

Genetic and phenotypic differentiation in functional traits of *Iris pseudacorus* L. in native and introduced Mediterranean climate ranges

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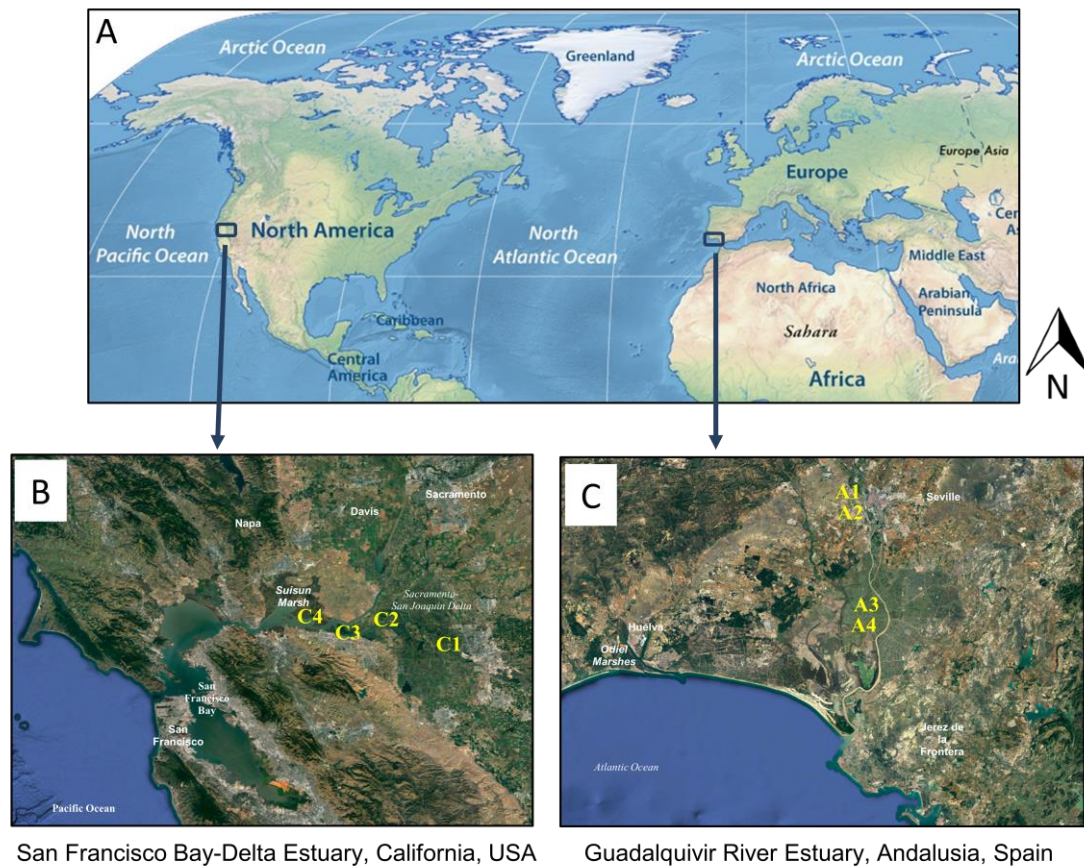


Fig. S1 A Geographical locations of studied introduced North American and native European ranges of *Iris pseudacorus*. Locations of population sites in B San Francisco Bay-Delta Estuary, California, USA and C Guadalquivir River Estuary, Andalusia, Spain.

Table S1 F-statistics and Pillai's trace from MANOVAs for three plant trait response groups of *Iris pseudacorus* for the factor distribution range (native and introduced), including main effect and model degrees of freedom (d.f.)

Plant trait response group	Pillai's Trace	F	d.f.	<i>P</i>
Biomass and growth	0.543	5.018	9	0.0002
Morphology	0.350	2.630	8	0.021
Biochemistry	0.566	19.097	3	< 0.0001

Table S2 General Linear Models with distribution range (native and introduced) as fixed factors, and seed mass as covariable, for biomass and growth, morphological and biochemical plant traits of *Iris pseudacorus*. Values are arithmetic mean $\pm$ SEM.

