

Supplementary material for:

Evolution of genetic variance during adaptive radiation

The American Naturalist

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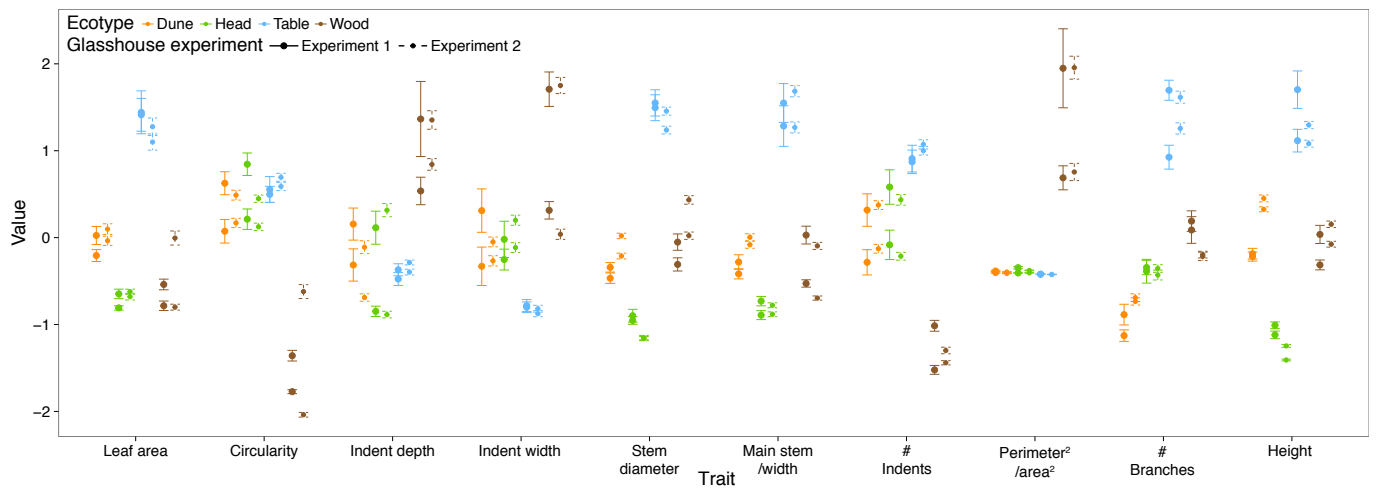


Figure S1 Mean and standard error estimates for all ten traits for the eight populations grown in both glasshouse experiments. Replicate populations within ecotype are represented by dots with the same colour. There were only minor differences in mean between glasshouse experiments.

