

INTRODUCTION

## Background

- Peptide therapeutics are emerging novel antimicrobials with great medical and biotech potential.
- Bacillus* species have several predicted bioactive secondary metabolites encoded in their genome.
- Oil and petroleum-contaminated sites may harbor microbes (e.g. *Bacillus*) that has unique bioactive pathways and products.

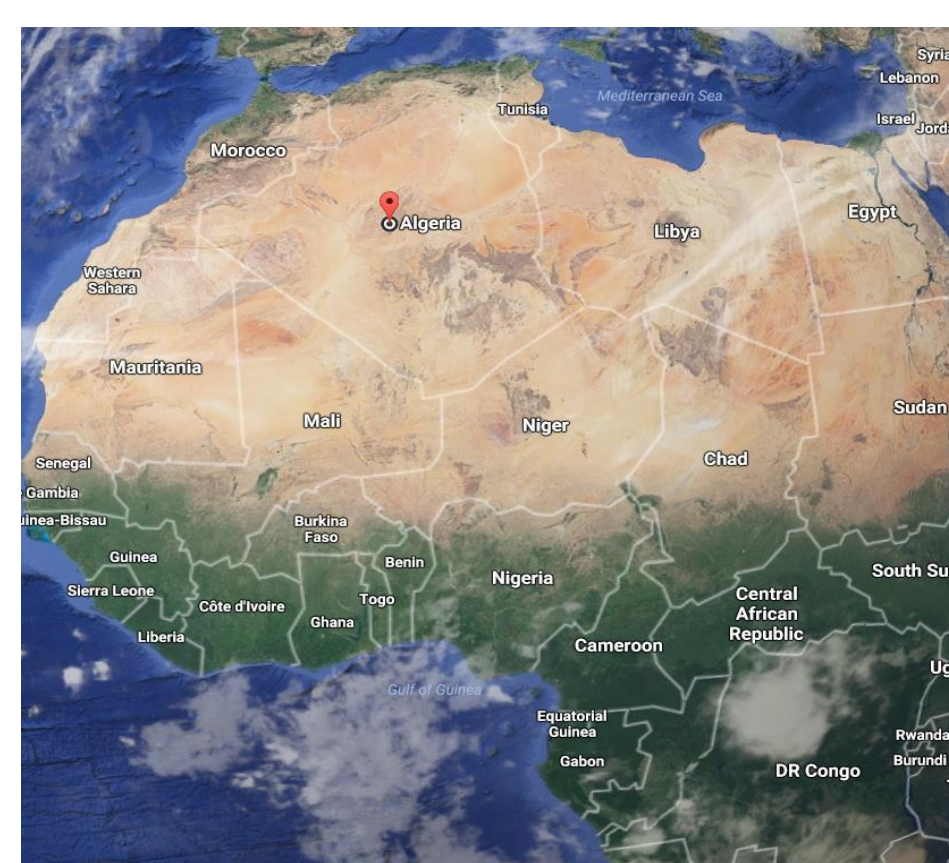


Fig 1. Algeria, the isolation site of ~800 *Bacillus* spp.

