Changes of spatio-temporal virus concentration in arbuscular mycorrhizal fungi inoculated grapevine

Emanuel Gaši[1*], Giorgio Gambino[2], Mate Čarija[1], Katarina Hančević[1], Frano Matić[3], Tomislav Radić[1]

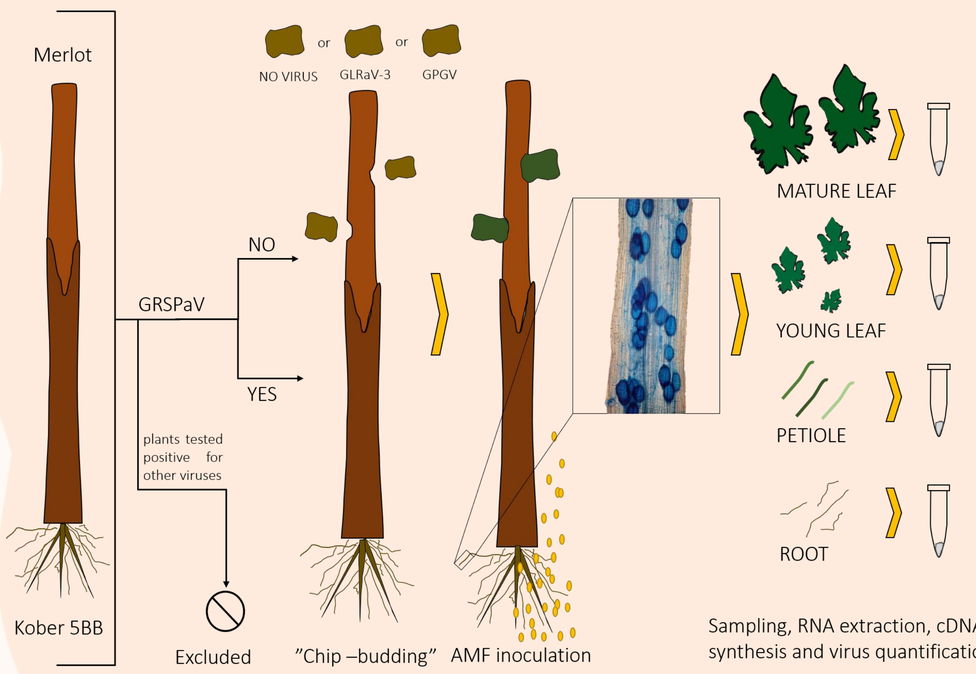
[1] *Insitute for Adriatic Crops and Karst Reclamation. Department of Plant Sciences, Put Duilova 11, 21000 Split, Croatia*
[2] *Institute for Sustainable Plant Protection, National Research Council, Strada delle Cacce 73, 10135 Torino, Italy*
[3] *University of Split, Department of Marine Studies, Ruđera Boškovića 37, 21000 Split, Croatia*
**Corresponding author: Emanuel.Gasi@krs.hr*

THEORETICAL BACKGROUND AND STUDY AIM

- AMF have been shown to improve plant host tolerance to biotic stresses, but protection against virus diseases has been highly variable and poorly investigated in perennial crops
- Grapevine is one of the most virus-prone, economically important crops
- Grapevine rupestris stem-pitting associated virus (GRSPaV) is ubiquitous across the grapevine growing regions.
- Virus tissue distribution is important for virus screening throughout the year. Benficial fungi are often an overlooked factor shaping virus-host interaction.