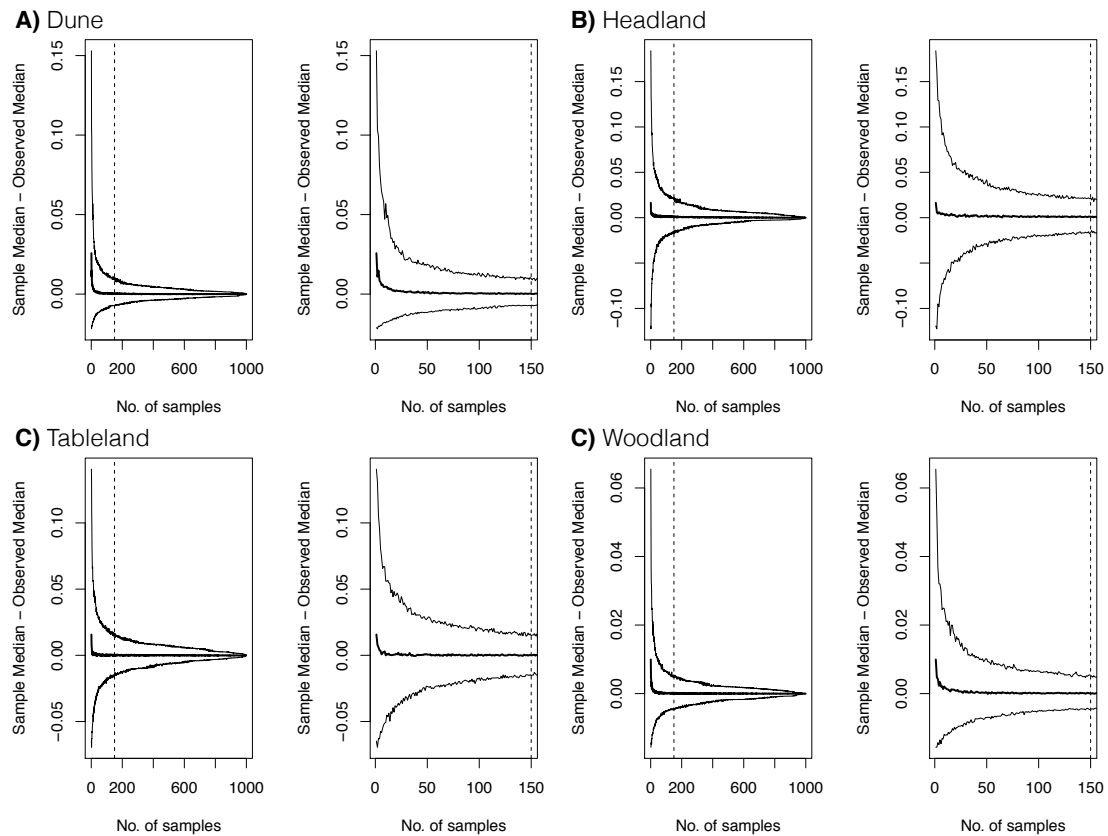


Figure S2 The total number of iterations required to estimate the posterior mean of each model implemented on a single randomisation of the data. Dashed line at 150 iterations shows the plateau in the error for the estimation of the median. Here we present the estimation of the variance for one trait (main stem length / width), with all other traits showing the same pattern.

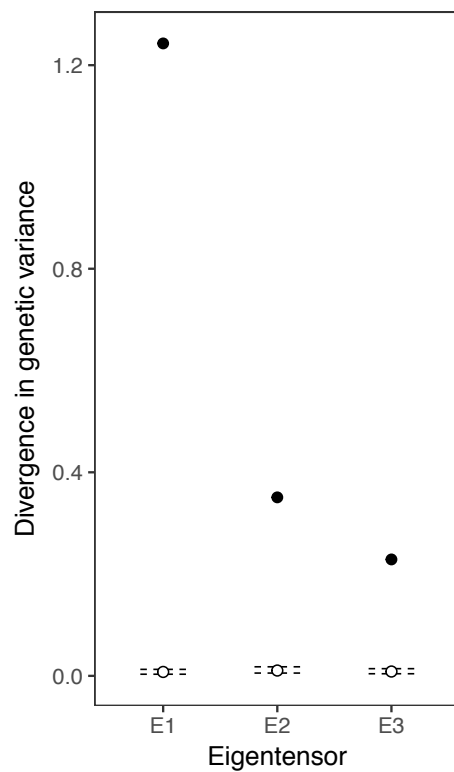


Figure S3 Significant variation explained by the covariance tensor on **G**. Unfilled circles represent the tensor conducted on the randomised **G** matrices, with dashed lines showing the 95% HPD intervals. Eigenvalues from the observed tensor analysis (filled circles) were higher than the random distribution, suggesting that all three eigentensors explained more divergence in genetic variation than expected by sampling error.