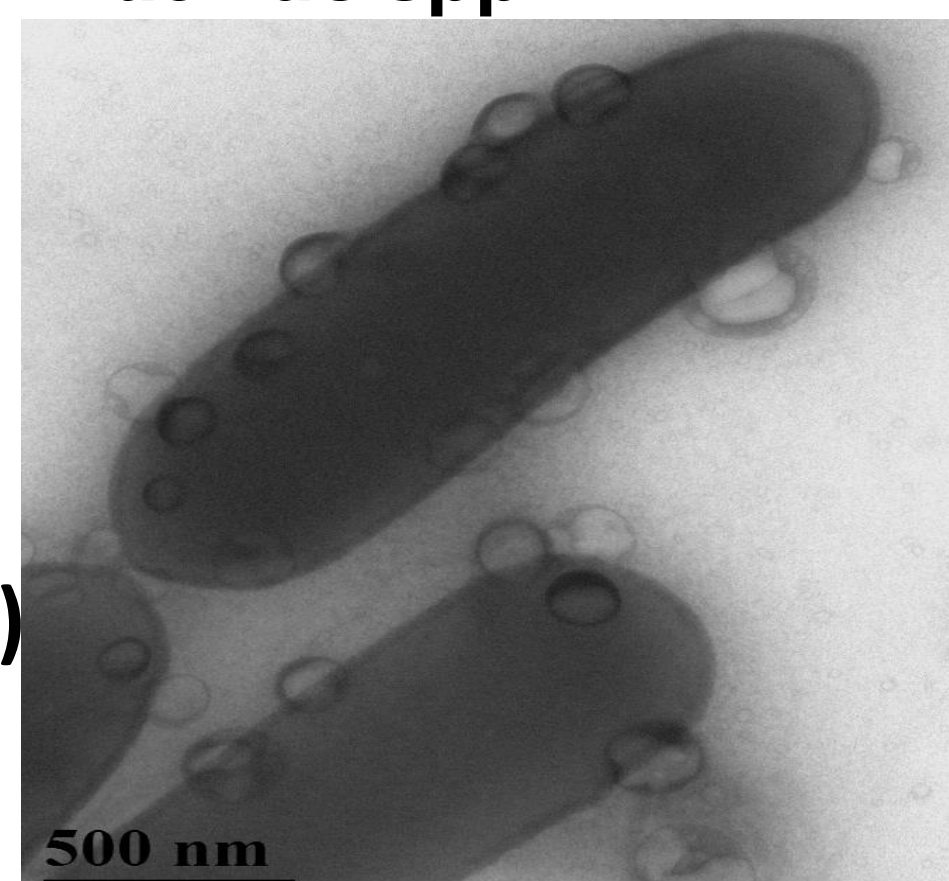
