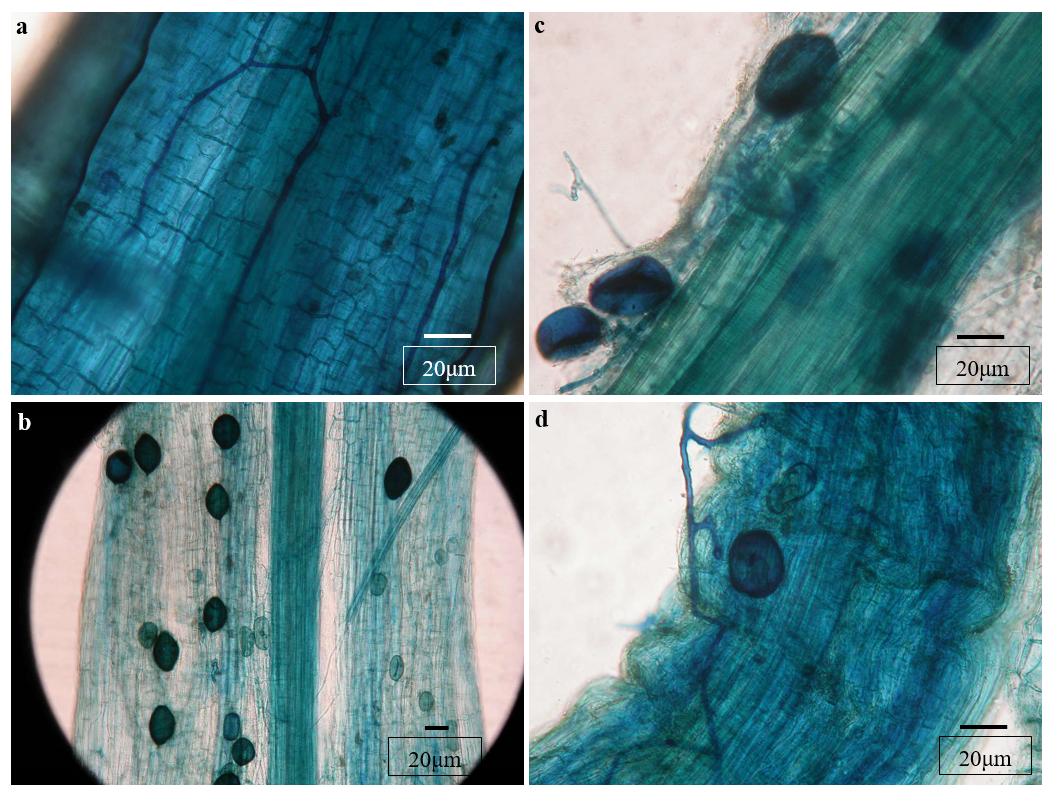
Supplementary Material

**Supplementary Figures**



**Supplementary Figure S1.** Photos of the *Desmodium triflorum* - *Zoysia tenuifolia* symbiotic system showing a low coverage level (a) and a high coverage level (b) of *Desmodium triflorum* in the lawn.



**Supplementary Figure S2.** Hyphal and vesicular structures in the roots of *Zoysia tenuifolia* (a, c) and *Desmodium triflorum* (b, d).

**Supplementary Tables**