Significant differences ($P < 0.05$) are marked in bold

Plant traits	Distribution ranges		Distribution range		Seed mass	
	Native	Introduced	F _{1,5}	P	F _{1,5}	P
Biomass and growth	Live leaf biomass (g)	27.8 $\pm$ 2.8	23.1 $\pm$ 2.6	0.450	0.532	0.106 0.758
	Senescent leaf biomass (g)	7.1 $\pm$ 0.5	6.0 $\pm$ 0.4	1.024	0.358	0.016 0.905
	Crown biomass (g)	2.2 $\pm$ 0.2	2.7 $\pm$ 0.4	0.656	0.455	0.163 0.703
	Root biomass (g)	15.2 $\pm$ 2.9	14.4 $\pm$ 2.4	0.162	0.704	0.759 0.424
	Rhizome biomass (g)	1.6 $\pm$ 0.3	2.6 $\pm$ 0.4	1.338	0.300	0.161 0.705
	Root mass ratio	0.26 $\pm$ 0.02	0.28 $\pm$ 0.02	0.001	0.981	2.702 0.161
	Leaf mass ratio	0.51 $\pm$ 0.02	0.47 $\pm$ 0.02	0.233	0.650	1.530 0.271
	Leaf elongation rate (cm day ⁻¹)	5.4 $\pm$ 0.3	5.7 $\pm$ 0.3	0.322	0.595	0.171 0.697
Morphology	Specific leaf area (cm ² g ⁻¹)	3.5 $\pm$ 0.3	5.3 $\pm$ 0.4	13.987	0.013	0.590 0.477
	Total live leaves per plant (#)	33.4 $\pm$ 2.7	44.7 $\pm$ 3.0	10.311	0.002	2.539 0.118
	Live leaves per fan ¹ (#)	10.4 $\pm$ 0.5	8.6 $\pm$ 0.3	4.115	0.098	0.179 0.690
	Total senescent leaves (#) ¹	12.2 $\pm$ 0.7	12.2 $\pm$ 1.1	0.041	0.847	0.397 0.556
	Senescent leaves per fan ¹ (#)	4.5 $\pm$ 0.5	2.5 $\pm$ 0.2	4.393	0.090	0.161 0.705
	Total leaves per fan (#)	14.9 $\pm$ 0.9	11.2 $\pm$ 0.3	9.134	0.029	0.216 0.662
	Leaf width (cm)	2.7 $\pm$ 0.1	2.6 $\pm$ 0.1	0.326	0.593	0.415 0.548
	Leaf length (cm)	128.8 $\pm$ 7.1	112.3 $\pm$ 3.9	4.533	0.087	1.473 0.279
	Total leaf area (m ²)	0.26 $\pm$ 0.02	0.29 $\pm$ 0.03	0.641	0.460	0.673 0.449
Biochemistry	Rhizome TNC ² (mg g ⁻¹)	45.9 $\pm$ 4.4	123.3 $\pm$ 16.9	15.560	0.011	2.826 0.154
	Foliar C concentration (%)	40.4 $\pm$ 0.2	40.0 $\pm$ 0.2	1.017	0.360	0.195 0.678
	Foliar N concentration (%)	2.5 $\pm$ 0.1	2.7 $\pm$ 0.1	1.131	0.336	0.010 0.926

¹Data transformed using 1/x function. ² Data transformed using ln(x). TNC, total non-structural carbohydrates.

Table S3 Factor loadings of the individual variables obtained by a Principal ComponentAnalysis (PCA) on plant traits of *Iris pseudacorus* sourced from populations in the