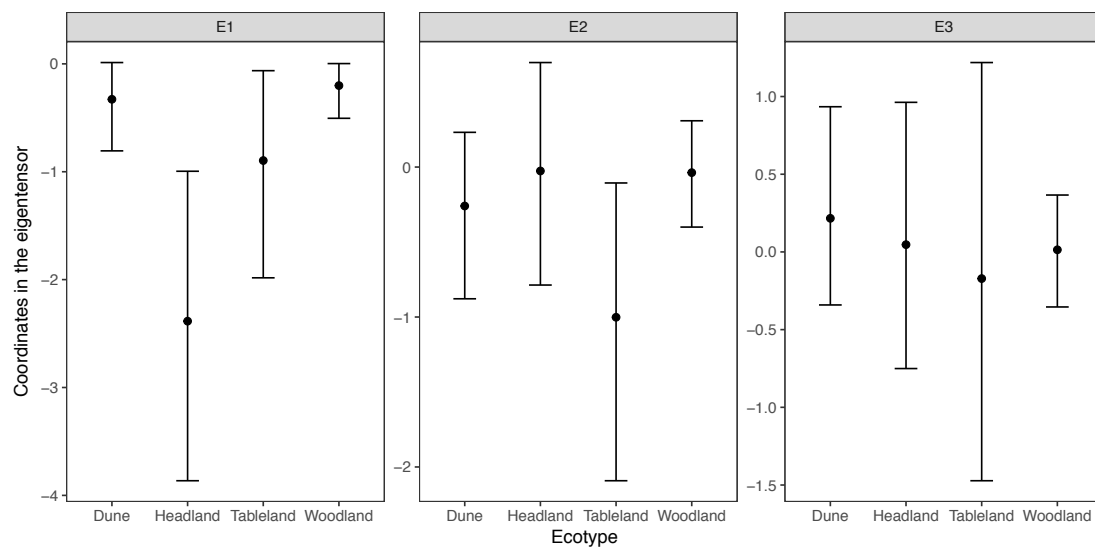


Figure S4 Coordinates of each ecotype **G** in the space of the eigentensor. Only the first eigentensor detected significant differences between ecotypes. Error bars are 95% HPD intervals.