**Supplementary Table S1.** Summary of the latin name, family name and genus name of the weeds in the lawn.

|  |  |  |  |
| --- | --- | --- | --- |
| NO. | Latin Name | Family | Genus |
| 1 | *Phyllanthus urinaria* L. | Euphorbiaceae | *Phyllanthus* |
| 2 | *Cassia mimosoides* L. | Fabaceae | *Cassia* |
| 3 | *Desmodium triflorum* (L.) DC. | Fabaceae | *Desmodium* |
| 4 | *Alysicarpus vaginalis* (L.) DC. | Fabaceae | *Alysicarpus* |
| 5 | *Lygodium scandens* (L.)Sw | Lygodiaceae | *Lygodium* |
| 6 | *Imperata cylindrica* (L.)P. Beauv. | Poaceae | *Imperata* |
| 7 | *Axonopus compressus* (Sw.) P. Beauv. | Poaceae | *Axonopus* |
| 8 | *Cynodon dactylon* (L.) Pers. | Poaceae | *Cynodon* |
| 9 | *Digitaria radicosa* (J. Presl) Miq. | Poaceae | *Digitaria* |
| 10 | *Sacciolepis indica* (L.) Chase | Poaceae | *Sacciolepis* |
| 11 | *Paspalum orbiculare* L. | Poaceae | *Paspalum* |
| 12 | *Ageratum conyzoides* L. | Asteraceae | *Ageratum* |
| 13 | *Conyza canadensis* (L.) Cronquist | Asteraceae | *Conyza* |
| 14 | *Vemonia cinerea* (L.) Less. | Asteraceae | *Vemonia* |
| 15 | *Emilia sonchifolia* (L.) DC. | Asteraceae | *Emilia* |
| 16 | *Tridax procumbens* L. | Asteraceae | *Tridax* |
| 17 | *Aster subulatus* Michx. | Asteraceae | *Aster* |
| 18 | *Ophioglossum vulgatum* L. | Ophioglossaceae | *Ophioglossum* |
| 19 | *Hedyotis corymbosa* L. | Rubiaceae | *Hedyotis* |
| 20 | *Centella asiatica* (L.) Urb. | Apiaceae | *Centella* |
| 21 | *Hydrocotyle sibthorpioides* Lam. | Apiaceae | *Hydrocotyle* |
| 22 | *Fimbristylis gracilenta* Hance | Cyperaceae | *Fimbristylis* |
| 23 | *Fimbristylis schoenoides* (Retz.) Vahl | Cyperaceae | *Fimbristylis* |
| 24 | *Cyperus rotundus* L. | Cyperaceae | *Cyperus* |
| 25 | *Kyllinga brevifolia* Rottb | Cyperaceae | *Kyllinga* |
| 26 | *Alternanthera sessilis* (L.) R. Br. ex DC. | Amaranthaceae | *Alternanthera* |
| 27 | *Lindernia anagallis* (Burm. F.) Pennell | Scrophulariaceae | *Lindernia* |

**Supplementary Table S2.** Pearson correlations among the root mycorrhizal colonizations, AM fungal spore densities and soil properties in different coverage levels of *Desmodium triflorum.* pH: soil pH; EC: electrical conductivity; TOC: total organic C; AP: available phosphorus; TP: total phosphorus; AN: available nitrogen; TN: total nitrogen. ZTC, ZHC and ZVC indicate the total colonization, hyphal colonization and vesicular colonization of *Zoysia tenuifolia*, respectively. DTC, DHC and DVC indicate the total colonization, hyphal colonization and vesicular colonization of *Desmodium triflorum*, respectively. SD: AM fungal spore density. The table shows the correlation coefficients, while \*, \*\* and \*\*\* indicate the correlation is significant at *p* < 0.05, *p* < 0.01 and *p* < 0.001 levels, respectively. The minus sign indicates a negative correlation.