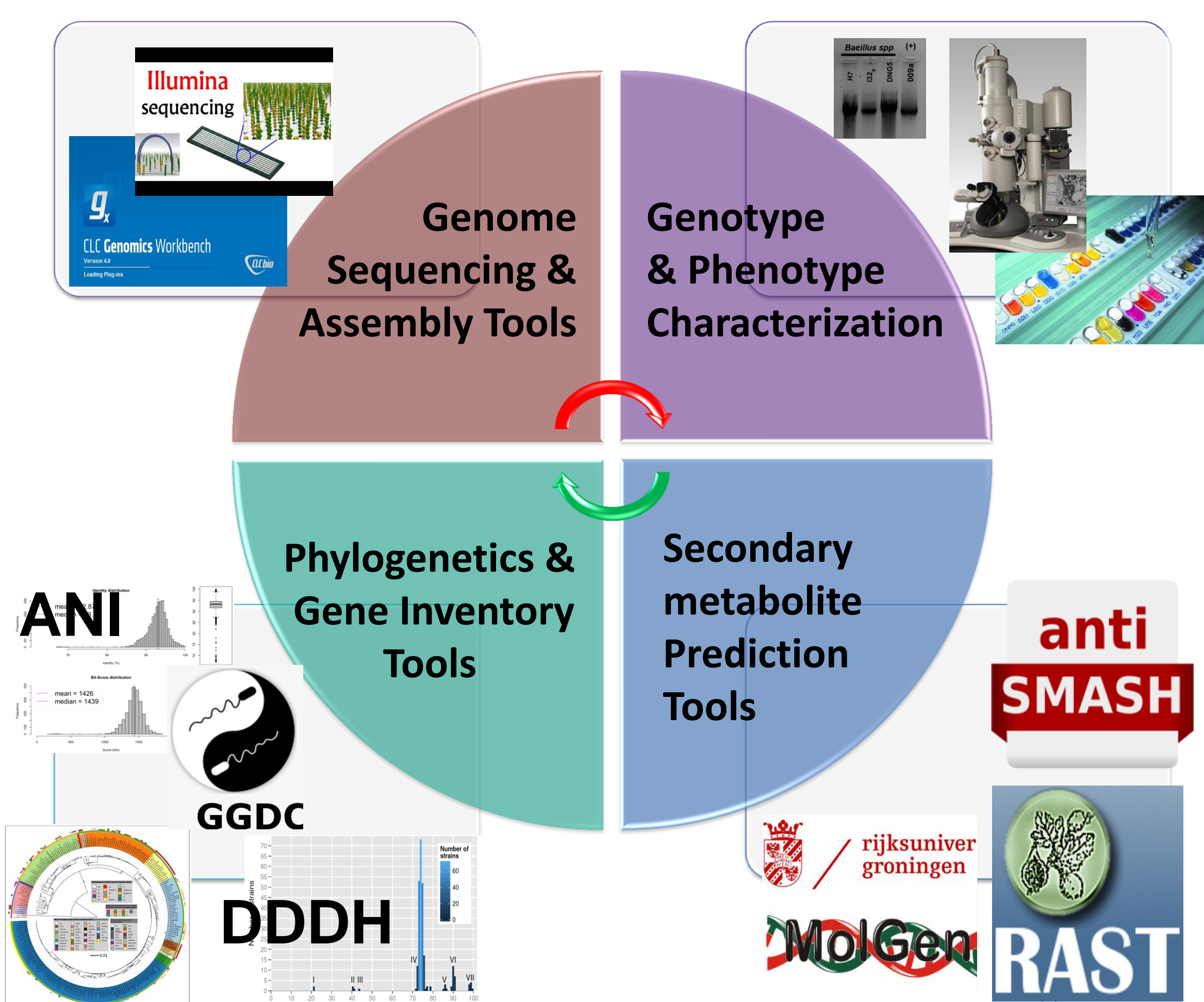


