Ecosphere

Richness, phylogenetic diversity, and abundance all have positive effects on invader performance in an arid ecosystem

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Appendix S1

Table S1. A list of gene number of the four sequenced genes (rbcl,matk,5.8s and ITS1) on the gene bank data base for the 18 experimental species including the invader *(Ipomoea carnea)*.

Species name	rbcl	matK	5.8s	ITS1	Congeneric species
Apium graveolens	KF613097.1	HM850719.1	KJ473893.1	KJ473893.1	NA
Amborella trichopoda	L12628.2	AF543721.1	NA	NA	NA
Beta vulgaris	AY270065.1	JN895701.1	AY858597.1	HE577334.1	NA
Centaurea calcitrapa	NA	KC969480.1	AY826252.1	L35864.1	NA
Chenopodium album	KJ204316.1	KC474467.1	JF976146.1	FN561552.1	NA
Chenopodium ficifolium	KM360714.1	HE855666.1	HE577466.1	HE577466.1	NA
Emex spinosa	HM849974.1	AY042582.1	KJ004358.1	JQ288755.1	NA
Ipomoea carnea	GU135243.1	GU135080.1	AF110920.1	AF110920.1	NA
Juncus acutus	HM850083.1	HM850944.1	AY727782.1	AY727782.1	*Juncus subulatus*
Melilotus indicus	JN376005.1	AF522111.2	KJ004336.1	NA	NA
Polypogon monspeliensis	KF713058.1	KF713154.1	KF850575.1	JN040633.1	NA
Rumex dentatus	NA	JX444530.1	NA	NA	NA
Spergularia marina	HM850381.1	AY936309.1	NA	NA	NA
Trifolium resupinatum	HM850421.1	AF522117.1	DQ307477.1	AF154361.1	NA
Urospermum picroides	NA	AJ633227.1	AJ633346.1	AJ633346.1	NA
Epilobium hirsutum	HQ590078.1	JN894073.1	KX166116.1	KX166116.1	NA
Cenchrus echinatus	AM849359.1	HF558494.1	KF850611.1	KF850611.1	NA

Table S2. The different treatments (A, B, C, D). (A) Low species richness with low phylogenetic distances (PD), (B) Low species richness with high phylogenetic distances, (C) High species richness with low phylogenetic distances, (D) High species richness with high phylogenetic distances. For each treatment there are three different combinations and two levels of invader density (highly invaded=1,lower invaded=2).

Treatments	Species1	Species 2	Faith's PD	Invader density
A11	*Centaurea_calcitrapa*	*Urospermum_picroides*	1.3062344	1
species abundance	*5*	*5*		
A21	*Emex_spinosa*	*Rumex_dentatus*	1.05901232	1
species abundance	*5*	*5*		
A31	*Rumex_dentatus*	*Beta_vulgaris*	1.10427939	1
species abundance	*5*	*5*		
A12	*Centaurea_calcitrapa*	*Urospermum_picroides*	1.3062344	2
species abundance	*5*	*5*		
A22	*Emex_spinosa*	*Rumex_dentatus*	1.05901232	2
species abundance	*5*	*5*		
A32	*Rumex_dentatus*	*Beta_vulgaris*	1.10427939	2
species abundance	*5*	*5*		
B11	*Emex_spinosa*	*Epilobium_hirsutum*	1.90308458	1
species abundance	*5*	*5*		
B21	*Urospermum_picroides*	*Apium_graveolens*	1.90308458	1
species abundance	*5*	*5*		
B31	*Rumex_dentatus*	*Urospermum_picroides*	1.90308459	1
species abundance	*5*	*5*		
B12	*Emex_spinosa*	*Epilobium_hirsutum*	1.90308458	2
species abundance	*5*	*5*		
B22	*Urospermum_picroides*	*Apium_graveolens*	1.90308458	2
species abundance	*5*	*5*		
B32	*Rumex_dentatus*	*Urospermum_picroides*	1.90308459	2
species abundance	*5*	*5*		

Treatments	Species 1	Species 2	Species 3	Species 4	Species 5	Faith's PD	Invader density
C11	*Urospermum_picroides*	*Spergularia_marina*	*Rumex_dentatus*	*Chenopodium_album*	*Chenopodium_ficifolium*	2.86284	1
species abundance	*2*	*2*	*2*	*2*	*2*		
C21	*Rumex_dentatus*	*Chenopodium_ficifolium*	*Centaurea_calcitrapa*	*Spergularia_marina*	*Emex_spinosa*	2.81757	1
species abundance	*2*	*2*	*2*	*2*	*2*		
C31	*Trifolium_resupinatum*	*Melilotus_indicus*	*Centaurea_calcitrapa*	*Rumex_dentatus*	*Emex_spinosa*	2.65031	1
species abundance	*2*	*2*	*2*	*2*	*2*		
C12	*Urospermum_picroides*	*Spergularia_marina*	*Rumex_dentatus*	*Chenopodium_album*	*Chenopodium_ficifolium*	2.86284	2
species abundance	*2*	*2*	*2*	*2*	*2*		
C22	*Rumex_dentatus*	*Chenopodium_ficifolium*	*Centaurea_calcitrapa*	*Spergularia_marina*	*Emex_spinosa*	2.81757	2
species abundance	*2*	*2*	*2*	*2*	*2*		
C32	*Trifolium_resupinatum*	*Melilotus_indicus*	*Centaurea_calcitrapa*	*Rumex_dentatus*	*Emex_spinosa*	2.65031	2
species abundance	*2*	*2*	*2*	*2*	*2*		
D11	*Melilotus_indicus*	*Juncus_subulatus*	*Epilobium_hirsutum*	*Rumex_dentatus*	*Urospermum_picroides*	4.04002	1
species abundance	*2*	*2*	*2*	*2*	*2*		
D21	*Epilobium_hirsutum*	*Juncus_subulatus*	*Polypogon_monspeliensis*	*Urospermum_picroides*	*Rumex_dentatus*	4.03562	1
species abundance	*2*	*2*	*2*	*2*	*2*		
D31	*Centaurea_calcitrapa*	*Cenchrus_echinatus*	*Emex_spinosa*	*Juncus_subulatus*	*Trifolium_resupinatum*	4.03562	1
species abundance	*2*	*2*	*2*	*2*	*2*		

