Groundwater, a reservoir for plant pathogenic bacteria : the case of the Pseudomonas syringae complex in alluvial aquifer of Avignon

Odile Berge, Salah Nofal, Ludivine Rousset, Anne-Laure Cognard-Plancq, Caroline Guilbaud, Cindy E. Morris

Groundwater, a reservoir for plant pathogenic bacteria : the case of the *Pseudomonas syringae* complex in alluvial aquifer of Avignon

Berge O.[1], Nofal S. [2], Rousset L. [1], Cognard-Plancq A-L.[2], Guilbaud C. [1], Morris C. [1]

[1] *INRAE, Pathologie Végétale, F-84140, Montfavet, France*
[2] *EMMAH, UMR 1114 INRAE-AU, Avignon University, Avignon, France*
(odile.berge@inrae.fr)

….

Groundwater is the main reservoir of freshwater (98 %) on earth excluding glaciers. During last decades the use of groundwater for irrigation have increased following agriculture intensification and climate change, in particular in southern Europe. However, there is a significant lack of information on the presence of plant pathogens in aquifer, the current knowledge being to consider the risk negligible [1]. We decided to evaluate the possibility for groundwater to hosted plant pathogens with the model *Pseudomonas syringae* complex (*Psy*), a bacteria closely linked to the freshwater cycle [2].

We report evidence for the presence of *Psy* population at various places and dates in groundwater of Avignon, an intensive irrigation area in the south-east of France. Their concentration was highly variable and inversely correlated with water conductivity explaining 27% of variability. Their mean abundance were 100 times lower than in the river Durance connected with the aquifer but surprisingly, their genetic structure were more homogeneous i.e. 94 % belonged to *Psy* Phylogroup 02 [3], than in the river (PG02 = 32% of strains). Moreover, most strains (98 %) from groundwater were tested potentially pathogenic on plant, when in river they were only 66%. Determinants of this low diversity and prominence of PG02 in groundwater remains to be identified.

In conclusion even if more surveys are needed, aquifers must be considered as potential plant pathogenic reservoirs especially when used for crop irrigation. These results could influence new approaches to disease forecasting and surveillance and could lead to adaptation of agricultural practices.

[1] Gu, G., Yin, H., Ottesen, A., Bolten, S., Patel, J., Rideout, S. and Nou, X., 2019. Phytobiomes J 3 2: 137-147.
[2] Morris C.E., Monteil C.L. and Berge O., 2013. Annu Rev Phytopathol 51: 85–104.
[3] Berge O, Monteil CL, Bartoli C, Chandeysson C, Guilbaud C, *et al.*, 2014. PLoS ONE 9:(9): e105547.