Fig2. *B. paralicheniformis*, biosurfactant producer isolated from Algeria

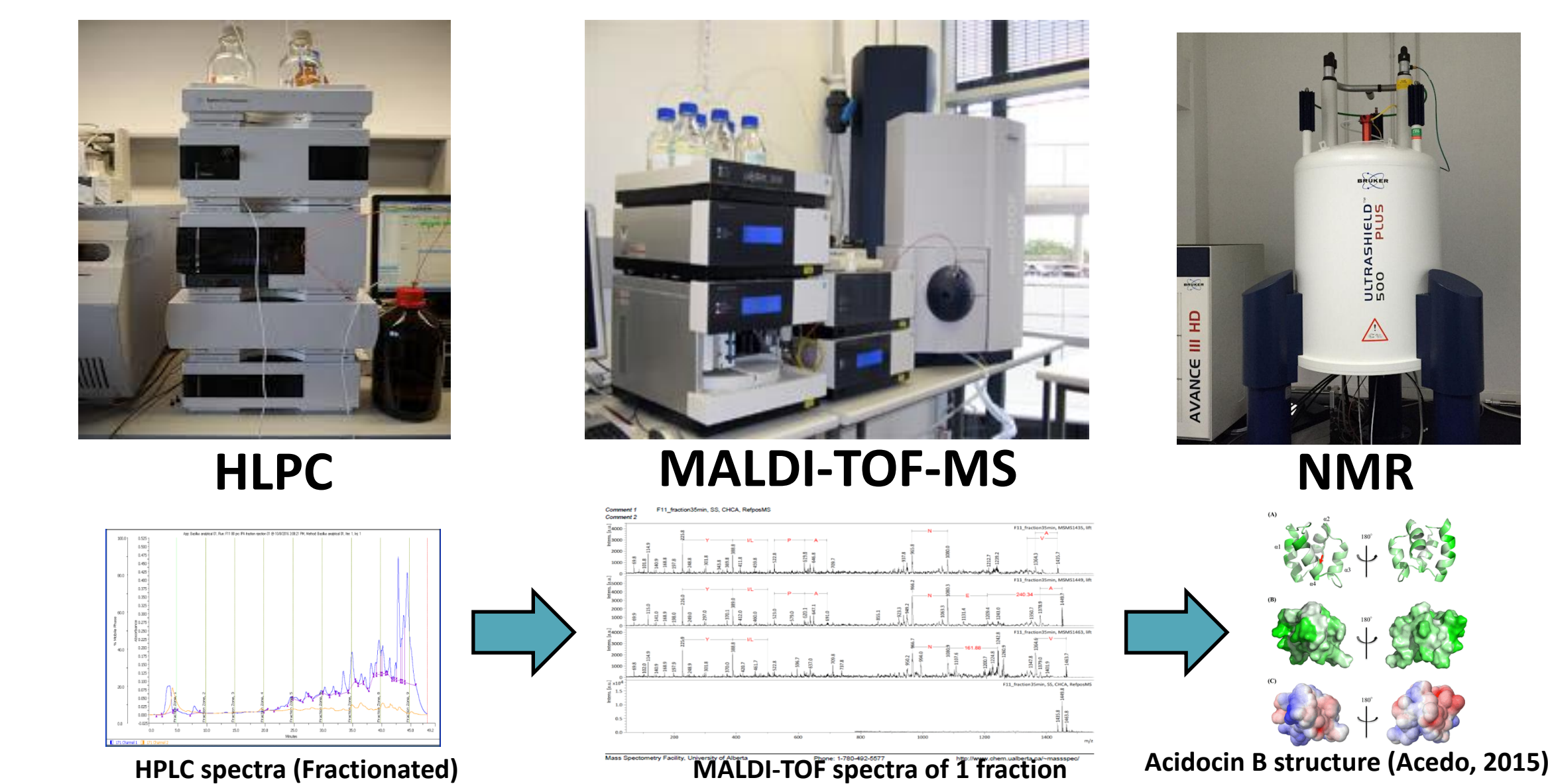
## Objectives

- To sequence the genome of bioactive *Bacillus* spp. isolated from oil-contaminated sites for secondary metabolite (bioactives) mining.
- To characterize the bioactives (lipopeptides) isolated from biotechnologically promising *Bacillus* spp.

## A. Genomics & Bio-Informatics Tools



## B. Proteomics & Metabolomics Tools



## A. Phenotype, genomics, and bio-actives mining

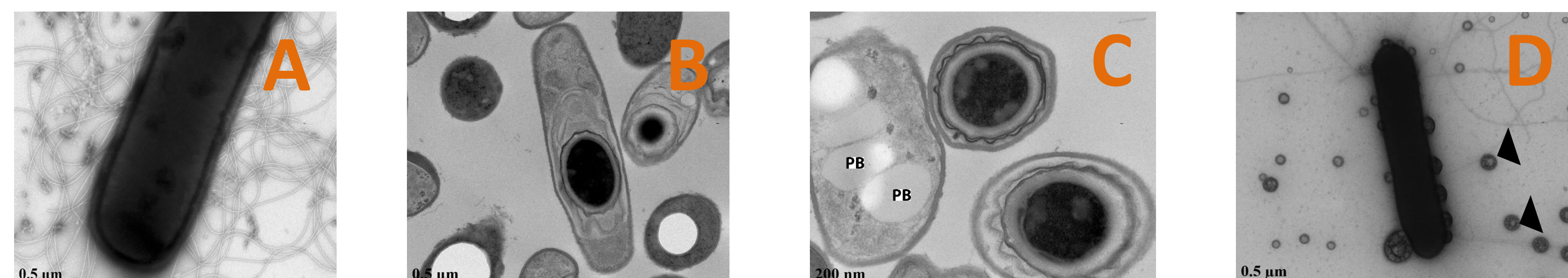


Fig 3. Phenotypic characteristics of biosurfactant-producing *Bacillus* spp. isolated from oil-mining sites in Algeria. Peritrichously flagellated cell (A), subcentral endospore (B), parasporal bodies (C), and “lipid vesicles” (D).