native and introduced ranges and grown in a common garden experiment. Factor

loadings $> \pm 0.600$ are marked in bold

	PC1	PC2	PC3	PC4	PC5	PC6
NATIVE RANGE (Andalucía)						
Live leaf biomass	0.923	0.210	0.132	0.026	0.164	0.065
Above-ground biomass	0.910	0.273	0.119	0.125	0.166	-0.010
Total leaf area	0.887	-0.021	-0.013	0.118	0.204	0.185
Total leaf # per plant	0.790	-0.467	-0.092	0.077	0.255	0.092
Live leaf # per plant	0.767	-0.465	-0.185	0.065	0.123	0.238
Specific leaf area	-0.741	-0.400	-0.370	0.055	0.059	-0.062
Crown biomass	0.730	0.234	0.171	0.328	-0.147	-0.189
Senescent leaves per fan	-0.664	0.484	0.298	0.021	0.407	-0.090
Rhizome total non-structural carbohydrates	0.655	-0.083	-0.380	-0.395	0.117	0.078
Leaf C concentration	0.587	-0.198	-0.004	0.290	-0.538	-0.189
Live leaves # per fan	-0.239	0.772	0.205	0.074	0.147	0.432
Leaf width	0.446	0.696	0.274	0.117	-0.108	0.129
Total leaves # per fan	-0.514	0.693	0.283	0.052	0.316	0.177
Fan # per plant	0.647	-0.667	-0.207	-0.054	0.086	0.047
Below-ground biomass	0.606	0.631	-0.331	-0.239	0.058	-0.137
Root biomass	0.557	0.613	-0.359	-0.319	0.122	-0.144
Root mass ratio	0.114	0.579	-0.446	-0.578	-0.115	-0.084
Leaf mass ratio	0.476	-0.558	0.489	0.117	0.125	0.363
Leaf length	0.447	0.486	0.261	-0.005	-0.080	0.216
Leaf C:N ratio	0.410	-0.050	0.690	-0.448	-0.214	-0.235
Leaf N concentration	-0.409	0.071	-0.678	0.511	0.213	0.120
Leaf elongation rate	-0.453	-0.289	0.630	-0.109	-0.133	-0.024
Senescent leaf biomass	0.155	0.440	-0.044	0.629	0.051	-0.455
Senescent leaf # per plant	0.398	-0.191	0.321	0.078	0.605	-0.521
Rhizome biomass	0.358	0.491	-0.119	0.355	-0.493	0.122
<i>Eigen values</i>	8.9	5.3	2.9	1.9	1.6	1.2
<i>Explained variance (%)</i>	35.5	21.1	11.6	7.7	6.3	4.9
INTRODUCED RANGE (California)						
Above-ground biomass	0.957	0.165	0.074	-0.150	0.071	0.059
Live leaf biomass	0.954	0.171	0.074	-0.153	-0.049	0.020
Total leaf area	0.917	-0.091	-0.124	-0.165	-0.103	0.100
Crown biomass	0.875	0.085	0.170	0.234	0.001	-0.198
Below-ground biomass	0.826	0.314	-0.368	0.218	-0.014	-0.125
Root biomass	0.772	0.295	-0.450	0.238	-0.081	-0.116
Leaf width	0.735	0.441	0.129	-0.269	-0.118	-0.001
Rhizome biomass	0.710	0.469	-0.195	0.003	0.356	-0.063
Leaf N concentration	-0.703	0.221	-0.104	-0.281	0.250	-0.451
Leaf length	0.663	0.407	0.248	-0.343	-0.151	0.010
Leaf C:N ratio	0.648	-0.316	0.061	0.366	-0.088	0.514

Fan # per plant	0.516	-0.811	-0.203	0.007	0.037	-0.076
Total leaves # per plant	0.526	-0.778	-0.131	-0.077	0.070	0.042
Live leaves # per plant	0.469	-0.712	-0.404	-0.235	0.105	0.028
Total leaf # per fan	-0.502	0.688	0.098	-0.045	0.059	0.397
Leaf elongation rate	0.571	0.584	-0.157	0.033	-0.055	0.058
Live leaf # per fan	-0.401	0.512	-0.471	-0.384	0.148	0.314
Senescent leaves # per plant	0.211	-0.262	0.731	0.420	-0.089	0.042
Root mass ratio	0.061	0.282	-0.717	0.549	-0.128	-0.065
Senescent leaf # per fan	-0.246	0.382	0.716	0.401	-0.093	0.199
Specific leaf area	-0.470	-0.353	-0.510	0.085	-0.164	0.195
Rhizome total non-structural carbohydrates	0.310	0.251	0.477	0.071	0.013	-0.343
Leaf mass ratio	0.320	-0.276	0.583	-0.617	-0.282	0.093
Senescent leaf biomass	0.360	0.018	0.030	-0.033	0.840	0.289
Leaf C concentration	0.070	-0.261	0.514	0.220	0.585	-0.099
<i>Eigen values</i>	9.3	4.5	3.7	1.9	1.5	1.1
<i>Explained variance (%)</i>	37.1	17.8	14.6	7.7	6.0	4.5