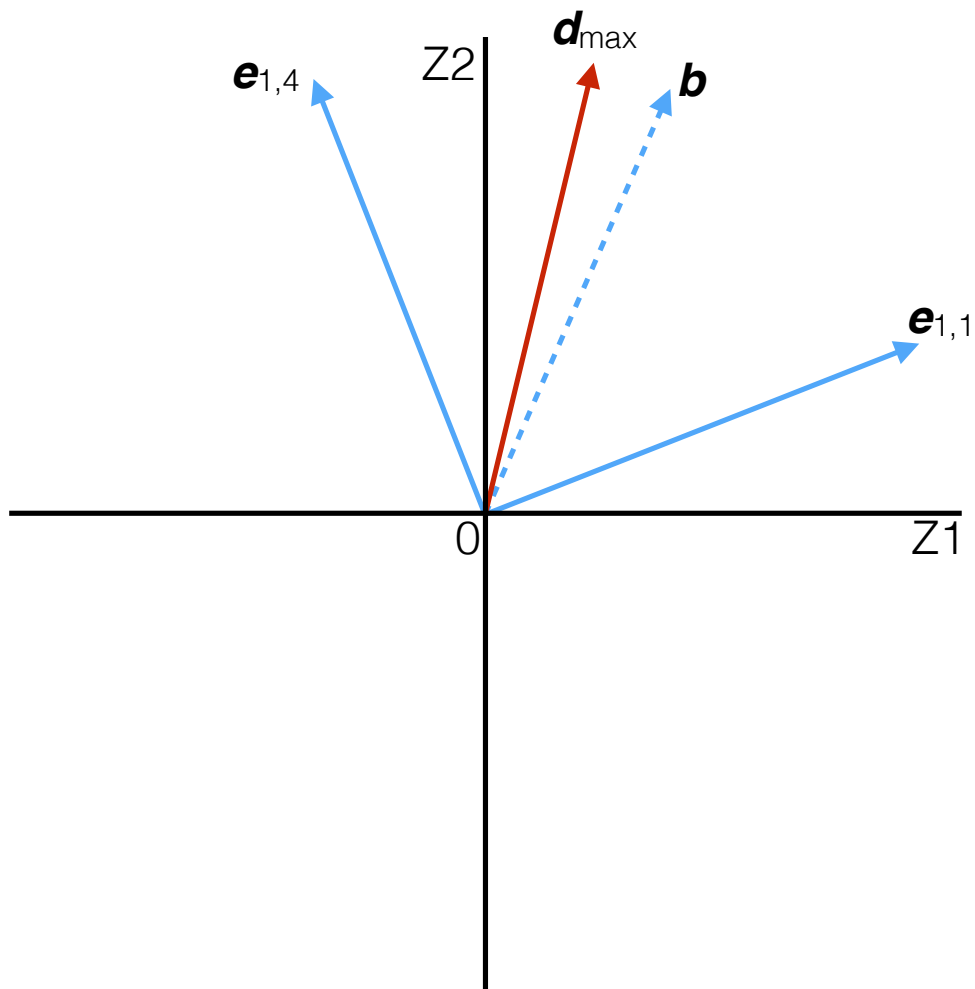


Figure S5 Two trait (Z1 and Z2) representation for the vector comparison of $e_{1,1}$, $e_{1,4}$ and their bisector (b), to d_{\max} . The bisector aligned closely with d_{\max} .

Table S1 Posterior mean **G** matrices for each ecotype. Genetic correlations are presented below the diagonal.

Traits	1	2	3	4	5	6	7	8	9	10
	Height	Stem Length / Width	# Branches	Stem Diameter	Leaf Area	Perimeter ² / Area ²	Circularity	# Indents	Indent Width	Indent Depth
Dune										
	1	2	3	4	5	6	7	8	9	10
1	0.294	0.096	0.060	0.067	0.013	-0.019	0.007	0.019	-0.021	-0.012
2	0.40	0.196	0.049	0.011	0.013	0.009	0.001	0.009	-0.016	0.005
3	0.18	0.18	0.366	0.005	0.001	-0.056	0.014	0.014	0.020	-0.024
4	0.20	0.04	0.01	0.399	0.001	-0.009	0.013	0.003	0.008	-0.005
5	0.10	0.12	0.01	0.01	0.058	-0.007	0.005	0.019	-0.023	0.005
6	-0.10	0.06	-0.26	-0.04	-0.08	0.126	-0.009	-0.026	-0.010	0.040
7	0.05	0.01	0.09	0.08	0.08	-0.10	0.060	0.019	-0.019	-0.008
8	0.08	0.05	0.05	0.01	0.18	-0.16	0.17	0.203	-0.126	-0.067
9	-0.09	-0.08	0.07	0.03	-0.22	-0.06	-0.17	-0.63	0.197	0.027
10	-0.07	0.04	-0.13	-0.03	0.07	0.38	-0.11	-0.50	0.21	0.088
Headland										
	1	2	3	4	5	6	7	8	9	10
1	0.421	0.155	-0.110	0.286	0.294	-0.054	0.062	-0.121	-0.015	0.122
2	0.28	0.737	0.171	0.398	0.493	-0.064	0.062	-0.181	0.013	0.178
3	-0.19	0.23	0.768	-0.068	-0.127	-0.003	-0.021	0.092	-0.027	-0.047
4	0.49	0.51	-0.09	0.822	0.585	-0.059	0.107	-0.242	-0.018	0.233
5	0.45	0.57	-0.14	0.64	1.003	-0.097	0.112	-0.310	0.019	0.276
6	-0.31	-0.28	-0.01	-0.24	-0.36	0.071	-0.020	0.020	-0.009	-0.010
