Supporting information to the paper

Bai. et al. Contrasting responses of life-history groups determine the effects of a shrub species on their understorey herbs along a dune stabilization gradient

**Table S1**. Mean (± SE, N=30) dimensions and cover of the sampled shrubs in all treatments. Different letters mean signiﬁcantly different values (Tukey HSD after one-way ANOVA, *P* < 0.05).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Dune stages | Size | Length (cm) | Width (cm) | Height (cm) | Cover (m2) |
| SF | Large | 160.00±25.07ab | 138.00±22.42a | 81.00±11.98a | 1.76±0.51a |
| Small | 108.33±11.90c | 83.67±14.45b | 66.00±12.13bc | 0.72±0.18b |
| FD | Large | 136.67±21.60b | 128.67±25.88a | 72.33±14.50a | 1.42±0.49a |
| Small | 98.67±13.56c | 87.00±15.33b | 54.67±8.76bc | 0.69±0.21b |
| FC | Large | 161.67±34.93a | 122.00±14.24a | 79.33±12.80ab | 1.57±0.48a |
| Small | 101.00±18.15c | 85.00±11.02b | 60.00±12.96c | 0.69±0.19b |

**Table S2**. Results of three-way ANOVAs on the effects of dune stabilization (D), shrub size (S), species group (G) and their interactions on Biomass, Richness and Abundance of subordinate plant species in open plots. Significant results are indicated in bold.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | df | Open plots | | | | | |  |
| Biomass | | Abundance | | Richness | |  |
| F | P | F | P | F | P |  |
| Dune | 2 | 10.33 | **<0.001** | 17.18 | **<0.001** | 6.84 | **0.001** |  |
| Size | 1 | 1.42 | 0.236 | 1.59 | 0.209 | 3.69 | 0.056 |  |
| Group | 1 | 0.56 | 0.455 | 17.07 | **<0.001** | 95.86 | **<0.001** |  |
| Dune × Size | 2 | 3.32 | **0.039** | 8.09 | **<0.001** | 3.24 | **0.041** |  |
| Dune × Group | 2 | 19.68 | **<0.001** | 54.26 | **<0.001** | 3.07 | **0.049** |  |
| Size × Group | 1 | 2.80 | 0.096 | 4.34 | **0.039** | 3.69 | 0.056 |  |
| Dune × Size × Group | 2 | 18.20 | **<0.001** | 12.62 | **<0.001** | 1.68 | 0.189 |  |
| Error | 168 |  |  |  |  |  |  |  |

**Table S3**. Results of three-way ANOVAs on the effects of dune stabilization (D), shrub size (S), species group (G) and their interactions on RIIBiomass, RIIRichness and RIIAbundance of subordinate plant species. Significant results are indicated in bold.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | df | Biomass | | Abundance | | Richness | |
| F | P | F | P | F | P |
| Dune | 2 | 1.41 | 0.244 | 4.49 | **0.013** | 2.73 | 0.068 |
| Size | 1 | 7.95 | **0.005** | 6.91 | **0.009** | 9.13 | **0.005** |
| D×S | 2 | 3.44 | **0.034** | 0.31 | 0.735 | 0.82 | 0.440 |
| Group | 1 | 99.48 | **<0.001** | 3.61 | **0.049** | 2.37 | 0.126 |
| D×G | 2 | 4.24 | **0.016** | 3.81 | **0.024** | 3.62 | **0.029** |
| S×G | 1 | 0.03 | 0.872 | 0.39 | 0.530 | 1.13 | 0.288 |
| D×S×G | 2 | 6.46 | **0.002** | 8.68 | **<0.001** | 9.71 | **<0.001** |
| Error | 168 |  |  |  |  |  |  |

**Table S4** Parameters of the regressions of Relative Interaction Index against shrub size (RII = *β0* + *β1* × Canopy). Code: PA, perennials abundance; AA, annuals abundance; A, abundance; PB, perennials biomass; AB, annuals biomass; B, biomass; PR, perennials richness; AR, annuals richness; R, richness. Significant (*P* < 0.05) regressions are indicated in bold.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Dependent variable | Numbers of variable | Parameter estimates | | *R2* | P-value |
| *β0* | *β1* |
| **RII-PB** | **90** | **0.545** | **-0.448** | **0.165** | **<0.001** |
| RII-AB | 90 | -0.007 | -0.251 | 0.012 | 0.310 |
| **RII-B** | **90** | **0.422** | **-0.434** | **0.121** | **<0.001** |
| **RII-PR** | **90** | **0.102** | **0.173** | **0.049** | **0.036** |
| RII-AR | 90 | 0.056 | 0.179 | 0.026 | 0.129 |
| **RII-R** | **90** | **0.129** | **0.242** | **0.179** | **<0.001** |

**Table S5**. List of herb species in different dune stabilization stages

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| name | family | life form | frequency in the open | | | frequency under the canopy | | |
| SF | FD | FC | SF | FD | FC |
| *Artemisia annua* | Asteraceae | Annual | - | 1/30 | 1/30 | - | 0/30 | 2/30 |
| *Astragalus melilotoides* | Leguminosae | Perennial | 0/30 | 4/30 | - | 5/30 | 2/30 | - |
| *Calamagrostis epigeios* | Gramineae | Perennial | 1/30 | - | - | 2/30 | - | - |
| *Chenopodium aristatum* | Chenopodiaceae | auunal | 1/30 | - | - | 2/30 | - | - |
| *Cleistogenes squarrosa* | Gramineae | Perennial | 11/30 | 2/30 | 1/30 | 16/30 | 1/30 | 2/30 |
| *Corispermum puberulum* | Chenopodiaceae | auunal | 30/30 | 28/30 | 5/30 | 30/30 | 29/30 | 2/30 |
| *Cynanchum thesioides* | Asclepiadaceae | Perennial | 3/30 | 2/30 | 16/30 | 5/30 | 6/30 | 17/30 |
| *Euphorbia esula* | Euphorbiaceae | auunal | - | 11/30 | - | - | 17/30 | - |
| *Euphorbia humifusa* | Euphorbiaceae | auunal | - | - | 3/30 | - | - | 2/30 |
| *Heteropappus altaicus* | Asteraceae | Perennial | 1/30 | 2/30 | 6/30 | 6/30 | 5/30 | 4/30 |
| *Ixeridium gracile* | Asteraceae | Perennial | 11/30 | 13/30 | 28/30 | 23/30 | 25/30 | 30/30 |
| *Lespedeza davurica* | Leguminosae | Perennial | 3/30 | 0/30 | - | 8/30 | 1/30 | - |
| *Leymus secalinus* | Gramineae | Perennial | 8/30 | 29/30 | 17/30 | 9/30 | 30/30 | 20/30 |
| *Oxytropis racemosa* | Leguminosae | Perennial | 1/30 | 1/30 | - | 1/30 | 1/30 | - |
| *Psammochloa villosa* | Gramineae | Perennial | 6/30 | - | - | 6/30 | - | - |
| *Salsola collina* | Chenopodiaceae | auunal | 1/30 | 6/30 | 2/30 | 4/30 | 13/30 | 5/30 |
| *Setaria viridis* | Gramineae | auunal | - | 1/30 | 21/30 | - | 1/30 | 24/30 |
| *Stipa glareosa* | Gramineae | Perennial | 6/30 | 15/30 | - | 11/30 | 11/30 | - |