



The LifeWatch ERIC Biodiversity
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Fungal Diversity and Functional Potential of Vineyard Rhizosphere Soils in Bulgaria Revealed by ITS2 Metabarcoding

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Why Study Vineyard Microbiomes?

Background

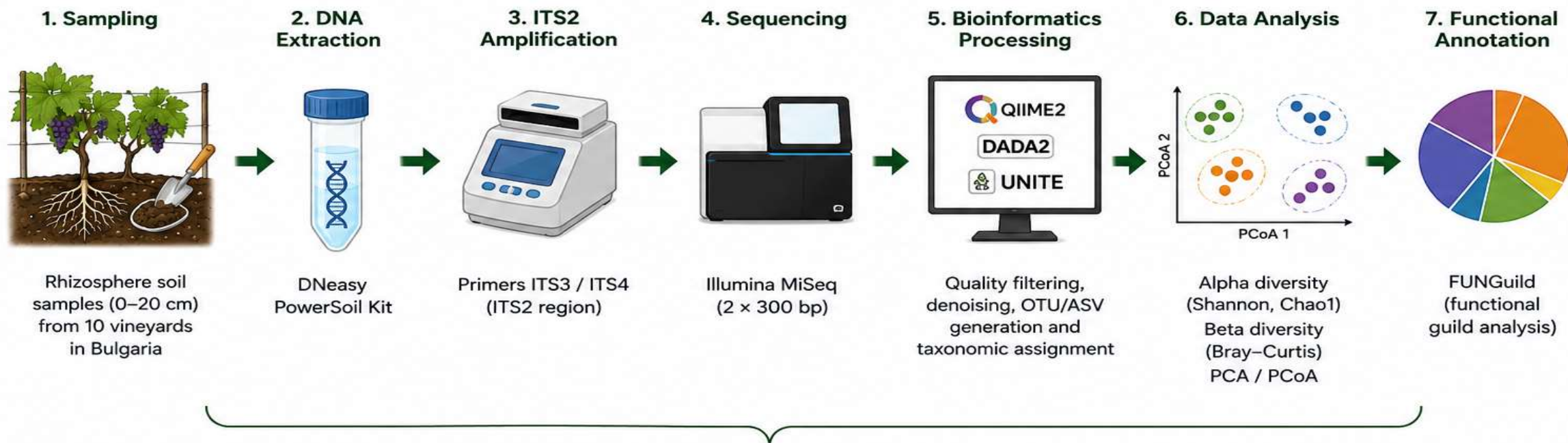
- Soil fungi are key drivers of nutrient cycling and soil fertility.
- They influence plant growth, stress tolerance and disease suppression.
- Vineyard ecosystems are strongly affected by local environmental conditions and management practices.
- Understanding fungal diversity may support sustainable viticulture and biological control strategies.

Research Question

How do fungal communities differ among vineyard soils from different regions of Bulgaria, and what functional roles do they perform?

The fungal microbiome represents an essential component of vineyard health. Current research aimed to identify both taxonomic and functional patterns across different viticultural regions.