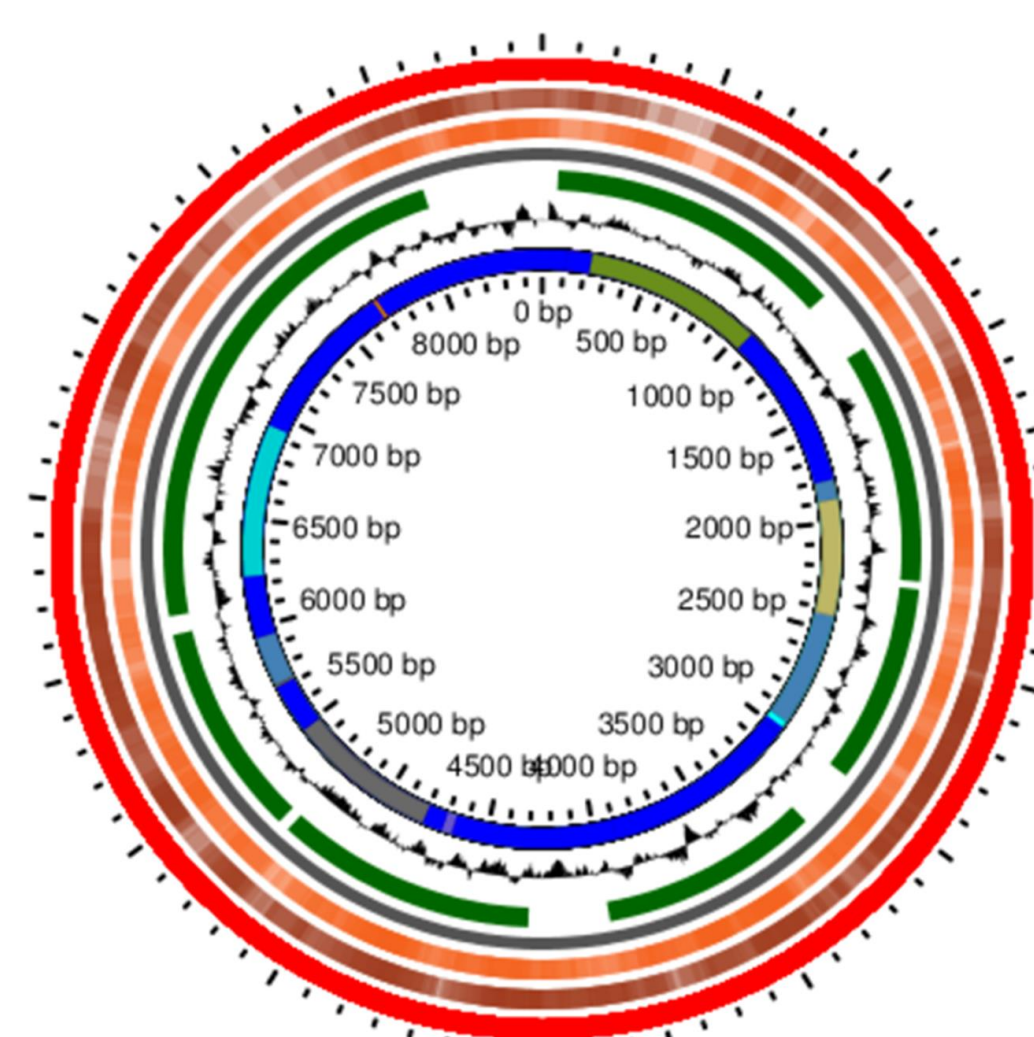


Fig 4. Circular genome of 4 *Bacillus* spp. Blast atlas analysis using *B. subtilis* as reference genome.