7	0.33	0.25	-0.08	0.41	0.39	-0.26	0.083	-0.024	-0.019	0.038
8	-0.40	-0.45	0.22	-0.57	-0.66	0.16	-0.18	0.219	-0.063	-0.123
9	-0.06	0.04	-0.08	-0.05	0.05	-0.08	-0.17	-0.34	0.158	-0.003
10	0.45	0.49	-0.13	0.61	0.66	-0.09	0.31	-0.63	-0.02	0.176
Tableland										
	1	2	3	4	5	6	7	8	9	10
1	0.342	0.193	0.028	0.243	0.022	-0.035	0.019	0.007	0.001	0.039
2	0.49	0.455	0.013	0.203	0.102	-0.037	0.108	-0.038	-0.023	0.162
3	0.10	0.04	0.242	0.024	-0.02	0.004	-0.026	0.001	0.026	-0.082
4	0.46	0.34	0.05	0.812	-0.014	-0.034	-0.018	0.062	-0.024	-0.032
5	0.08	0.31	-0.09	-0.03	0.236	-0.033	0.122	-0.047	-0.099	0.188
6	-0.21	-0.19	0.03	-0.13	-0.23	0.086	-0.024	-0.012	-0.003	-0.006
7	0.06	0.31	-0.10	-0.04	0.49	-0.16	0.266	-0.041	-0.065	0.202
8	0.03	-0.14	0.00	0.17	-0.24	-0.10	-0.19	0.165	-0.057	-0.142
9	0.00	-0.07	0.11	-0.05	-0.40	-0.02	-0.25	-0.28	0.262	-0.084
10	0.09	0.34	-0.23	-0.05	0.54	-0.03	0.55	-0.49	-0.23	0.514
Woodland										
	1	2	3	4	5	6	7	8	9	10
1	0.173	0.029	-0.011	0.015	0.014	0.00	0.001	-0.027	0.017	0.00
2	0.21	0.106	0.015	0.017	-0.009	0.024	-0.006	-0.025	0.036	0.004
3	-0.05	0.09	0.278	0.008	-0.031	-0.027	-0.009	0.061	-0.010	-0.026
4	0.10	0.14	0.04	0.135	0.017	-0.037	0.017	0.022	-0.019	-0.022
5	0.12	-0.10	-0.20	0.16	0.084	-0.028	0.037	-0.013	-0.022	-0.012
6	0.00	0.18	-0.13	-0.25	-0.24	0.162	-0.016	-0.072	0.035	0.033
7	0.01	-0.06	-0.06	0.15	0.41	-0.13	0.095	-0.034	-0.048	-0.018
8	-0.13	-0.15	0.22	0.12	-0.09	-0.34	-0.21	0.269	-0.053	-0.045
9	0.11	0.28	-0.05	-0.13	-0.20	0.22	-0.40	-0.26	0.151	0.034
10	0.00	0.04	-0.16	-0.20	-0.14	0.27	-0.19	-0.28	0.29	0.094

