Metagenomic prediction of potential nitrogen-fixing bacteria in coffea *canephora*

Cleidiana Vieira Guimarães [1]*, Taís Rizzo Moreira[2], Lucas Louzada Pereira[3], Tomas Gomes Reis Veloso[1], Aldemar Polonini Moreli[3], Marliane de Cássia Soares da Silva[1]

[1] *Universidade Federal de Viçosa, Departamento de Microbiologia, Laboratory of Mycorrhizal Associations – LAMIC. Avenida Ph Rolfs S/N, Viçosa, CEP:36570-000, Minas Gerais, Brazil. E-mail: cleidiana.guimaraes@ufv.br; tomasgomesrv@gmail.com; marliane.silva@ufv.br;*

[2] *Universidade Federal do Espírito Santo. Centro de ciências agrárias e engenharias. Av. Gov. Lindemberg, 316 - Centro, Jerônimo Monteiro, CEP: 29550-000, Espírito Santo, Brazil. E-mail: taisr.moreira@hotmail.com, ORCID: 0000-0001-5536-6286; E-mail: mundogeomatica@yahoo.com.br;*

[3] *Instituto Federal do Espírito Santo. Coffee design. Avenida Elizabeth Minete Perim, S/N, Bairro São Rafael, Venda Nova do Imigrante, CEP: 29375-000, Espírito Santo, Brazil. E-mail: lucaslozada@hotmail.com; aldemarpolonini@gmail.com; gwill.bio@gmail.com.*

* Corresponding author. E-mail: marliane.silva@ufv.br

The global economic importance of coffee, as the second largest commodity, is linked to a complex production chain influenced by genetic, environmental and post-harvest factors. The state of Espírito Santo stands out in the production of coffee *canephora*, being the largest producer in Brazil, responsible for approximately 75% of the national production, which is equivalent to 20% of the world's production. Soil quality is a determining factor in coffee plant tree nutrition and the subsequent sensory experience of the beverage. The soil microbiota constitutes a hotspot of ecological richness and variety of microbial taxa with important contributions to the biogeochemical cycles of the planet and maintenance of sustainability and balance of ecosystems. A specific group of soil bacteria called diazotrophs conduct the biochemical process of biological nitrogen fixation (BNF), through the reduction of atmospheric N2 into ammonia, making it bioavailable for assimilation by plants. The present $_{study}$ aimed at metagenomic prediction for the identification of potential microbial communities with biological functions such as nitrogen fixation. Soil samples were obtained from *canephora* coffee farms with different edaphoclimatic conditions. All samples were taken to the laboratory for chemical assays and DNA extraction. Based on this, through the PICRUSt2 program, a total of 44 bacterial genera were predicted. The order *Rhizobiales*, known for comprising nitrogen-fixing bacteria, was represented by 11 genera: *Afipia, Allorhizobium-Neorhizobium-Pararhizobium-Rhizobium, Bauldia, Bradyrhizobium, Mesorhizobium, Methylocystis, Methylovirgula, Microvirga, Rhodopseudomonas, Roseiarcus* and 1174-901-12. The most abundant genus of *Rhizobiales* was *Bradyrhizobium*, representing about 4% of all sequences, revealing to be a genus that constitutes the central microbiota of the soil of *canephora* coffee plantations. This taxonomic abundance of potentially atmospheric N2-fixing bacteria indicates that the mineral nutrition of these coffee trees is being partially driven by these genera. Faced with the importance and current challenge of increasing the production and yield of large crops in a sustainable manner, the expansion of studies on the microbiological quality of the soil implies the possibility of improving the coffee production chain, which, despite being a monoculture, has a variety of taxa with potential biotechnological applications. Thus, studies on the efficiency of diazotrophic bacterial strains as plant growth promoters, phosphate solubilization, hormonal regulation and biological nitrogen fixation in coffee are necessary, since the final quality of the beverage is influenced by the chemical and microbiological composition of the soil, praising the strong plant-microorganism interactions.

Key words: *Coffea canephora*; Nitrogen fixing; Soil Microbiology.

Predição metagenômica de potenciais bactérias fixadoras de nitrogênio em café canéfora

A qualidade do solo assistida pelas funções dos microrganismos, associa-se intimamente a nutrição e rendimento do cafeeiro. O objetivo deste estudo foi utilizar ferramentas de predição metagenômica para avaliação de potenciais bactérias fixadoras de nitrogênio, do solo de fazendas de café canéfora. Foram previstos um total de 44 gêneros, sendo 11 pertencentes a classe dos *Rhiazobiales*. Destaque especial foi dado

ao gênero *Bradyrhizobium*. Diante da importância a nível mundial da cafeicultura e da necessidade de reversão dos modelos convencionais de cultivo, a emergência e expansão de estudos acerca do potencial biotecnológico dessas comunidades microbionas, são de extrema contribuição.

Palavras-chave: Café; Microrganismos do solo; Fixação de nitrogênio.