Invited Talk 3

Impact of natural radioactivity on microorganisms

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Radiation is present everywhere in the universe and on earth. The role it has played in the emergence and evolution of life is still a completely open question. Within the framework of the ZATU Long-Term Socio-Ecological Research observatory, we have started to explore how microorganisms were impacted by natural radioactivity. In order to suppress cosmic rays, we have first conducted long term evolution experiments in the Modane Underground Laboratory (LSM) at the frontier between France and Italy. These experiments have shown that microorganisms displayed the same evolutionary path when natural radioactivity was reduced by a factor 7 (figure 1)[1].

In a second step, we are now studying microbial biodiversity in radioactive mineral springs which are peculiar ecosystems where physico-chemical and radiological parameters are significantly different from their surroundings and extremely stable over very long periods of time. We recently observed that a significant fraction of the microscopic algae (diatoms) colonizing the most radioactive springs of the Auvergne region (La Montagne spring) displayed stress response through deformation of their exoskeleton (figure 2) [2]. The roles played by both chemical and radiological stresses are currently under investigation in 30 mineral springs in Auvergne and beyond.

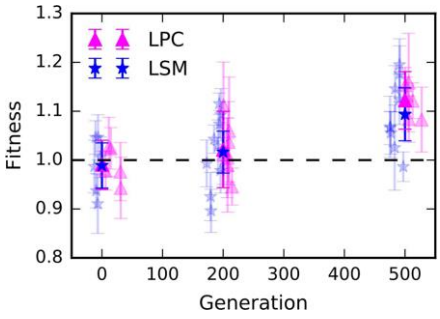

Figure 1: Bacteria evolved for 500 generations in Clermont-Ferrand (LPC) and Modane Undergound Laboratory (LSM) have similar fitness increases. [1]

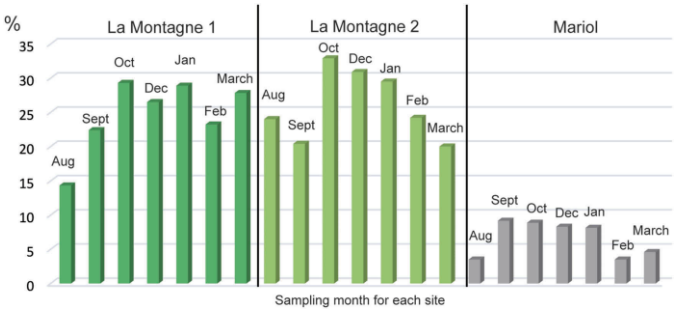

Figure 2 : time variation of the deformation rate (in %) of diatom exoskeletons in two radioactive springs of the Auvergne region [2]. La Montagne radon activity reaches up to 4000 Bq/l

References

[1]. Lampe, N., Marin, P., Coulon, M., et al, Reducing the ionizing radiation background does not significantly affect the evolution of *Escherichia coli* populations over 500 generations. *Sci Rep* 9, 14891 (2019).

[1]. F. Millan et al., The effect of natural radioactivity on diatom communities in mineral springs, *Botany Letters*, 2019