Methodological Workflow for Vineyard Rhizosphere Fungal Metabarcoding



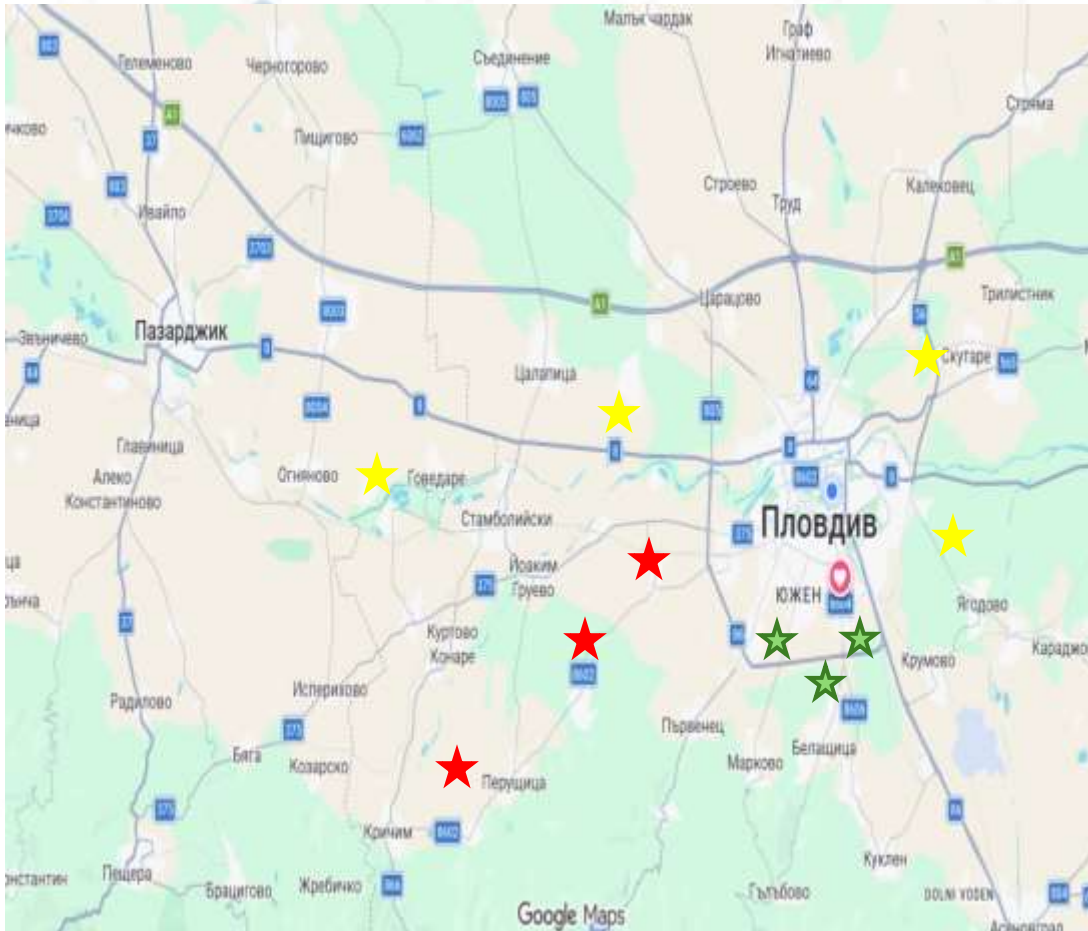
Study Outputs

- ✓ Fungal community composition and diversity
- ✓ Spatial patterns among vineyards
- ✓ Identification of beneficial fungal taxa
- ✓ Ecological roles of vineyard fungi



Better understanding of vineyard soil fungal communities for sustainable viticulture