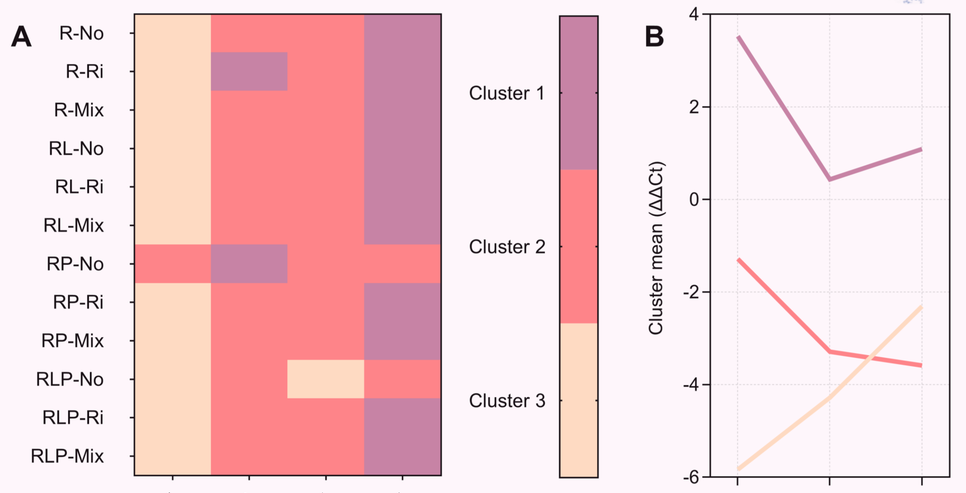
Aim was to investigate influence of mycorrhizal symbiosis on concentration and distribution of GRSPaV in different grapevine tissues

EXPERIMENTAL DESIGN AND METHODOLOGY

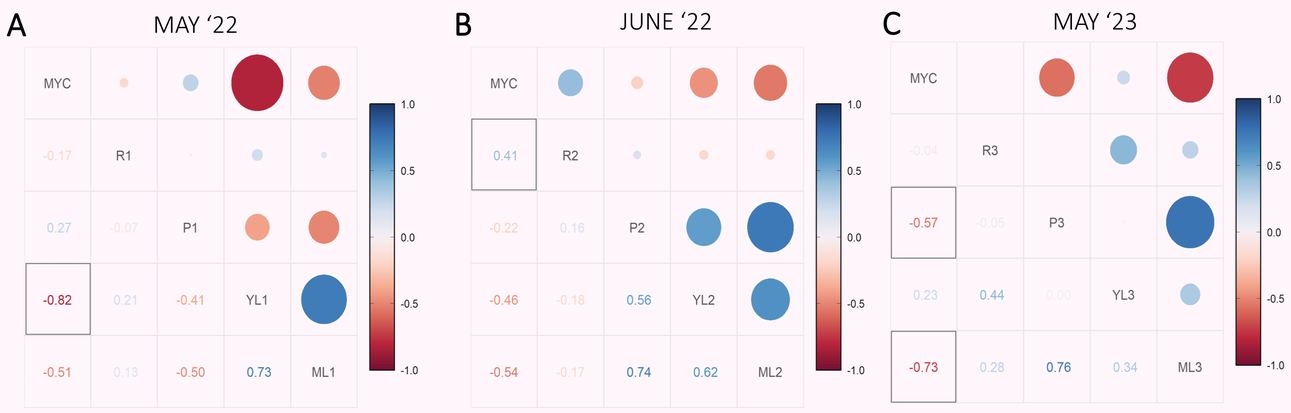


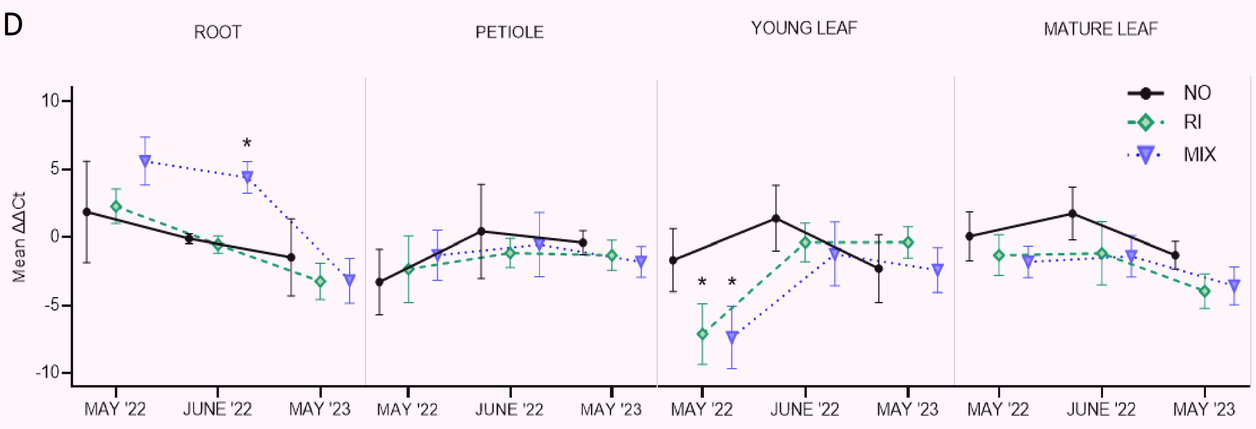
- VIRUS: GRSPaV, solely or in coinfection with GLRaV-3 and GPGV. AMF: ***R. irregularis*** **(Ri) or** ***R. irregularis, F. mosseae*** **and** ***F. caledonium*** **(Mix)**
- RT-qPCR in three time points / in four distinct grapevine tissues.
- Modified ΔΔCt method was used for statistical analysis
- Only GRSPaV without AMF were used as reference treatment

