

GENOMIC CHARACTERIZATION OF LACTIC ACID BACTERIA STRAINS FOR THE DEVELOPMENT OF A NOVEL PSYCHOBIOITIC PRODUCT

Chiara Maria Calvanese (chiaramaria.calvanese@unina.it)

Dept. Agricultural Sciences and Technology, University of Naples Federico II, Italy
Tutor: Prof. Francesca De Filippis

This PhD thesis research project is aimed to exploit the autochthonous microbial communities of typical Italian fermented products to design new microbial consortia that have psychobiotic properties.
The main results of the first two activities of the PhD thesis project are reported:

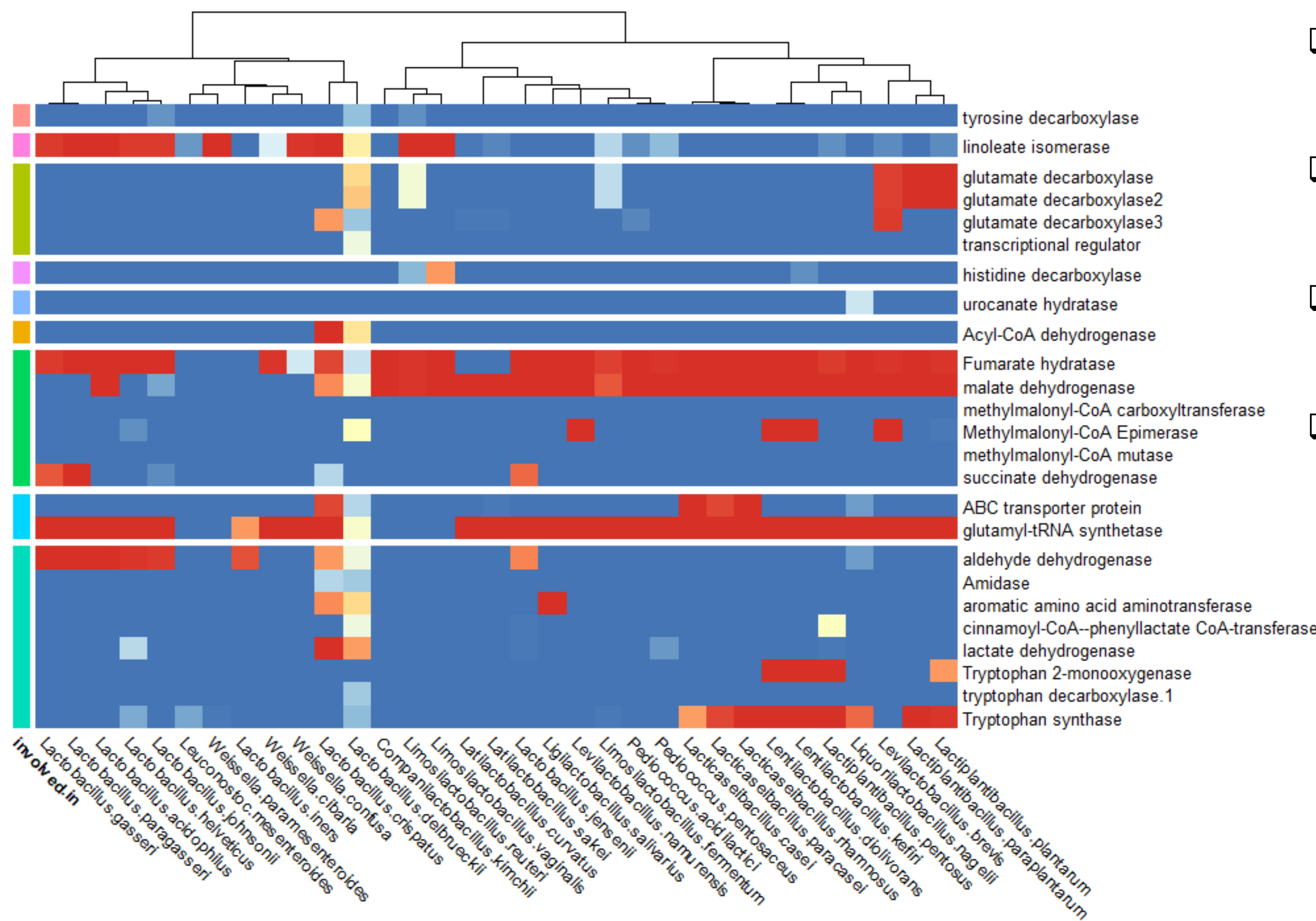
A1) Comparative genomic analysis for screening potentially psychobiotic species;

A2) Developing a collection of potentially psychobiotic Lactic Acid Bacteria (LAB) from typical Italian FFs

Genes related to the biosynthesis of neuroactive molecules and genomes (n=3998) belonging to 33 LAB species were selected and downloaded from the NCBI public database. For each genomes, the genes were predicted using the PROKKA software and were mapped against previously selected genes using DIAMOND software. Finally, the results were statistically processed with the R Studio software (Figure 1).

LAB isolation was carried out from traditional Italian cheeses samples, fermented table olives samples and sourdough samples. 74 LAB strains were isolated, identified by MALDI-TOF Biotyper and their genomes were sequenced and analyzed according to the same pipeline used in the comparative genomic analysis (Figure 2).

