



**Fig. S3.** ANI-based phylogenetic tree of the genus *Virgibacillus*. The phylogenetic tree represents the relationships among 28 species within the genus *Virgibacillus* based on average nucleotide identity (ANI) values. The tree was constructed using ANI distances calculated from whole-genome sequences, with branch lengths reflecting genetic distances. Scale bar represents 0.2 indicates the evolutionary distance based on ANI values.