Table S4 Pearson correlation coefficient (r) and bilateral signification (P) between inter- and intra-population trait variability indexes and relative phenotypic variability index (RIPV) of *Iris pseudacorus* traits recorded in a common garden experiment (CGE) and in the field for both native and alien plants (n = 10). Significant correlations (P < 0.05) are marked in bold

Alien plants		Intra- CGE	RIPV CGE	Inter- Field	Intra- Field	RPPI Field
Inter- CGE	r	0.978	0.508	0.969	0.898	0.126
	P	0.000	0.134	0.000	0.000	0.729
Intra- CGE	r	1	0.318	0.905	0.853	0.080
	P		0.371	0.000	0.002	0.825
RIPV CGE	r		1	0.670	0.563	0.237
	P			0.034	0.090	0.510
Inter- Field	r			1	0.928	0.127
	P				0.000	0.727
Intra- Field	r				1	-0.253
	P					0.481
Native plants						
Inter- CGE	r	0.925	0.479	0.856	0.841	0.384
	P	0.000	0.161	0.002	0.002	0.274
Intra- CGE	r	1	0.110	0.868	0.911	0.231
	P		0.762	0.001	0.000	0.521
RIPV CGE	r		1	0.233	0.095	0.472
	P			0.517	0.794	0.169
Inter- Field	r			1	0.951	0.533
	P				0.000	0.113
Intra- Field	r				1	0.244
	P					0.496

Table S5 Pearson correlation coefficient (up) and bilateral signification (down) between *Iris pseudacorus* traits recorded in a common garden experiment and environmental variables recorded in the field for both native and introduced ranges (n = 8 populations). Significant correlations (P < 0.05) are marked in bold

	Bulk density	Organic matter	Sediment C concentration	Sediment N concentration	pH	Electric conductivity	Plant cover	Marsh elevation	Hydrologic distance	Mean inundation period	Maximum water depth
Total leaf area	-0.188	0.348	0.127	0.309	-0.028	-0.210	0.200	-0.122	-0.120	-0.083	-0.002
	0.656	0.399	0.764	0.456	0.947	0.617	0.636	0.773	0.777	0.845	0.996
Live leaf biomass	0.301	-0.171	0.222	-0.182	0.492	-0.034	0.630	0.219	-0.446	0.251	-0.312
	0.469	0.686	0.597	0.667	0.215	0.936	0.094	0.601	0.268	0.548	0.452
Senescent leaf biomass	-0.018	-0.131	0.334	-0.106	0.473	0.766	0.753	0.257	-0.729	0.724	-0.372
	0.967	0.758	0.420	0.803	0.237	0.027	0.031	0.539	0.040	0.042	0.364
Crown biomass	-0.196	0.385	0.077	0.347	-0.013	-0.162	0.215	-0.186	-0.210	0.040	0.078
	0.642	0.346	0.855	0.399	0.976	0.702	0.609	0.660	0.618	0.924	0.854
Root biomass	-0.201	0.211	0.343	0.218	0.147	0.198	0.530	-0.184	-0.444	0.236	-0.087
	0.633	0.616	0.405	0.604	0.728	0.639	0.177	0.662	0.271	0.574	0.838
Rhizome biomass	-0.596	0.636	0.170	0.648	-0.352	-0.009	0.029	-0.565	-0.030	0.113	0.394
	0.119	0.090	0.688	0.082	0.392	0.983	0.946	0.144	0.944	0.790	0.335
Above-ground biomass	0.283	-0.184	0.268	-0.190	0.548	0.098	0.726	0.252	-0.548	0.362	-0.359
	0.498	0.662	0.521	0.652	0.160	0.817	0.041	0.547	0.160	0.378	0.382
Below-ground biomass	-0.259	0.291	0.325	0.295	0.088	0.154	0.485	-0.242	-0.409	0.223	-0.022
	0.535	0.484	0.432	0.478	0.836	0.715	0.223	0.563	0.314	0.595	0.958
Root mass ratio	-0.341	0.073	-0.115	0.093	-0.169	0.401	0.259	-0.505	-0.315	0.389	0.272
	0.409	0.863	0.786	0.826	0.690	0.325	0.536	0.202	0.447	0.340	0.515
Leaf mass ratio	0.484	-0.186	-0.105	-0.237	0.226	-0.519	-0.173	0.430	0.186	-0.401	-0.239
	0.224	0.659	0.804	0.572	0.591	0.187	0.683	0.287	0.659	0.325	0.569