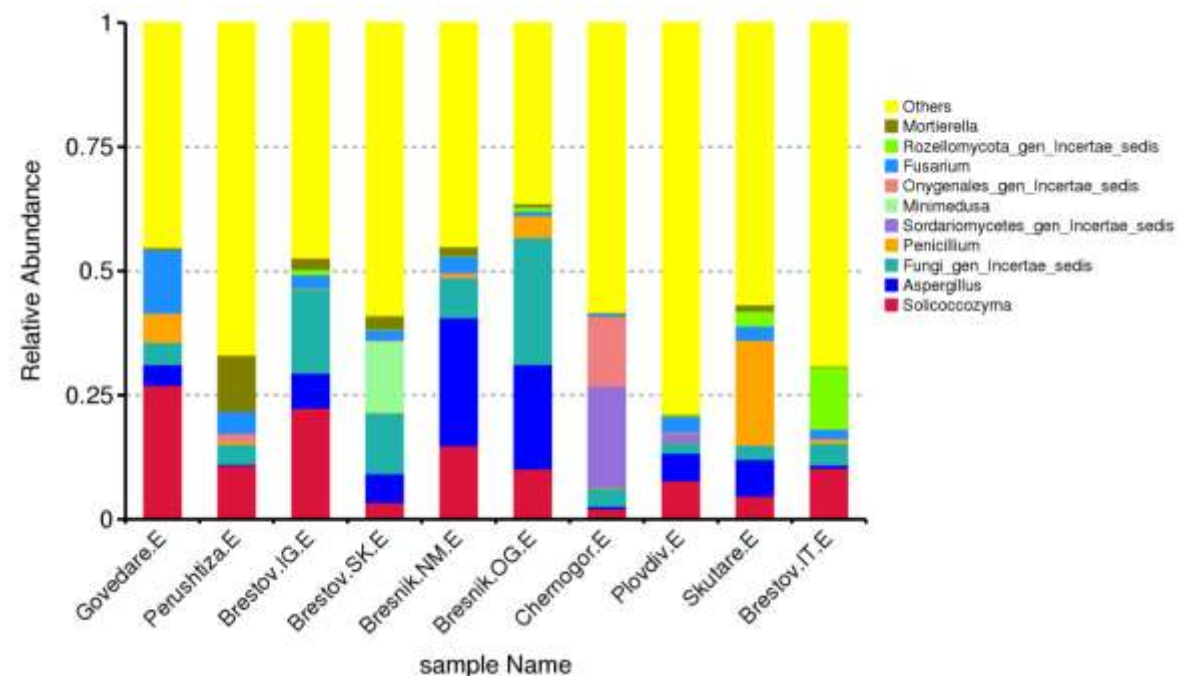
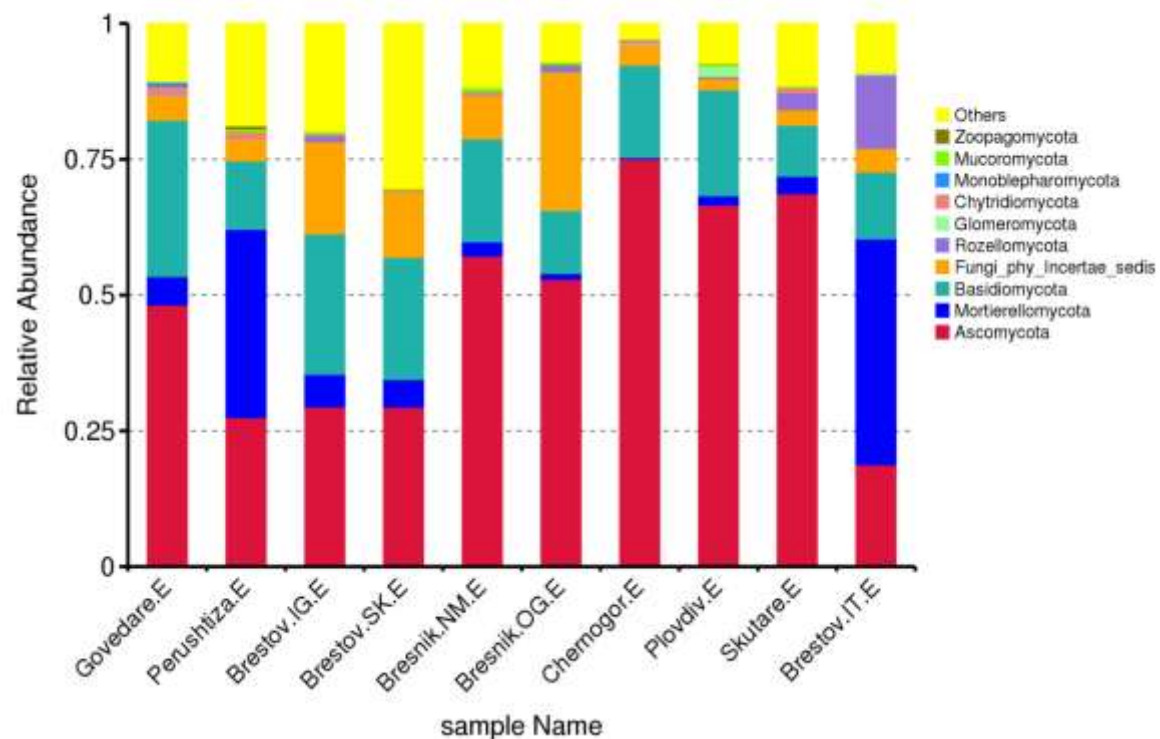
Viticultural regions in the Plovdiv district, Southern Bulgaria



We analysed the eukaryotic microbiomes of ten vineyard soils from three viticultural regions in the Plovdiv district, Southern Bulgaria:

- ★❖ North region (Chernogor.P, Plovdiv.P, Skutare.P, and Govedare.P)
- ★❖ Southwest region (Perushtitza.P, Bresnik.NM.P, and Bresnik.OG.P)
- ★❖ South region near Brestovitza (Brestov.IG.P, Brestov.SK.P, and Brestov.IT.P)

Dominant Fungal Phyla and Genera in Vineyard Rhizosphere Soils



Regional Differences in Fungal Communities

North Region

(Chernogor, Plovdiv, Skutare, Govedare)

The most balanced and diverse fungal community profiles were observed in this region.

