Active virus-host interactions at sub-freezing temperatures in Arctic peat soil

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Video Byte

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Abstract

In northern ecosystems, winter carbon loss is estimated to exceed growing season carbon uptake, primarily because of microbial decomposition. Viruses in soil alter microbial carbon cycling by affecting metabolic pathways and killing their hosts, but whether viruses are active under anoxic and sub-freezing soil conditions remains unknown. To find out, a recent study used stable isotope probing (SIP) targeted metagenomics to investigate active microbes in Alaskan Arctic peat soils under simulated winter conditions, with a particular focus on viruses and virus-host dynamics. Overall, 46 bacterial and 243 viral populations actively took up soil water labeled with ^{18}O and respired CO_2 . Active bacteria represented a small proportion of the total microbial community but were able to ferment and degrade organic matter. In contrast, a large diversity of viruses were found to be active, one-third of which were linked to active bacteria. The researchers identified 86 auxiliary metabolic genes (AMGs) and other environmentally relevant genes, most of which were carried by active viruses. These genes function in carbon utilization and scavenging, providing fitness advantages. Notably, this study provides evidence that microbes contribute to CO_2 loss from sub-freezing soil. It also reveals remarkable community differences between active bacteria/viruses and unlabeled organisms and suggests that viruses are major determinants of community structures and carbon loss in peat soils during winter.