Selection analysis on microbial community metrics

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Analysis

* Evaluate linear relationship of *I.purpurea* fitness and microbial richness, inverse Simpson, and evenness within the control (alone) treatment for each metric separately.
* Evaluate if relationship above is impacted by treatment via ANCOVA
* Assess how *I.purpurea* fitness in control varies with microbial diversity while controlling for root architecture and other root traits and interactions.

Regression performed *within* the controls

Table 1. Results from simple model performed on relative fitness as a function of species evenness within control treatment.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **term** | ***b*** | **SE** | ***t*-statistic** | ***p*-value** |
| (Intercept) | 0.865 | 0.096 | 8.989 | <0.001\*\*\* |
| Species evenness | -0.2 | 0.098 | -2.05 | 0.052^ |

Table 2. Results from simple model performed on relative fitness as a function of inverse Simpson diversity within control treatment.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Term** | ***b*** | **SE** | ***t*-statistic** | ***p*-value** |
| (Intercept) | 0.916 | 0.102 | 8.997 | <0.001\*\*\* |
| Inverse Simpson diversity | 0.044 | 0.141 | 0.316 | 0.755 |

Table 3. Results from simple model performed on relative fitness as a function of species richness within control treatment.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Term** | ***b*** | **SE** | ***t*-statistic** | ***p*-value** |
| (Intercept) | 0.879 | 0.099 | 8.896 | <0.001\*\*\* |
| Species Richness | 0.159 | 0.1 | 1.595 | 0.125 |

Results from linear regression on species evenness within controls after adjusting for root traits and species evenness by root trait interactions.

| **Term** | ***b*** | **SE** | ***t*-statistic** | ***p*-value** |
| --- | --- | --- | --- | --- |
| (Intercept) | 0.584 | 0.427 | 1.367 | 0.199 |
| Species Evenness | -0.058 | 0.217 | -0.266 | 0.795 |
| PC1 | -0.147 | 0.134 | -1.1 | 0.295 |
| PC2 | -0.016 | 0.108 | -0.147 | 0.886 |
| PC3 | -0.511 | 0.347 | -1.476 | 0.168 |
| PC4 | -0.199 | 0.266 | -0.749 | 0.469 |
| Block2 | 0.161 | 0.365 | 0.443 | 0.667 |
| Block3 | 0.599 | 0.402 | 1.492 | 0.164 |
| Block4 | 0.819 | 0.367 | 2.235 | 0.047\* |
| Species Evenness × PC1 | -0.147 | 0.108 | -1.36 | 0.201 |
| Species Evenness × PC2 | 0.14 | 0.25 | 0.561 | 0.586 |
| Species Evenness × PC3 | -0.361 | 0.32 | -1.127 | 0.284 |
| Species Evenness × PC4 | -0.235 | 0.319 | -0.737 | 0.477 |

Results from linear regression on relative fitness as a function of species inverse Simpson diversity after adjusting for root traits and inverse Simpson diversity by root trait interactions within controls.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Term** | ***b*** | **SE** | ***t*-statistic** | ***p*-value** |
| (Intercept) | 0.489 | 0.406 | 1.205 | 0.253 |
| Inverse Simpson diversity | -0.313 | 0.384 | -0.817 | 0.432 |
| PC1 | -0.122 | 0.138 | -0.882 | 0.397 |
| PC2 | -0.036 | 0.123 | -0.295 | 0.773 |
| PC3 | -0.306 | 0.251 | -1.216 | 0.249 |
| PC4 | -0.125 | 0.283 | -0.441 | 0.668 |
| Block2 | -0.018 | 0.348 | -0.05 | 0.961 |
| Block3 | 0.866 | 0.443 | 1.953 | 0.077 |
| Block4 | 0.674 | 0.374 | 1.8 | 0.099 |
| Inverse Simpson diversity × PC1 | 0.068 | 0.18 | 0.376 | 0.714 |
| Inverse Simpson diversity × PC2 | 0.106 | 0.199 | 0.533 | 0.604 |
| Inverse Simpson diversity × PC3 | 0.649 | 0.487 | 1.331 | 0.21 |
| Inverse Simpson diversity × PC4 | -0.153 | 0.402 | -0.38 | 0.711 |

Results from linear regression on relative fitness as a function of species richness after adjusting for root traits and species richness by root trait interactions within controls.