High abundance of *Mortierella*, *Aureobasidium*, and *Chaetomium*, indicating biologically active and healthy soils.

Some sites, particularly Skutare, showed elevated levels of *Aspergillus*, which may serve as an indicator of drought stress.

Southwest Region

(Perushtitsa, Brestov IG, Brestov SK, Bresnik NM, Bresnik OG)

Greater abundance of *Aspergillus* and *Solicoccozyma*, suggesting adaptation to warmer and drier soil conditions.

Several vineyards exhibited lower fungal diversity, which may indicate reduced biological activity or early signs of soil fatigue.

Brestovitsa Area

(Brestov IT, Brestov SK)

Dominated by *Mortierellaceae*, *Chaetomium*, *Pulvinula*, and *Onygenales*.

The clay-rich and nutrient-rich soils provide favourable conditions for saprotrophic fungi involved in organic matter decomposition and nutrient cycling.

Beneficial Fungal Genera

Mortierella

- Most widespread beneficial genus.
- Associated with phosphorus mobilization and nutrient cycling.
- Indicator of biologically active soils.

Chaetomium

- Known for decomposition of plant residues.
- Potential antagonist of soil-borne pathogens.

Solicoccozyma

Common yeast-like fungus in vineyard soils.

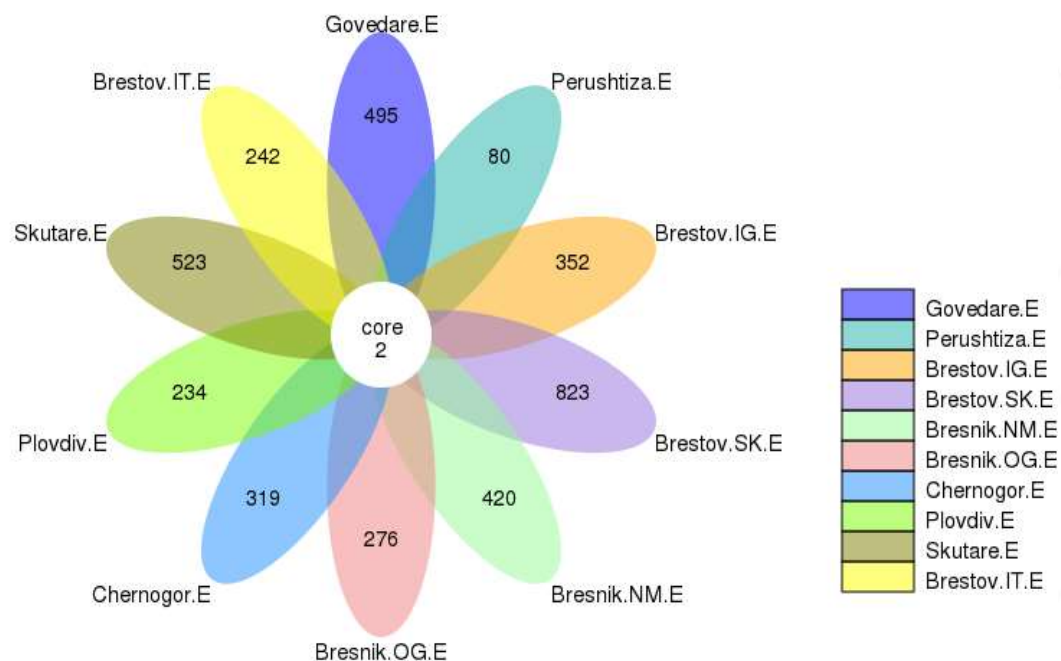
Associated with ecosystem stability and adaptation to environmental stress.

Aureobasidium

Frequently reported as a beneficial epiphytic and endophytic fungus.

