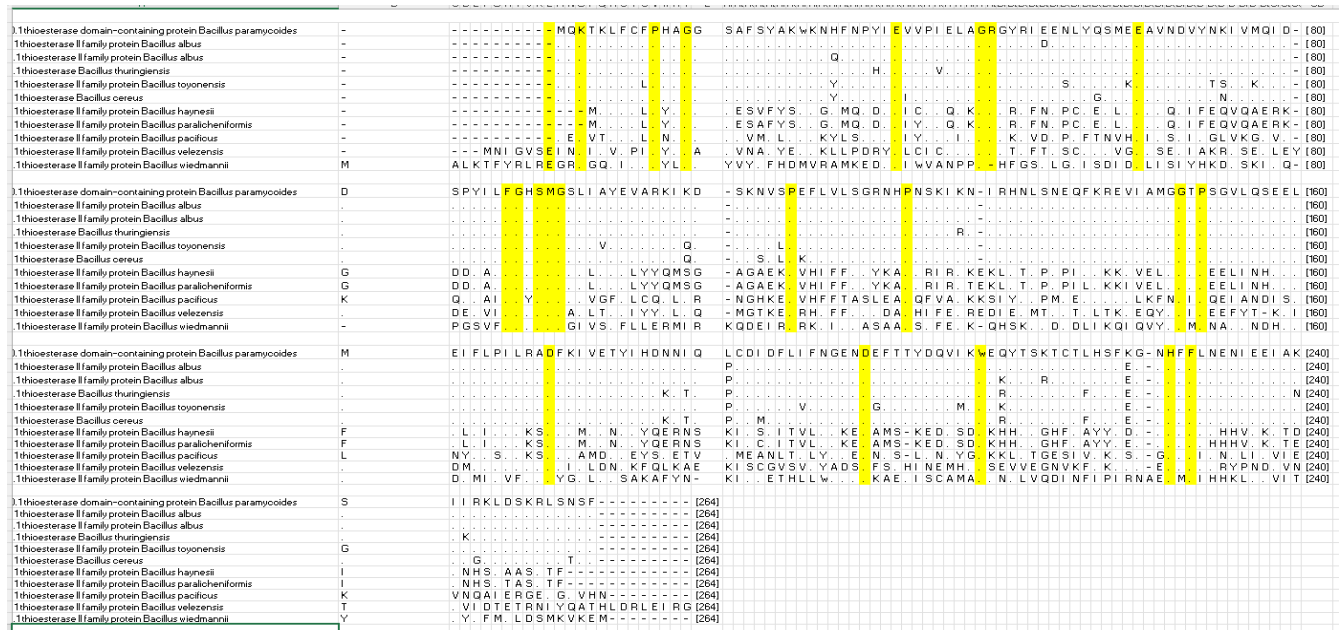
**Figure S1:** Phylogenetic tree of *Bacillus paramycoides* strain NT001 based on 16S rRNA sequencing