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | pH | EC | TOC | AP | TP | AN | TN | JHC | JVC | JTC | SHC | SVC | STC | SD |
| **Level-1** | pH | 1 | -0.377 | -0.301 | **0.455\*** | -0.065 | **0.469\*** | -0.172 | -0.207 | -0.130 | -0.214 | -0.210 | -0.290 | -0.372 | -0.387 |
| EC |  | 1 | 0.153 | 0.142 | 0.257 | 0.006 | 0.307 | 0.171 | 0.127 | 0.135 | 0.062 | 0.007 | 0.138 | 0.122 |
| TOC |  |  | 1 | 0.069 | **0.590\*\*** | 0.370 | **0.701\*\*** | -0.376 | -0.345 | -0.371 | -0.220 | -0.211 | -0.155 | -0.071 |
| AP |  |  |  | 1 | **0.445\*** | **0.614\*\*** | 0.432 | 0.002 | 0.036 | 0.026 | -0.039 | -0.259 | -0.087 | -0.206 |
| TP |  |  |  |  | 1 | **0.447\*** | **0.833\*\*** | -0.029 | -0.037 | -0.041 | -0.161 | -0.222 | -0.095 | 0.244 |
| AN |  |  |  |  |  | 1 | **0.483\*** | -0.440 | -0.431 | **-0.465\*** | -0.222 | -0.270 | -0.249 | -0.336 |
| TN |  |  |  |  |  |  | 1 | -0.032 | 0.001 | -0.045 | -0.296 | -0.229 | -0.173 | 0.257 |
| JHC |  |  |  |  |  |  |  | 1 | **0.965\*\*** | **0.979\*\*** | **0.499\*** | 0.355 | 0.418 | **0.603\*\*** |
| JVC |  |  |  |  |  |  |  |  | 1 | **0.975\*\*** | **0.468\*** | 0.334 | 0.382 | **0.608\*\*** |
| JTC |  |  |  |  |  |  |  |  |  | 1 | **0.492\*** | 0.350 | 0.412 | **0.593\*\*** |
| SHC |  |  |  |  |  |  |  |  |  |  | 1 | **0.782\*\*** | **0.934\*\*** | 0.147 |
| SVC |  |  |  |  |  |  |  |  |  |  |  | 1 | **0.900\*\*** | 0.159 |
| STC |  |  |  |  |  |  |  |  |  |  |  |  | 1 | 0.204 |
| SD |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 |
| **Level-2** | pH | 1 | -0.385 | -0.340 | 0.243 | **-0.558\*** | -0.007 | -0.414 | -0.185 | -0.417 | -0.274 | -0.400 | -0.303 | -0.442 | **-0.571\*\*** |
| EC |  | 1 | **0.451\*** | **0.470\*** | **0.539\*** | 0.018 | **0.712\*\*** | 0.211 | 0.216 | 0.264 | 0.389 | **0.558\*** | **0.508\*** | 0.149 |
| TOC |  |  | 1 | 0.289 | **0.611\*\*** | -0.066 | **0.654\*\*** | 0.009 | -0.037 | 0.013 | 0.381 | 0.144 | 0.344 | 0.331 |
| AP |  |  |  | 1 | 0.193 | -0.018 | 0.418 | -0.295 | -0.146 | -0.280 | -0.173 | -0.085 | -0.188 | -0.157 |
| TP |  |  |  |  | 1 | 0.312 | **0.854\*\*** | 0.110 | 0.098 | 0.168 | 0.436 | 0.256 | 0.404 | 0.392 |
| AN |  |  |  |  |  | 1 | 0.212 | 0.438 | 0.173 | 0.431 | 0.388 | 0.291 | 0.343 | 0.272 |
| TN |  |  |  |  |  |  | 1 | 0.177 | 0.140 | 0.232 | 0.413 | **0.484\*** | **0.487\*** | 0.352 |
| JHC |  |  |  |  |  |  |  | 1 | **0.623\*\*** | **0.990\*\*** | **0.614\*\*** | **0.476\*** | **0.611\*\*** | -0.027 |