- Correlation analysis of total root mycorrhization percentage and virus concentration revieled strong negative correlation for young leaves in first sampling – May of '22. (bottom A), positive correlation for roots in June of '22. (bottom B), and negative correlation for petioles and mature leaves in the May of '23 (bottom C).
- K-means cluster analysis revealed three clusters represented with distinct patterns of temporal GRSPaV relative concentration changes with GRSPaV concentrations being similar in mature leaves.
- Roots and young leaves grouped in distinct clusters showing decrease and increase on the temporal scale, respectively



RESULTS





- Repeated measures ANOVA revealed grapevine roots with Mix inoculum had significantly greater concentration in first sampling point – May '22. and similar trend continued in June '22 (bottom D).
- Virus titer in young leaves showed increase along temporal scale, with lowest GRSPaV relative concentration detected in first sampling for both Ri and Mix AMF inoculated plants. This differences were lost one year after mycorrhizal inoculation.
- Petioles and mature leaves had more stable GRSPaV relative concentrations along the investigated temporal scale.

- GRSPaV concentrations varied significantly in AMF treated plants, with MIX inoculum having more pronounced effect in the roots.
- Increase in GRSPaV quantity in root could possibly be due to induced root formation and nutrient supply supported by newly established symbiosis.
- Changes in virus quantity for developing leaves of AMF plants toward later sampling suggests virus translocation in a source-sink manner from root to young leaves.

CONCLUSION

AMF influenced transient changes of GRSPaV concentration depending on tissue type, with greatest increase in roots during early symbiosis period.

REFERENCES

Fuchs, M. (2020). Grapevine viruses: a multitude of diverse species with simple but overall poorly adopted management solutions in the vineyard. J. Plant Pathol. 102, 643–653. https://doi.org/10.1007/s42161-020-00579-2

Gambino, G., Cuozzo, D., Fasoli, M., Pagliarani, C., Vitali, M., Boccacci, P., Pezzotti, M., & Mannini, F. (2012). Co-evolution between Grapevine rupestris stem pitting-associated virus and Vitis vinifera L. leads to decreased defence responses and increased transcription of genes related to photosynthesis. Journal of Experimental Botany, 63(16), 5919–5933. https://doi.org/10.1093/jxb/ers244

Hu, G., Dong, Y., Zhu, H., Zhang, Z., Fan, X., & Ren, F. (2018). Detection and distribution of Grapevine rupestris stem pitting-associated virus in grapevine. Scientia Horticulturae, 239, 64–69. https://doi.org/10.1016/j.scienta.2018.05.028

Miozzi, L., Vaira, A. M., Catoni, M., Fiorilli, V., Accotto, G. P., & Lanfranco, L. (2019). Arbuscular Mycorrhizal Symbiosis: Plant Friend or Foe in the Fight Against Viruses? Frontiers in Microbiology, 10(JUN). https://doi.org/10.3389/FMICB.2019.01238

MYCOOGRAPE

Research project: IP-2020-02-8397

HrZZ Croatian Science Foundation

ICOM12 International Conference on Mycorrhiza