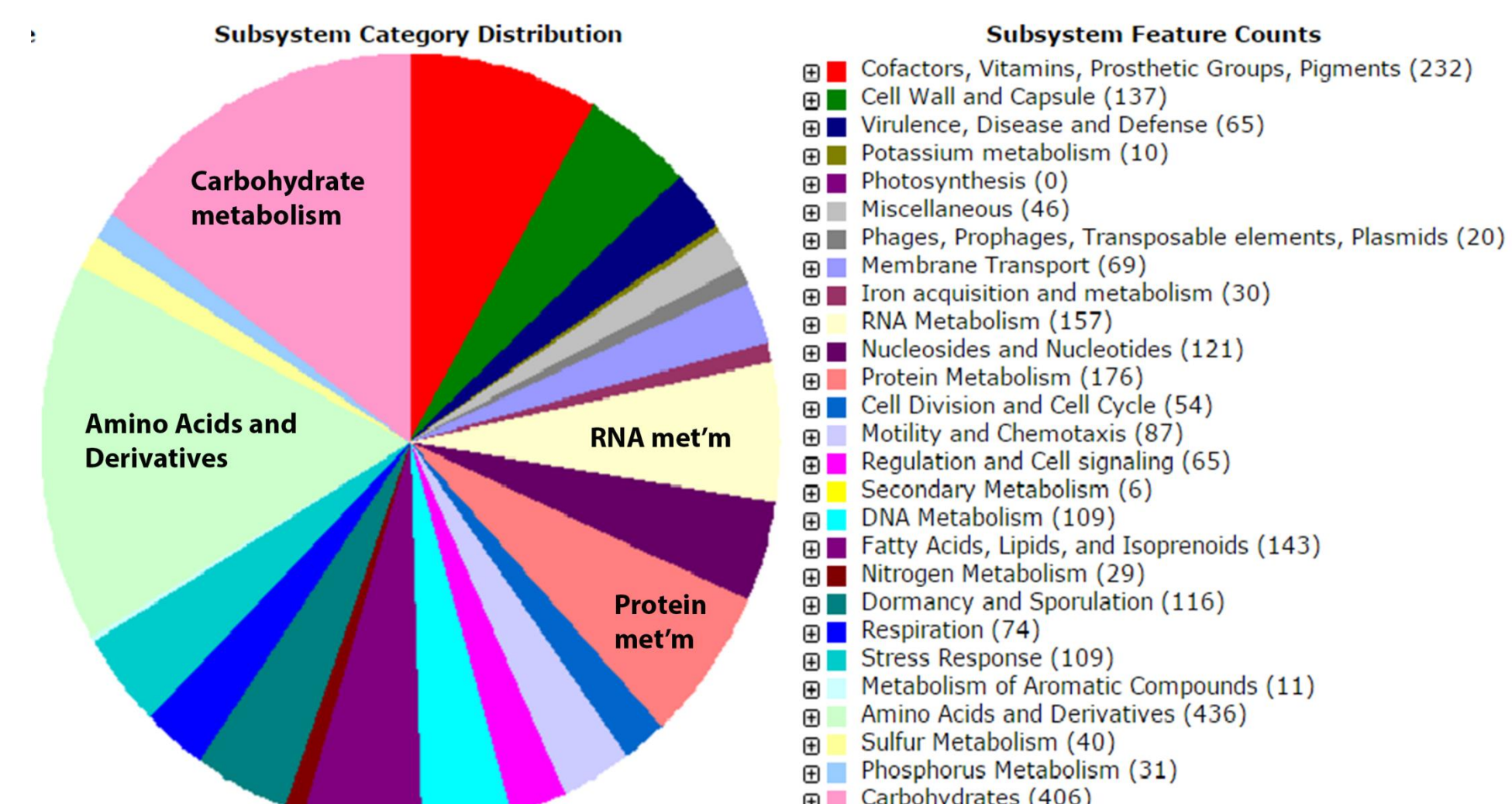


Fig 5. Proportion of genes in *B. thuringiensis* DNG9 associated with the 27 general COG functional categories generated using RAST analysis pipeline.

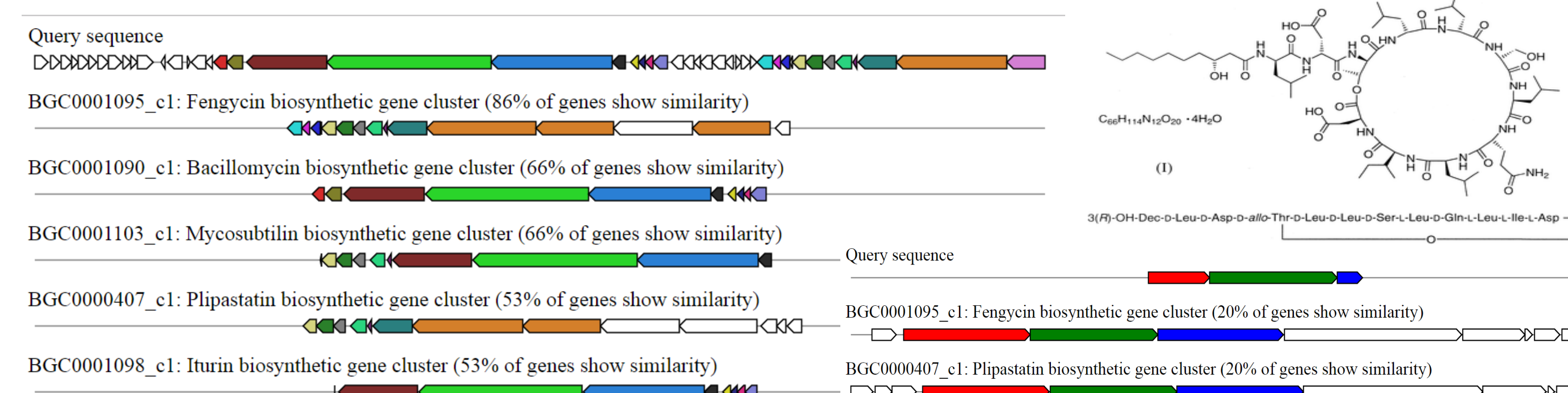


Fig 6. Hybrid NRPS-PKS fengycin biosynthetic cluster. Gene cluster predicted in the genome of *B. amyloliquefaciens* F11 using antiSMASH. Fengycin, a strong antifungal and antibacterial lipopeptide shown with a cyclic peptide and a short fatty acid moiety (insert)