Potential role in natural biological control.

Vineyard-Specific Microbiomes



Key findings

- ❖ Each vineyard harboured a distinct fungal community.
- ❖ Only a very small number of fungal taxa were shared among all vineyard sites.
- ❖ The highest numbers of unique OTUs were observed in:

Brestov.SK

Skutare

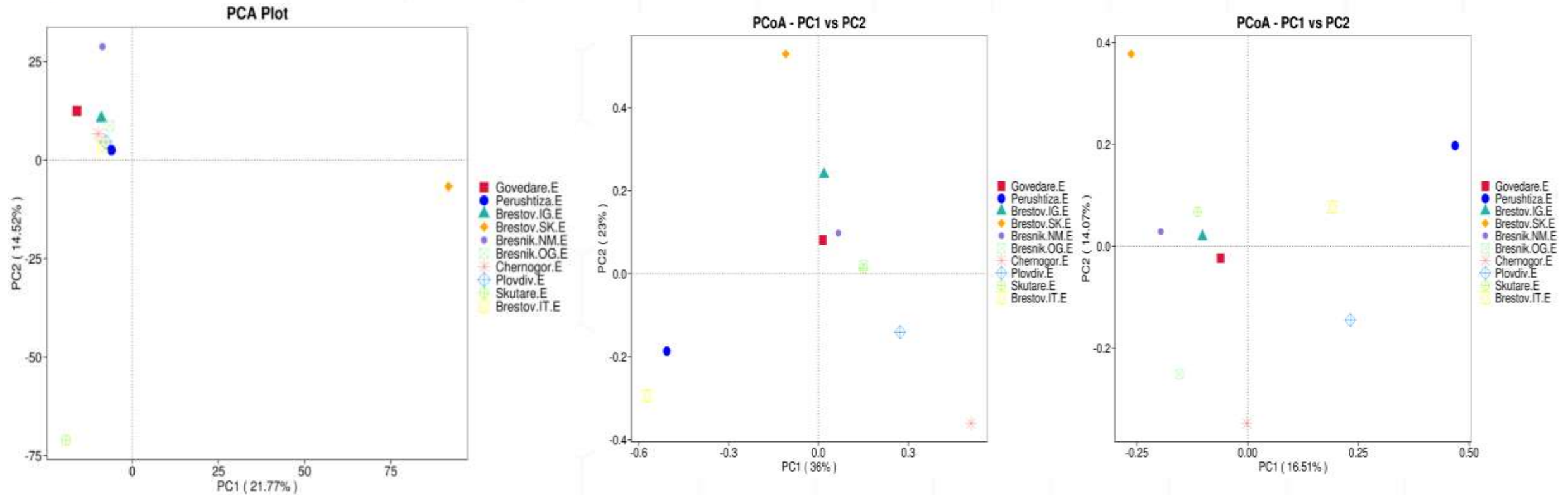
Govedare

Vineyards with higher numbers of unique taxa may represent specialised ecological niches shaped by local soil and environmental conditions.

Ecological Interpretation

The strong differentiation among vineyard microbiomes indicates that fungal community assembly is primarily driven by local environmental factors, soil characteristics and management practices.