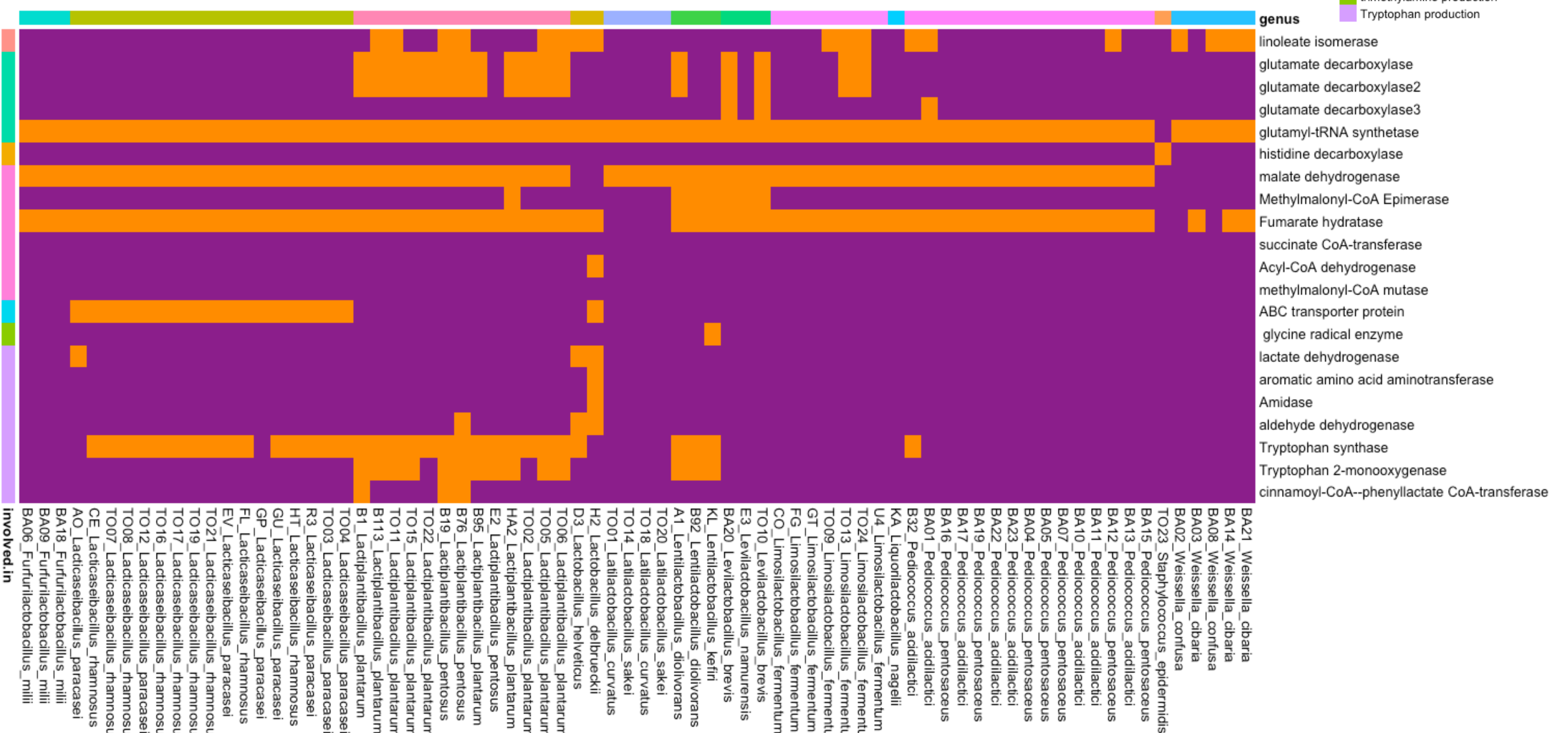
Figure 1. Prevalence (%) of genes related to the production of neuroactive molecules in LAB genomes downloaded from public databases.



- Highest occurrence of genes related to GABA production in *L. brevis*, *L. plantarum* and *L. paraplantarum* species;
- Highest occurrence of genes related to tryptophan metabolism in the genera *Lactocaseibacillus*, *Lentilactobacillus* and *Lactiplantibacillus*;
- Genes related to conjugate linoleic acid, propionate and taurine production in most of the species included in the dataset;
- Occurrence related to catecholamines, histamine and imidazole propionate production was low in all species included in the dataset.

Figure 2. Prevalence of genes related to the production of the main neuro-active molecules in strains isolated from typical Italian FFs.

In accordance with the comparative genomic analysis, the strains with the highest potential for psychobiotic activities fall into the species of *L. plantarum* (B1, B95, HA2, TO02, TO05, TO06, TO11, TO15, TO22), *L. pentosus* (E2), *Lactobacillus delbrueckii* (H2), *L. brevis* (TO10), *L. diolivorans* (A1, B92), and *L. kefir* (KL).



These selected strains will be tested in vitro and in a SHIME model to develop a plant-based, yogurt-like product with psychobiotic properties.

Acknowledgements

This work was partially funded by the project HOLOGRAM - Exploiting autochthonous microbial resources from traditional Italian fermented foods for gut-brain axis modulation, funded by the European Union - NextGenerationEU, NRRP Missione 4 "Istruzione e Ricerca" - Componente C2, Investimento 1.1, "Fondo per il Programma Nazionale di Ricerca e Progetti di Rilevante Interesse Nazionale (PRIN)" (P2022X8A9M) and by the European Union - NextGenerationEU, NRRP - Mission 4, Component 2, Investment 1.4 - National Biodiversity Future Center - CN_00000033 (D.M. Prot. 1034 of 17/06/2022).