## B. Lipopeptides, antibiotics and novel drugs

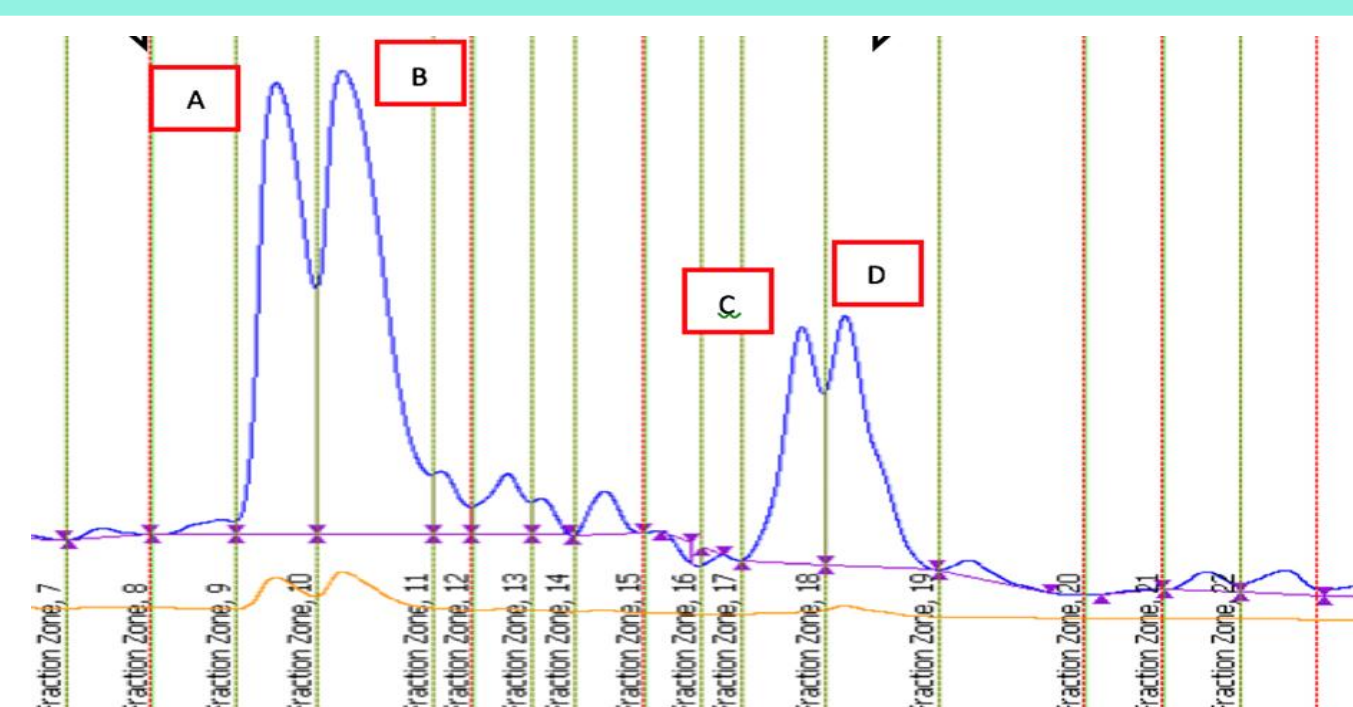


Fig 7. HPLC spectra of *Bacillus* sp. F11 cell lysate active fraction against Gram +/- bacteria.