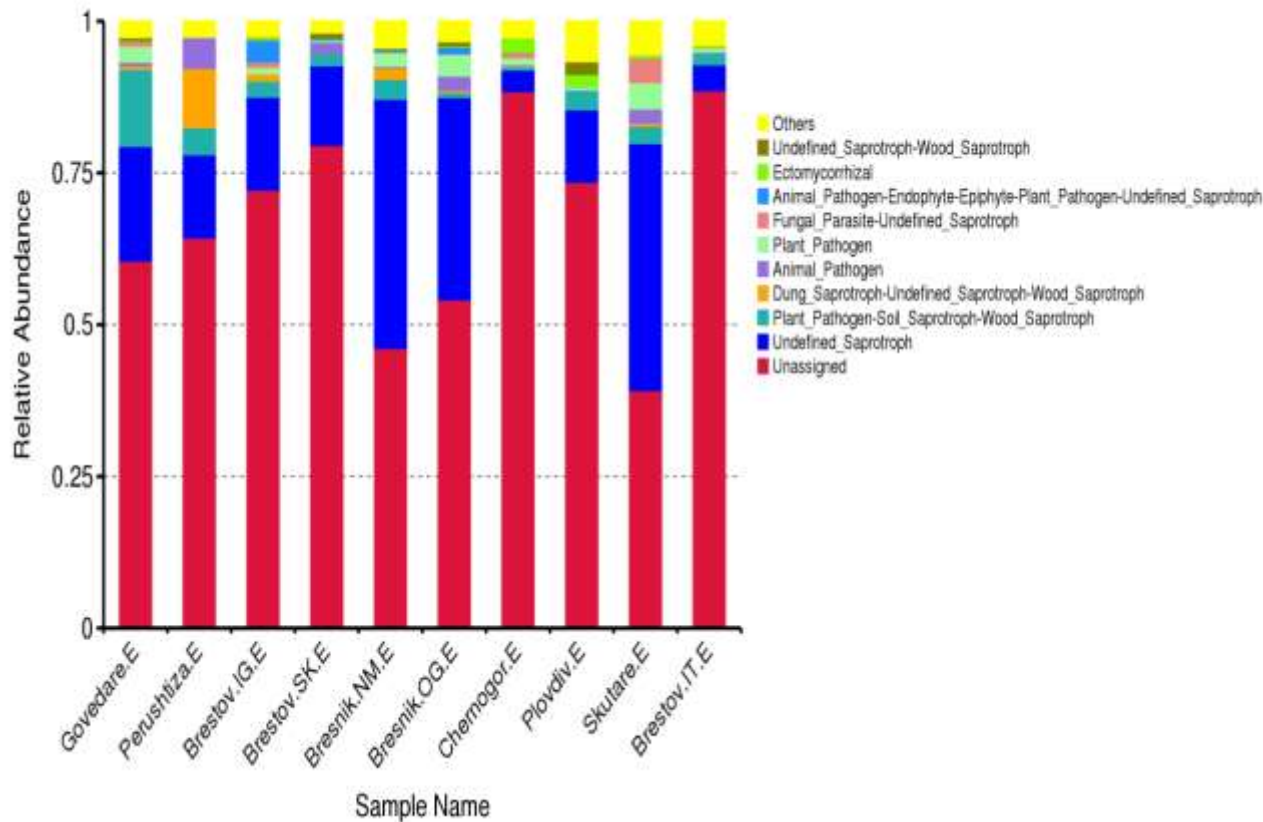
Spatial Differentiation of Vineyard Fungal Communities



Each vineyard supports a distinct fungal community, and spatial variation is a key determinant of vineyard soil biodiversity and ecosystem functioning. Samples tended to cluster according to their location, indicating that local environmental conditions and soil characteristics strongly influence fungal community assembly. These results support the concept of vineyard-specific microbiomes and highlight the importance of regional factors in shaping soil biodiversity.

Functional groups and beneficial fungi

FUNGuild results and dominant beneficial genera



Dominant Functional Groups

- **Saprotrophs**

The most abundant functional group across vineyard soils.

Responsible for organic matter decomposition and nutrient recycling.

Contribute to soil fertility and ecosystem functioning.

- **Endophytes**

Associated with plant tissues and potential stress tolerance.

May contribute to plant health and resilience.

- **Mycorrhiza-associated fungi**

Detected in several vineyard sites.

Important for nutrient uptake and soil-plant interactions.

Conclusions & Implications for Sustainable Viticulture

- ❖ Vineyard soils harbour highly diverse and site-specific fungal communities.
- ❖ Fungal community composition varies significantly among vineyards, reflecting local soil and environmental conditions.
- ❖ Beneficial fungi, particularly *Mortierella*, *Chaetomium*, *Solicoccozyma*, and *Aureobasidium*, were widespread across the studied soils.
- ❖ Saprotrophic fungi represented the dominant functional group, highlighting their importance in nutrient cycling and organic matter decomposition.
- ❖ Potentially pathogenic taxa, including *Fusarium* and *Alternaria*, were detected at low abundance, while beneficial saprotrophic fungi predominated across most vineyard soils, suggesting generally balanced and biologically active ecosystems.



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"Every vineyard tells a story through its
microbiome."

THANK YOU!

Questions?

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