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4° Congresso Nazionale AIDA

2° Forum Italiano Di Agroforestazione AIAF

**AGROECOLOGICAL AND AGROFORESTRY APPROACHES FOR A
SUSTAINABLE FUTURE**

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A Collection of root endophytes from grapevine for sustainable vineyard management

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Intensive soil exploitation has led to a change in the chemical, physical and biological properties of soils, with a subsequent decrease in fertility. Moreover, conventional agriculture has been identified as one of the causes of the increase in environmental problems such as soil loss, desertification, erosion, hydrogeological instability and, consequently, of socio-economic drawbacks i.e. low income of farmers, abandonment of agriculture, depopulation of green areas. There is therefore a need to mitigate the negative effects of intensive agriculture by promoting the transition to more sustainable practices in order to combat climate change and allow the recovery of soil fertility.

Sicily is the second largest Italian region in terms of vineyards area (98,753 hectares) according to ISTAT 2024 data, but at the same time over 60% of the Sicilian lands is susceptible to desertification (Catania et al., 2024). It is important to safeguard the excellence of Sicilian viticulture to by guaranteeing the quality of the final product, but also by protecting the whole agroecosystems from the effects of climate change.

Agroecology principles rely on soil defense and biodiversity as drivers of agroecosystem health and U.N. sustainable development goals aim to reduce hunger while protecting wildlife and biodiversity. In agroecosystems, microbial diversity is generally overlooked but microorganisms play a crucial role by acting as drivers for biogeochemical cycles by influencing the flow of nutrients (Yi et al., 2022). Many are responsible for nitrification and denitrification, as well as, the accumulation of soil organic carbon and its aggregation. Furthermore, microorganisms control soil structure and function through the action of extracellular enzymes and polysaccharides (Schimel et al., 2012).

In addition, microorganisms also play an important ecological role as plant symbionts. A large microbial community inhabits the rhizosphere, and specialized bacteria known as Plant Growth-Promoting Rhizobacteria (PGPR) confer benefits. These bacteria have been shown to function as biological control agents and to substitute for chemical fertilizers by means of nutrient solubilisation or hormone synthesis and pesticides/fungicides effects (Besset-Manzoni et al., 2018; Wang et al., 2021). Over the years, several mechanisms of action have been studied to explain growth promotion and biocontrol mechanisms, including direct competition for nutrients and niches, antibiosis, enzymatic lysis, signal interference and indirect induction of host resistance (Barea et al., 2005; Tabassum et al., 2017). Bacterial and fungal isolates can be tested for the ability to promote plant growth (auxins production, nitrogen fixation, phosphate solubilization, etc.) and selected for plant inoculation in the field. In this study, a collection of root endophytes and epiphytes was isolated from grapevine to create a collection of growth-promoting microorganisms to promote vine growth in semi-arid vineyards for sustainable viticulture management. Vines with different levels of vigor were selected to verify the hypothesis that higher vigor could be related to higher diversity of microbial endophytes endowed with more PGP traits.

Vine root endophytes and epiphytes were isolated from roots sampled in a vineyard (Catarratto) in Camporeale (PA) presenting markedly different levels of vigor, determined based on observations of foliage, pruning wood yield, and NDVI values. For endophytes isolation, roots were surface-sterilized and dismembered in sterile water, the homogenate was spread on Nutrient Agar and Potato Dextrose Agar plates until colonies appeared. For epiphyte isolation, the washed root samples were swabbed on NA and PDA plates before surface sterilization. After 48 hours of incubation at 30°C, phenotypically different colonies were isolated from each plate and transferred until pure cultures were obtained (Figure 1).

About 100 isolates were obtained, 63 from NA plates and 36 from PDA plates. All bacterial isolates were subjected to DNA extraction and molecular identification by 16S ribosomal gene amplification and sequencing, while for the fungal isolates the internal intergenic spacer (ITS) was amplified. The amplicons were sequenced and the sequences analysed by BLAST towards nr database. Preliminary results assigned part of the bacterial collection to the genera: *Bacillus*, *Peribacillus*, *Paenibacillus*, *Klebsiella*, *Serratia*, *Pseudomonas*, *Pantoea*, *Rahnella*. A higher number of bacterial genera was retrieved from low vigor vine roots.

The collection of vine root epiphytes and endophytes is now under screening for the Plant Growth Promoting activity of the isolates. A first test on the production of indolacetic acid (IAA) was

conducted on some bacterial strains selected in accordance with their affiliation to genera known to include plant growth-promoting strains. The analysis revealed that all strains exhibited IAA production (Figure 1).

Identification of all bacterial and fungal isolates and PGP tests are in progress.

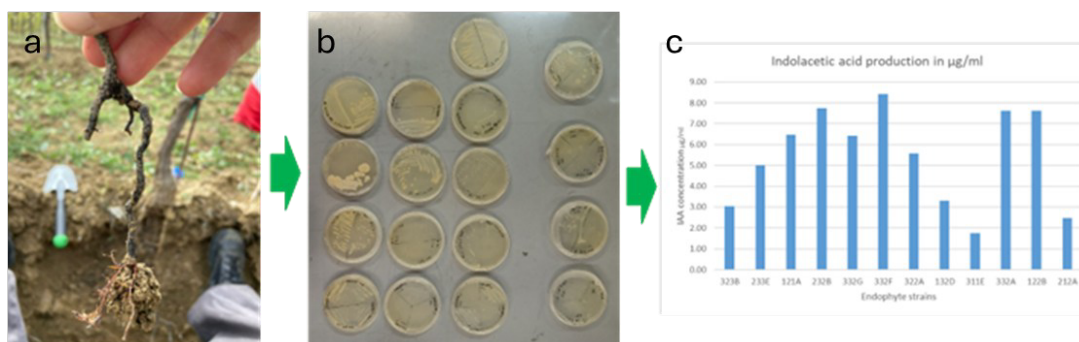


Figure 1. Workflow of vine endophytes collection: from root sampling a) to isolation b) to PGP trait screening c)

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