D12	*Melilotus_indicus*	*Juncus_subulatus*	*Epilobium_hirsutum*	*Rumex_dentatus*	*Urospermum_picroides*	4.04002	2
species abundance	*2*	*2*	*2*	*2*	*2*		
D22	*Epilobium_hirsutum*	*Juncus_subulatus*	*Polypogon_monspeliensis*	*Urospermum_picroides*	*Rumex_dentatus*	4.03562	2
species abundance	*2*	*2*	*2*	*2*	*2*		
D32	*Centaurea_calcitrapa*	*Cenchrus_echinatus*	*Emex_spinosa*	*Juncus_subulatus*	*Trifolium_resupinatum*	4.03562	2
species abundance	*2*	*2*	*2*	*2*	*2*		

Table S3. Full and Top Mixed Linear Models with different aspects of invader performance as response variables (height, shoot biomass, root biomass, photosynthetic rate and leaf production) regressed on (~) the fixed effects:- (resident richness of each combination without the invader (SR community),mean phylogenetic distance between the invader and residents in each combination (Relatedness), phylogenetic diversity of each combination without the invader (PD. without) , invader density (INV.L) and the random effect is pot identity (POTID).These models were weighted by the lower value of AIC and the highest value of Akaike weight (AW).

Response Variable	Model	Model Structure	AIC	logLik	Df	BIC	Deviance	R^2marginal	R^2conditional	AW
Height (log)	Full model	Log (Height) ~ Relatedness + PD.without + SR community + INV.L + Date + (1 | PLOTID)	250.75228	-113.37614	12	293.93	226.75228	0.2366	0.542319	0.04523
	Best model	Log (Height) ~ Phylogenetic relatedness + Date + (1 | PLOTID)	248.39386	-115.19693	9	280.78	230.39386	0.1914	0.5465558	0.19639
Shoot biomass (log)	Full model	log(shoot biomass) ~ Relatedness + PD.without + SR community + INV.L + Date + (1 | PLOTID)	-176.07504	100.03752	12	-132.89	-200.07504	0.5786	0.5815	0.02298
	Best model	Log (shoot biomass) ~ SR community + Date + (1 | PLOTID)	-180.23872	99.11936	9	-147.85	-198.23872	0.5755	0.5774	0.22532
		log(shoot biomass) ~ PD.without + Date + (1 | PLOTID)	-180.64122	99.320609	9	-148.26	-198.64122	0.5755	0.5705	0.22532
Root biomass (log)	Full model	Log (root biomass) ~ Relatedness + PD.without + SRwithout + INV.L + Date + (1 | PLOTID)	477.40685	-226.70342	12	520.59	453.40685	0.7792	0.7840274	0.02675
	Best model	Log (root biomass)~ Relatedness + Date + (1 | PLOTID)	472.10732	-227.05366	9	504.49	454.10732	0.7785	0.7842119	0.22945
		Log (root biomass) ~ PD.without + Date + (1 | PLOTID)	472.1328	-227.0664	9	504.52	454.1328	0.7786	0.7833352	0.21842
Photosynhetic rate (log)	Full model	Log (photosynhetic rate) ~Relatedness + PD.without + SR community + INV.L + Date + (1 | PLOTID)	210.79413	-93.397067	12	245.3	186.79413	0.4611	0.4610875	0.04943
	Best model	Log (photosynhetic rate) ~ INV.L + Date + (1 | PLOTID)	206.23233	-94.116166	9	232.11	188.23233	0.4551	0.4551135	0.48368
Leaf production	Full model	S.leaves ~ Relatedness + PD.without + SRwithout + INV.L + Date + (1 | PLOTID)	1506.1708	-741.08538	12	1549.4	1482.1708	0.3003	0.5347198	0.03229
	Best S.leaves ~ SRwithout + Date + (1 | PLOTID) 1500.3511 -741.17557 9 1532.7 1482.3511 0.2992 0.5338109 0.22945 model S.leaves ~ Relatedness + Date + (1 | PLOTID) 1500.4496 -741.22482 9 1532.8 1482.4496 0.2984 0.5335941 0.21842									