Bad Altitude: Climate Change in the Alpine May Alter Beneficial Relationships between Plants and Their Fungal Symbionts

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Warming temperatures threaten alpine plant populations. Symbiotic relationships with arbuscular mycorrhizal fungi (AMF) and dark septate endophytes (DSE) may help ameliorate abiotic climate change stressors. This research observed fungal colonization levels across differing plants and determined variables (plant, environmental, or edaphic) that best predicted levels of colonization. Percent fungal colonization was determined using light microscopy and a visual counting method. These data were statistically analyzed with plant, environmental, and edaphic variables recorded at each sampling plot. Results revealed that unlike previous studies, colonization levels did not depend on root morphology. A Nemenyi test indicated that AMF colonized both forbs (thick roots) and sedges (thin roots) significantly more than n-fixers (thick roots) ($p<0.05$ for both), and DSE colonized grasses (thin roots) significantly more than forbs ($p<0.01$) and sedges ($p<0.01$). For prediction models, Akaike's corrected correlation coefficient indicated that DSE colonization ($\Delta AICc= -11.51$, $p<0.001$) was best predicted by edaphic and environmental variables whereas AMF colonization ($\Delta AICc= -4.35$, $p<0.05$) was only predicted by edaphic variables. Furthermore, DSE presence ($\Delta AICc= -13.20$, $p<0.001$) positively correlated with high elevation ($z= 3.233$, $p<0.01$) and low snowpack levels ($z=-2.666$, $p<0.01$). As a result, as alpine plant distributions shift upward in response to climate change, the DSE distribution may shift upwards maintaining colonization levels. AMF may not be able to accommodate such a shift, however, resulting in decreased AMF-plant colonization and numerous ramifications for alpine ecosystems.

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