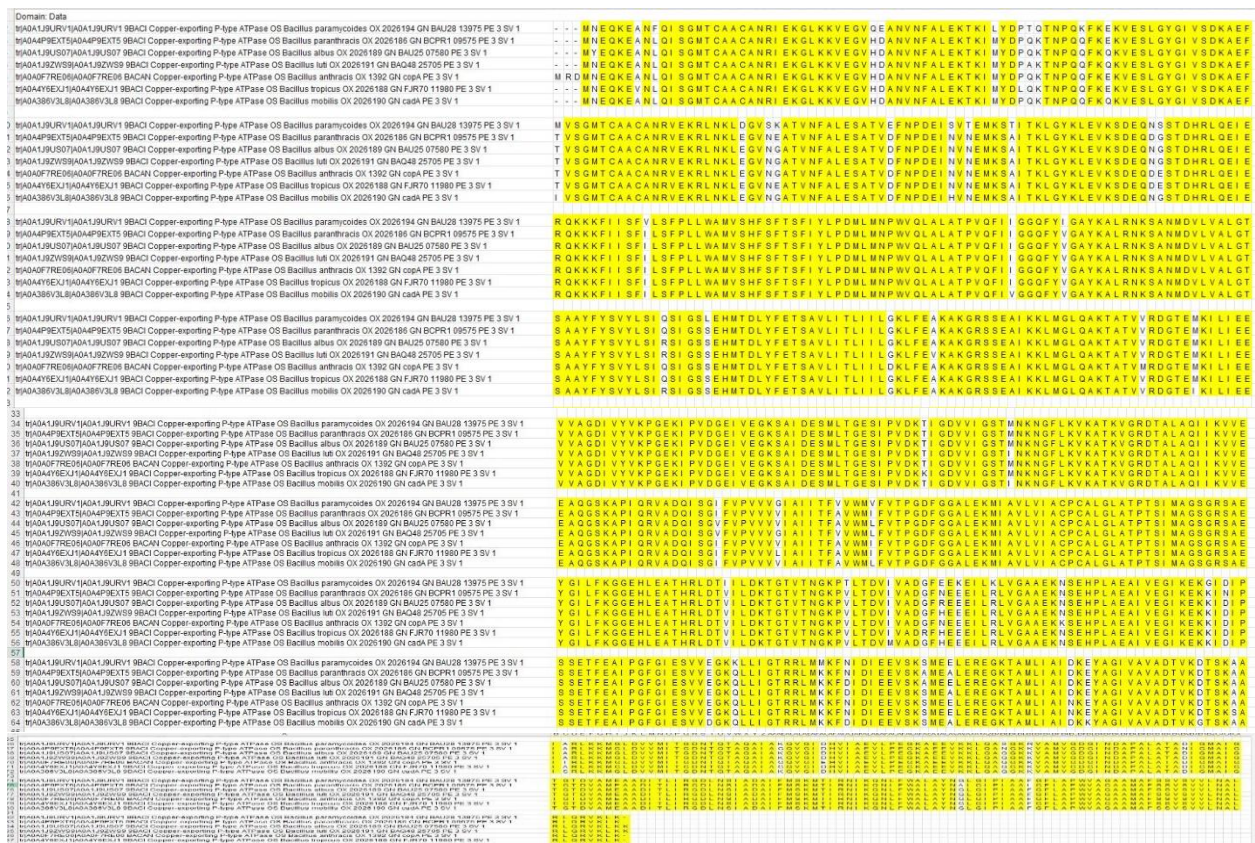
**Figure S2:** Growth of the bacteria *Bacillus paramycoides* strain NT001 on [A] nutrient agar plates and [B] nutrient broth. [C] Extraction and partial purification of bacteria using chloroform and methanol precipitation.



**Figure S3:** Growth of bacterial isolate *Bacillus paramycoides* strain NT001 at different time intervals of incubation, was correlated with biosurfactant production and assessment of the biosurfactant potential by measuring the surface tension and emulsification activity.



**Figure S4:** Multiple sequence alignment for the thioesterase domain of NRPS present in the bacterial isolate *Bacillus paramycoides* strain NT001.



**Figure S5:** Multiple sequence alignment for Cu-exporting P-Type ATPase present in the bacterial isolate *Bacillus paramycoides* strain NT001.

**Appendix 2:** Table S1: Statistical analysis among the treatment groups

<b>Response:</b>	<b>Copper Content</b>				
	<b>Df</b>	<b>Sum Sq</b>	<b>Mean Sq</b>	<b>F value</b>	<b>Pr(&gt;F)</b>
<b>Treatment</b>	2	0.87327	0.43663	94.578	<0.001***
<b>Residuals</b>	24	0.1108	0.00462		
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					

<b>Treatment</b>	<b>Copper Content (mg/Kg)</b>
Soil (control)	0.437 ± 0.0226 <sup>b</sup>
Contaminated Soil	0.787 ± 0.0226 <sup>a</sup>
Treated with NT001	0.380 ± 0.0226 <sup>b</sup>
Std. Err.	0.0226
Critical Diff.	0.0661
Treatments with the same letter in superscript are not significantly different.	