| JVC |  |  |  |  |  |  |  |  | 1 | **0.686\*\*** | 0.292 | 0.382 | 0.355 | -0.028 |
| JTC |  |  |  |  |  |  |  |  |  | 1 | **0.606\*\*** | **0.508\*** | **0.622\*\*** | 0.003 |
| SHC |  |  |  |  |  |  |  |  |  |  | 1 | **0.656\*\*** | **0.935\*\*** | 0.208 |
| SVC |  |  |  |  |  |  |  |  |  |  |  | 1 | **0.860\*\*** | 0.191 |
| STC |  |  |  |  |  |  |  |  |  |  |  |  | 1 | 0.276 |
| SD |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 |
| **Level-3** | pH | 1 | -0.158 | -0.248 | 0.320 | -0.227 | -0.069 | -0.332 | 0.002 | -0.388 | -0.142 | -0.132 | -0.032 | -0.166 | **-0.619\*\*** |
| EC |  | 1 | 0.082 | 0.339 | 0.108 | -0.321 | **0.503\*** | -0.323 | -0.163 | -0.292 | -0.116 | 0.041 | -0.052 | -0.024 |
| TOC |  |  | 1 | -0.145 | 0.303 | 0.314 | **0.545\*** | 0.373 | 0.265 | 0.413 | 0.158 | 0.076 | 0.154 | 0.354 |
| AP |  |  |  | 1 | 0.280 | -0.023 | 0.241 | -0.309 | -0.303 | -0.309 | -0.071 | -0.022 | -0.059 | -0.109 |
| TP |  |  |  |  | 1 | 0.005 | **0.631\*\*** | -0.292 | 0.095 | -0.183 | -0.122 | -0.161 | -0.116 | 0.388 |
| AN |  |  |  |  |  | 1 | -0.012 | **0.468\*** | 0.171 | **0.488\*** | 0.346 | 0.262 | 0.357 | 0.107 |
| TN |  |  |  |  |  |  | 1 | -0.210 | 0.091 | -0.124 | 0.050 | 0.083 | 0.071 | **0.499\*** |
| JHC |  |  |  |  |  |  |  | 1 | **0.459\*** | **0.972\*\*** | **0.594\*\*** | 0.437 | **0.585\*\*** | -0.164 |
| JVC |  |  |  |  |  |  |  |  | 1 | **0.614\*\*** | 0.114 | 0.044 | 0.088 | 0.212 |
| JTC |  |  |  |  |  |  |  |  |  | 1 | **0.535\*** | 0.385 | **0.530\*** | -0.055 |
| SHC |  |  |  |  |  |  |  |  |  |  | 1 | **0.781\*\*** | **0.986\*\*** | -0.153 |
| SVC |  |  |  |  |  |  |  |  |  |  |  | 1 | **0.840\*\*** | -0.244 |
| STC |  |  |  |  |  |  |  |  |  |  |  |  | 1 | -0.147 |
| SD |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 |
| **Level-4** | pH | 1 | -0.260 | -0.155 | 0.399 | 0.118 | -0.049 | -0.167 | 0.063 | -0.117 | -0.037 | -0.020 | -0.179 | -0.100 | **-0.713\*\*** |
| EC |  | 1 | **0.579\*\*** | 0.385 | 0.382 | 0.346 | **0.470\*** | 0.371 | **0.445\*** | 0.391 | 0.333 | **0.479\*** | 0.404 | 0.301 |
| TOC |  |  | 1 | 0.127 | **0.554\*** | 0.232 | **0.531\*** | 0.291 | 0.299 | 0.272 | 0.287 | **0.468\*** | 0.328 | 0.376 |
| AP |  |  |  | 1 | **0.568\*\*** | 0.476\* | 0.229 | 0.305 | 0.205 | 0.291 | 0.216 | 0.219 | 0.234 | -0.281 |
| TP |  |  |  |  | 1 | 0.370 | **0.556\*** | 0.408 | **0.464\*** | 0.430 | **0.476\*** | 0.402 | **0.509\*** | 0.339 |
| AN |  |  |  |  |  | 1 | **0.504\*** | 0.284 | 0.207 | 0.282 | 0.032 | 0.134 | 0.050 | 0.222 |
| TN |  |  |  |  |  |  | 1 | 0.406 | **0.468\*** | **0.464\*** | 0.212 | 0.346 | 0.253 | **0.508\*** |
