

Opposite response of DNA and RNA viruses to soil warming and implications for microbial functions

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Abstract: Soil viruses control the dynamics and metabolism of their hosts strongly modifying carbon and nutrient cycling as well as soil biogeochemistry. Warming specifically affects viruses and their hosts, but the consequences of climate warming on the virus–host interactions, and the consequences for soil functions remain unknown. We investigated the viral communities and the virus–host interactions under warming in situ based on a forest soil column translocation experiment. The abundance of the Patitvirales (DNA virus) decreased for 25%, but that of the Durnavirales and Martellivirales (RNA viruses) increased up to 9.5 times. The DNA viral lysogenic signals and RNA viral lytic protein increased in the soil, indicating the opposite lifestyles of DNA and RNA viruses. Correspondingly, the abundance of DNA viral hosts increased, whereas RNA viral hosts remained stable. The high DNA viruses / host ratios reflect very intensive interactions between the virus and the host leading to the drop of the host functions up to 43%. In contrast, the functions of the hosts for RNA viruses increased up to 48%. The fundamental difference in behavior of DNA and RNA viruses is that the former use mainly lysogenic, whereas the later - the lytic lifestyles and thus control host community's responses to warming. Concluding, the opposite response of DNA or RNA viruses to warming in abundance, lifestyle, and interactions with hosts, leads to divergent changes in nutrient fluxes in soil. These new perspectives on viral regulations of microbial communities under soil warming reveal the undeniable role of viruses in microbial ecology.

Keywords: soil warming; soil viruses; viral hosts and function; lysogenic and lytic lifestyles; forest soil