| **Term** | ***b*** | **SE** | ***t*-statistic** | ***p*-value** |
| --- | --- | --- | --- | --- |
| (Intercept) | 0.604 | 0.412 | 1.464 | 0.171 |
| Species richness | 0.065 | 0.217 | 0.299 | 0.77 |
| PC1 | -0.199 | 0.134 | -1.492 | 0.164 |
| PC2 | -0.013 | 0.117 | -0.113 | 0.912 |
| PC3 | -0.665 | 0.341 | -1.949 | 0.077 |
| PC4 | -0.246 | 0.281 | -0.873 | 0.401 |
| Block2 | 0.064 | 0.352 | 0.181 | 0.86 |
| Block3 | 0.613 | 0.395 | 1.553 | 0.149 |
| Block4 | 0.873 | 0.355 | 2.458 | 0.032\* |
| Species richness × PC1 | 0.204 | 0.116 | 1.753 | 0.107 |
| Species richness × PC2 | -0.056 | 0.195 | -0.288 | 0.778 |
| Species richness × PC3 | 0.531 | 0.302 | 1.76 | 0.106 |
| Species richness × PC4 | 0.234 | 0.311 | 0.752 | 0.468 |

Results from linear regression on relative fitness as a function of species evenness after adjusting for root traits and interactions between species evenness and root traits within controls.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Term** | **DF** | **SS** | **Mean SQ** | ***F*-value** | ***p-*value** |
| Species evenness | 1 | 1.405 | 1.405 | 18.333 | <0.001\*\*\* |
| Treatment | 1 | 0.261 | 0.261 | 3.41 | 0.068 |
| Block | 3 | 6.598 | 2.199 | 28.704 | <0.001\*\*\* |
| PC1 | 1 | 0.027 | 0.027 | 0.354 | 0.554 |
| PC2 | 1 | 0.003 | 0.003 | 0.037 | 0.849 |
| PC3 | 1 | 0.235 | 0.235 | 3.063 | 0.084 |
| PC4 | 1 | 0.005 | 0.005 | 0.068 | 0.795 |
| Species evenness × treatment | 1 | 0.086 | 0.086 | 1.121 | 0.293 |
| Species evenness × PC1 | 1 | 0.047 | 0.047 | 0.617 | 0.434 |
| Species evenness × PC2 | 1 | 0.001 | 0.001 | 0.012 | 0.912 |
| Species evenness × PC3 | 1 | 0.021 | 0.021 | 0.269 | 0.606 |
| Species evenness × PC4 | 1 | 0.092 | 0.092 | 1.201 | 0.276 |
| Residuals | 82 | 6.283 | 0.077 |  |  |

Results from linear regression on relative fitness as a function of Inverse Simpson diversity after adjusting for root traits and interactions between Inverse Simpson diversity and root traits within control.

| **Term** | **DF** | **SS** | **Mean Sq** | ***F*-value** | ***p*-value** |
| --- | --- | --- | --- | --- | --- |
| Inverse Simpson Diversity | 1 | 0.323 | 0.323 | 4.091 | 0.046\* |
| Treatment | 1 | 0.105 | 0.105 | 1.329 | 0.252 |
| Block | 3 | 7.795 | 2.598 | 32.93 | <0.001\*\*\* |
| PC1 | 1 | 0.043 | 0.043 | 0.55 | 0.461 |
| PC2 | 1 | 0.002 | 0.002 | 0.032 | 0.859 |
| PC3 | 1 | 0.237 | 0.237 | 3.008 | 0.087 |
| PC4 | 1 | 0.002 | 0.002 | 0.028 | 0.867 |
| Inverse Simpson Diversity × Treatment | 1 | 0 | 0 | 0.001 | 0.981 |
| Inverse Simpson Diversity × PC1 | 1 | 0.028 | 0.028 | 0.356 | 0.552 |
| Inverse Simpson Diversity × PC2 | 1 | 0.022 | 0.022 | 0.279 | 0.599 |
| Inverse Simpson Diversity × PC3 | 1 | 0.021 | 0.021 | 0.265 | 0.608 |
| Inverse Simpson Diversity × PC4 | 1 | 0.015 | 0.015 | 0.19 | 0.664 |
| Residuals | 82 | 6.47 | 0.079 |  |  |

Results from ANCOVA on relative fitness testing species richness by treatment interaction (control versus competition).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Term** | **DF** | **SS** | **Mean sq** | ***F*-value** | ***p-*value** |
| Species richness | 1 | 1.057 | 1.057 | 13.719 | <0.001\*\*\* |
| Treatment | 1 | 0.224 | 0.224 | 2.907 | 0.092 |
| Block | 3 | 6.948 | 2.316 | 30.061 | <0.001\*\*\* |
| PC1 | 1 | 0.03 | 0.03 | 0.386 | 0.536 |
| PC2 | 1 | 0.003 | 0.003 | 0.033 | 0.856 |
| PC3 | 1 | 0.252 | 0.252 | 3.275 | 0.074 |
| PC4 | 1 | 0.004 | 0.004 | 0.053 | 0.818 |
| Species richness × Treatment | 1 | 0.05 | 0.05 | 0.653 | 0.421 |
| Species richness × PC1 | 1 | 0.012 | 0.012 | 0.155 | 0.695 |
| Species richness × PC2 | 1 | 0.009 | 0.009 | 0.11 | 0.741 |
| Species richness × PC3 | 1 | 0.011 | 0.011 | 0.141 | 0.709 |
| Species richness × PC4 | 1 | 0.148 | 0.148 | 1.921 | 0.169 |
| Residuals | 82 | 6.317 | 0.077 |  |  |