| JHC |  |  |  |  |  |  |  | 1 | **0.876\*\*** | **0.980\*\*** | **0.696\*\*** | **0.682\*\*** | **0.685\*\*** | 0.215 |
| JVC |  |  |  |  |  |  |  |  | 1 | **0.933\*\*** | **0.625\*\*** | **0.644\*\*** | **0.658\*\*** | 0.404 |
| JTC |  |  |  |  |  |  |  |  |  | 1 | **0.656\*\*** | **0.656\*\*** | **0.666\*\*** | 0.290 |
| SHC |  |  |  |  |  |  |  |  |  |  | 1 | **0.839\*\*** | **0.984\*\*** | 0.385 |
| SVC |  |  |  |  |  |  |  |  |  |  |  | 1 | **0.869\*\*** | 0.394 |
| STC |  |  |  |  |  |  |  |  |  |  |  |  | 1 | **0.449\*** |
| SD |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 |
| **Level-5** | pH | 1 | 0.025 | -0.335 | -0.058 | -0.203 | -0.406 | -0.296 | -0.050 | -0.022 | -0.040 | **-0.629\*\*** | **-0.444\*** | **-0.638\*\*** | **-0.501\*** |
| EC |  | 1 | **0.544\*** | -0.033 | 0.067 | **0.739\*\*** | 0.282 | 0.424 | 0.203 | 0.408 | .451\* | 0.381 | **0.450\*** | .188 |
| TOC |  |  | 1 | 0.214 | 0.362 | **0.622\*\*** | 0.453 | **0.494\*** | 0.207 | 0.422 | **0.544\*** | 0.420 | **0.531\*** | .285 |
| AP |  |  |  | 1 | 0.354 | 0.109 | 0.379 | -0.129 | -0.253 | -0.200 | 0.109 | -0.086 | 0.075 | -.126 |
| TP |  |  |  |  | 1 | -0.033 | 0.441 | -0.071 | -0.217 | -0.135 | -0.009 | -0.172 | -0.037 | .040 |
| AN |  |  |  |  |  | 1 | **0.504\*** | **0.512\*** | 0.371 | **0.503\*** | **0.707\*\*** | **0.721\*\*** | **0.750\*\*** | **0.487\*** |
| TN |  |  |  |  |  |  | 1 | 0.308 | 0.095 | 0.245 | 0.405 | 0.309 | 0.430 | -.054 |
| JHC |  |  |  |  |  |  |  | 1 | **0.801\*\*** | **0.990\*\*** | **0.685\*\*** | **0.651\*\*** | **0.677\*\*** | .365 |
| JVC |  |  |  |  |  |  |  |  | 1 | **0.867\*\*** | **0.458\*** | **0.513\*** | **0.488\*** | **0.522\*** |
| JTC |  |  |  |  |  |  |  |  |  | 1 | **0.659\*\*** | **0.655\*\*** | **0.660\*\*** | .416 |
| SHC |  |  |  |  |  |  |  |  |  |  | 1 | **0.698\*\*** | **0.969\*\*** | **0.493\*** |
| SVC |  |  |  |  |  |  |  |  |  |  |  | 1 | **0.797\*\*** | **0.498\*** |
| STC |  |  |  |  |  |  |  |  |  |  |  |  | 1 | **0.571\*\*** |
| SD |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 |

**Supplementary Table S3.** Relative abundance of fungal phylum in the fungi community of soils from different coverage levels of *Desmodium triflorum*.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Fungal phylum | *D. triflorum* spread level | | | | |
| /Relative abundance (%) | level-1 | level-2 | level-3 | level-4 | level-5 |
| Ascomycota | 68.99 | 88.35 | 32.12 | 51.00 | 57.62 |
| Basidiomycota | 22.71 | 5.61 | 12.63 | 9.92 | 35.37 |
| Glomeromycota | 0.38 | 1.55 | 0.79 | 0.61 | 0.48 |
| Zygomycota | 1.90 | 0.03 | 0.11 | 0.13 | 0.12 |
| unidentified | 4.22 | 3.98 | 4.60 | 4.78 | 3.78 |
| Others | 1.79 | 0.47 | 49.75 | 33.56 | 2.63 |