Specific leaf area	-0.725	0.695	-0.201	0.676	-0.869	-0.237	-0.821	-0.543	0.646	-0.523	0.549
	0.042	0.056	0.633	0.066	0.005	0.572	0.012	0.164	0.084	0.183	0.159
Fan #	-0.551	0.662	-0.142	0.594	-0.621	-0.386	-0.502	-0.370	0.392	-0.609	0.286
	0.157	0.074	0.738	0.121	0.101	0.345	0.205	0.368	0.336	0.109	0.492
Total live leaves #	-0.644	0.730	-0.029	0.676	-0.683	-0.392	-0.519	-0.413	0.468	-0.660	0.295
	0.085	0.040	0.945	0.066	0.062	0.336	0.188	0.309	0.242	0.075	0.478
Live leaves per fan	0.249	-0.377	0.454	-0.308	0.494	0.434	0.525	0.382	-0.313	0.437	-0.404
	0.552	0.357	0.259	0.459	0.213	0.282	0.182	0.350	0.451	0.279	0.321
Total senescent leaves #	0.315	-0.265	-0.410	-0.339	0.265	-0.031	0.286	0.170	-0.361	0.173	-0.135
	0.447	0.526	0.314	0.412	0.526	0.942	0.492	0.687	0.379	0.681	0.750
Senescent leaves per fan	0.752	-0.773	0.067	-0.764	0.902	0.448	0.759	0.713	-0.692	0.663	-0.603
	0.032	0.024	0.874	0.027	0.002	0.265	0.029	0.047	0.057	0.073	0.113
Total leaves #	-0.459	0.548	-0.144	0.480	-0.507	-0.347	-0.359	-0.305	0.295	-0.513	0.214
	0.252	0.159	0.733	0.228	0.200	0.399	0.383	0.463	0.478	0.193	0.611
Total leaves per fan	0.549	-0.632	0.292	-0.588	0.767	0.486	0.705	0.602	-0.550	0.605	-0.553
	0.159	0.093	0.483	0.126	0.026	0.222	0.051	0.114	0.158	0.112	0.155
Leaf width	0.025	-0.109	0.171	-0.074	0.320	0.262	0.705	-0.152	-0.521	0.636	-0.008
	0.953	0.796	0.686	0.862	0.440	0.531	0.051	0.720	0.186	0.090	0.985
Leaf length	0.493	-0.476	0.166	-0.464	0.644	0.156	0.747	0.245	-0.594	0.414	-0.361
	0.215	0.233	0.694	0.247	0.085	0.713	0.033	0.558	0.121	0.308	0.380
Leaf elongation rate	0.111	0.271	0.136	0.303	-0.121	-0.870	-0.312	-0.242	0.506	-0.301	0.374
	0.794	0.516	0.749	0.466	0.776	0.005	0.452	0.564	0.200	0.468	0.361
Rhizome TNC	-0.116	0.138	-0.626	0.156	-0.543	-0.661	-0.466	-0.870	0.470	-0.010	0.941
	0.785	0.744	0.097	0.713	0.165	0.074	0.244	0.005	0.240	0.981	0.001
Foliar C concentration	0.538	-0.637	-0.443	-0.711	0.468	0.417	0.275	0.535	-0.534	0.199	-0.466
	0.169	0.089	0.272	0.048	0.242	0.305	0.510	0.171	0.173	0.637	0.245
Foliar N concentration	-0.471	0.249	-0.267	0.261	-0.604	0.144	-0.604	-0.347	0.424	-0.157	0.399
	0.238	0.553	0.522	0.533	0.113	0.733	0.113	0.399	0.295	0.711	0.327

Foliar C:N ratio	0.428	-0.234	0.265	-0.252	0.571	-0.105	0.587	0.362	-0.418	0.114	-0.431
	0.290	0.577	0.526	0.547	0.139	0.805	0.126	0.378	0.303	0.788	0.287