\*Within\* competition

Results from linear regression on relative fitness as a function of Species evenness after adjusting for root traits and interactions between Species evenness and root traits within competition treatment.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Term** | ***b*** | **SE** | ***t*-statistic** | ***p*-value** |
| (Intercept) | 0.681 | 0.06 | 11.333 | <0.001\*\*\* |
| Species evenness | 0.008 | 0.036 | 0.223 | 0.824 |
| PC2 | -0.005 | 0.064 | -0.073 | 0.942 |
| PC1 | 0.008 | 0.047 | 0.163 | 0.871 |
| PC3 | -0.063 | 0.096 | -0.658 | 0.513 |
| PC4 | -0.027 | 0.092 | -0.29 | 0.773 |
| Block2 | 0.101 | 0.076 | 1.328 | 0.189 |
| Block3 | 0.778 | 0.077 | 10.166 | <0.001\*\*\* |
| Block4 | 0.343 | 0.077 | 4.445 | <0.001\*\*\* |
| Species evenness × PC2 | -0.005 | 0.062 | -0.087 | 0.931 |
| Species evenness × PC1 | 0.006 | 0.049 | 0.112 | 0.911 |
| Species evenness × PC3 | -0.013 | 0.092 | -0.143 | 0.887 |
| Species evenness × PC4 | 0.034 | 0.098 | 0.343 | 0.733 |

Results from linear regression on relative fitness as a function of Inverse Simpson diversity after adjusting for root traits and interactions between Inverse Simpson diversity and root traits within competition treatment.

| **Term** | ***b*** | **SE** | ***t*-statistic** | ***p*-value** |
| --- | --- | --- | --- | --- |
| (Intercept) | 0.675 | 0.06 | 11.195 | <0.001\*\*\* |
| Inverse Simpson Diversity | -0.003 | 0.032 | -0.101 | 0.92 |
| PC2 | -0.013 | 0.064 | -0.196 | 0.845 |
| PC1 | 0.012 | 0.046 | 0.256 | 0.799 |
| PC3 | -0.056 | 0.098 | -0.572 | 0.569 |
| PC4 | -0.028 | 0.094 | -0.295 | 0.769 |
| Block2 | 0.099 | 0.074 | 1.336 | 0.187 |
| Block3 | 0.787 | 0.077 | 10.235 | <0.001\*\*\* |
| Block4 | 0.341 | 0.076 | 4.488 | <0.001\*\*\* |
| Inverse Simpson Diversity × PC2 | -0.055 | 0.068 | -0.815 | 0.418 |
| Inverse Simpson Diversity × PC1 | -0.048 | 0.04 | -1.189 | 0.239 |
| Inverse Simpson Diversity × PC3 | -0.055 | 0.091 | -0.606 | 0.547 |
| Inverse Simpson Diversity × PC4 | 0.05 | 0.093 | 0.539 | 0.592 |

Results from linear regression on relative fitness as a function of Species richness after adjusting for root traits and interactions between Species richness and root traits within competition treatment.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Term** | ***b*** | **SE** | ***t*-statistic** | ***p*-value** |
| (Intercept) | 0.684 | 0.061 | 11.212 | <0.001\*\*\* |
| Species richness | -0.004 | 0.035 | -0.12 | 0.905 |
| PC2 | -0.012 | 0.064 | -0.193 | 0.848 |
| PC1 | -0.003 | 0.048 | -0.056 | 0.956 |
| PC3 | -0.077 | 0.097 | -0.795 | 0.43 |
| PC4 | -0.031 | 0.092 | -0.342 | 0.734 |
| Block2 | 0.09 | 0.075 | 1.202 | 0.234 |
| Block3 | 0.785 | 0.078 | 10.097 | <0.001\*\*\* |
| Block4 | 0.345 | 0.077 | 4.507 | <0.001\*\*\* |
| Species richness × PC2 | -0.034 | 0.067 | -0.505 | 0.616 |
| Species richness × PC1 | -0.046 | 0.046 | -0.992 | 0.325 |
| Species richness × PC3 | -0.05 | 0.089 | -0.56 | 0.578 |
| Species richness × PC4 | 0 | 0.099 | 0.002 | >0.99 |

**Additional comments**

I also evaluated other simpler models including just PC2 (root architecture) and PC2 with PC2 by microbial species diversity interaction and I only had null results. Model of relative fitness as a function of species richness and Inverse Simpson Diversity and root architecture also yielded null results.

Supplementary figure showing relationship between microbial diversity metrics scaled to a mean of 0 and SD of 1 (x-axis) and relative fitness.

Chart, scatter chart

Description automatically generated