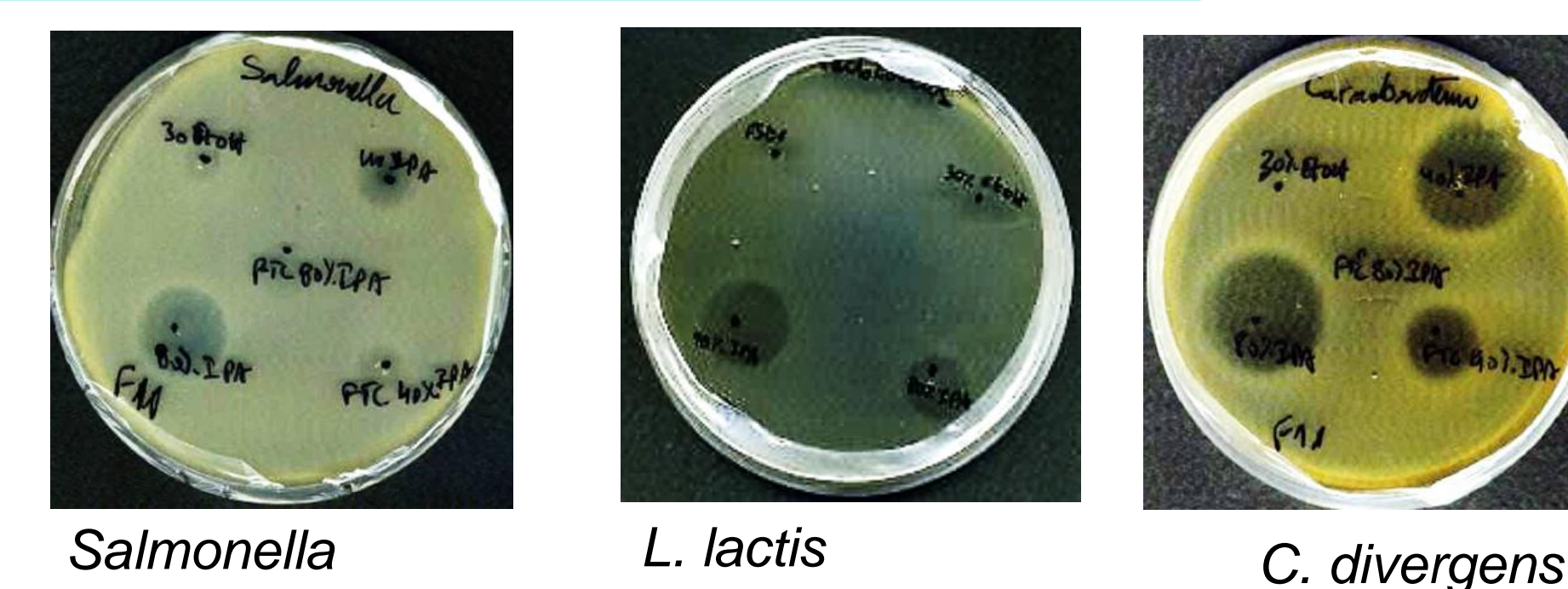


Fig 8. Spot-on-lawn assay. Active cell fraction (HPLC) where tested against the indicator test bacterium. Positive zone of inhibition shown with clearing.

EXPERIMENTAL APPROACH

CONCLUSION

- Bacillus* spp. may contain >20 secondary metabolites such as the lipopeptide-FENGYCIN
- Genome mining revealed an arsenal of bioactives from *Bacillus* spp. isolated from petroleum-contaminated sites.
- Combining OMICS approaches for bioactive gene cluster mining and secondary metabolite discovery could help accelerate microbial drug discovery.

FUTURE WORK

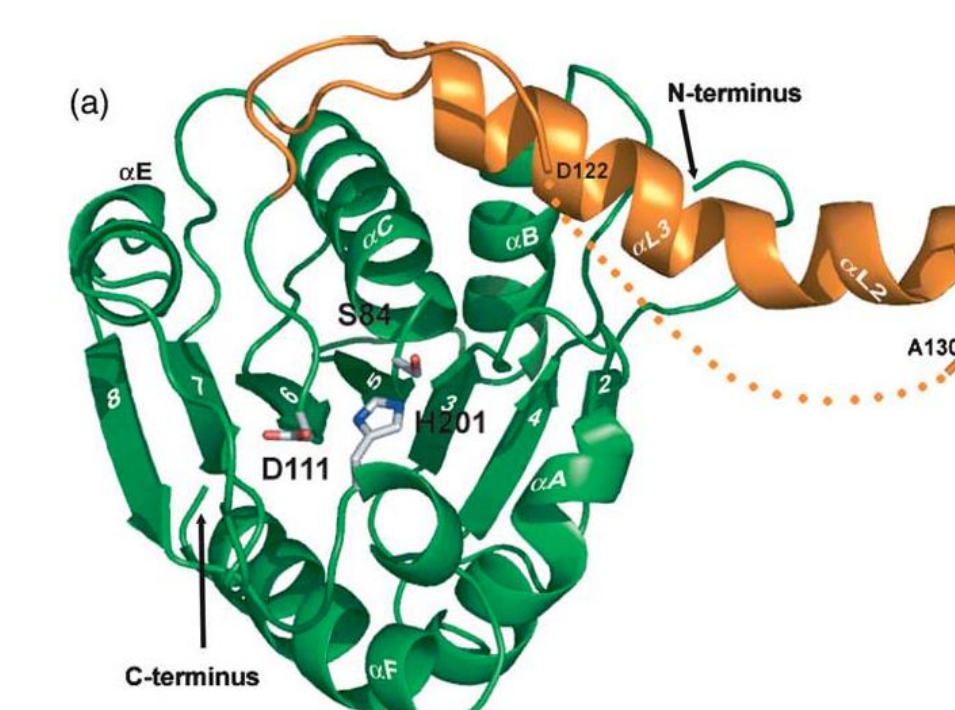


Fig 9. Predicted protein structure of the peptide moiety of fengycin

- To elucidate the structure of fengycin (nuclear magnetic resonance)