Table S2 Full covariance tensor analysis of ecotype G.

Eigen-tensor	α (Proportion)	Eigen-vector	λ (Proportion)	Architecture				Leaf Morphology					
				Height	Stem Length / Width	# Branches	Stem Diameter	Leaf Area	Perimeter ² / Area ²	Circularity	# Indents	Indent Width	Indent Depth
Tensor 1	1.24 (0.38)	$e_{1,1}$	-0.95 (0.62)	-0.25	-0.45	0.04	-0.50	-0.61	0.07	-0.09	0.21	0.00	-0.23
		$e_{1,2}$	-0.26 (0.17)	0.23	-0.51	-0.81	0.08	0.14	-0.02	0.02	-0.06	0.03	0.02
		$e_{1,3}$	-0.09 (0.06)	0.44	-0.05	0.10	0.55	-0.65	0.04	0.11	0.01	-0.19	0.16
		$e_{1,4}$	0.08 (0.05)	0.00	0.03	0.00	-0.20	-0.17	0.48	0.04	-0.73	0.29	0.28
		$e_{1,5}$	-0.07 (0.04)	0.09	-0.71	0.54	0.16	0.36	0.14	-0.04	-0.05	-0.05	0.08
		$e_{1,6}$	-0.04 (0.03)	0.74	0.07	0.13	-0.59	0.08	-0.16	0.13	0.09	-0.05	0.14
		$e_{1,7}$	0.02 (0.02)	-0.14	-0.13	0.08	-0.03	-0.10	-0.75	0.27	-0.54	-0.11	-0.09
		$e_{1,8}$	0.02 (0.01)	0.03	-0.06	0.05	0.08	-0.11	-0.39	-0.48	0.13	0.66	0.38
		$e_{1,9}$	0 (0)	0.14	0.06	-0.02	-0.04	0.00	-0.04	-0.81	-0.29	-0.45	-0.16
		$e_{1,10}$	0 (0)	0.30	0.03	0.09	0.14	-0.01	0.05	-0.02	-0.13	0.47	-0.80
Tensor 2	0.35 (0.11)	$e_{2,1}$	-0.73 (0.34)	-0.40	-0.26	-0.06	-0.81	0.21	0.02	0.08	-0.15	-0.01	0.18
		$e_{2,2}$	-0.46 (0.21)	0.24	0.43	-0.02	-0.03	0.07	-0.05	0.45	-0.02	-0.23	0.70
		$e_{2,3}$	0.42 (0.19)	0.14	-0.04	-0.71	0.18	0.54	0.02	-0.03	-0.34	0.15	-0.03
		$e_{2,4}$	0.23 (0.11)	-0.16	0.27	0.61	0.13	0.65	-0.08	-0.11	-0.20	0.15	-0.04
		$e_{2,5}$	-0.14 (0.06)	-0.56	-0.46	0.01	0.52	0.04	0.06	0.08	0.00	-0.26	0.35
		$e_{2,6}$	-0.06 (0.03)	0.16	0.06	-0.03	-0.10	0.18	0.09	-0.57	0.07	-0.77	0.01
		$e_{2,7}$	-0.05 (0.02)	-0.22	0.19	-0.09	0.00	0.19	0.14	0.58	0.22	-0.38	-0.56
		$e_{2,8}$	0.04 (0.02)	-0.04	0.14	0.11	0.03	-0.29	0.59	0.04	-0.71	-0.10	-0.07
		$e_{2,9}$	0.02 (0.01)	-0.11	0.18	-0.09	-0.01	0.14	0.73	-0.16	0.50	0.29	0.18
		$e_{2,10}$	-0.01 (0.01)	0.58	-0.61	0.29	-0.03	0.24	0.28	0.27	0.05	-0.05	-0.01
Tensor 3	0.23 (0.07)	$e_{3,1}$	-0.77 (0.39)	-0.03	-0.20	0.14	0.04	-0.44	0.03	-0.36	0.30	0.12	-0.71
		$e_{3,2}$	0.59 (0.3)	-0.52	-0.53	-0.50	-0.42	-0.05	0.06	-0.01	-0.06	0.01	0.07
		$e_{3,3}$	0.16 (0.08)	0.67	-0.14	-0.69	0.17	-0.09	0.04	0.02	0.06	-0.05	-0.06
		$e_{3,4}$	-0.14 (0.07)	0.07	0.06	-0.04	0.02	-0.06	0.11	-0.33	-0.55	0.75	0.08
		$e_{3,5}$	0.08 (0.04)	0.07	0.66	-0.20	-0.68	-0.04	0.13	-0.15	0.10	-0.05	-0.12
		$e_{3,6}$	-0.07 (0.04)	-0.02	-0.06	-0.08	0.02	0.81	-0.05	-0.18	-0.20	-0.10	-0.50
		$e_{3,7}$	0.07 (0.03)	0.51	-0.45	0.41	-0.56	0.08	-0.17	-0.03	0.00	0.03	0.11
		$e_{3,8}$	-0.06 (0.03)	0.00	-0.04	0.00	0.12	0.04	0.07	-0.83	0.09	-0.35	0.40
		$e_{3,9}$	-0.02 (0.01)	-0.06	0.03	-0.11	0.03	0.31	-0.28	-0.06	0.70	0.53	0.18
		$e_{3,10}$	0 (0)	-0.06	0.12	-0.13	-0.01	-0.19	-0.92	-0.10	-0.24	-0.11	-0.04

Table S3 Results of the tensor analyses conducted on the covariance matrices representing ecotype g_{\max} and g_2 .

Eigen-tensor	α (Proportion)	Eigen-vector	λ (Proportion)	Architecture				Leaf Morphology					
				Height	Stem Length / Width	# Branches	Stem Diameter	Leaf Area	Perimeter ² / Area ²	Circularity	# Indents	Indent Width	Indent Depth
A) g_{\max}													
Tensor 1	0.39 (0.56)	$e_{1,1}$	-0.73 (0.5)	0.11	0.08	-0.5	-0.18	-0.03	0.37	0	-0.67	0.28	0.21
		$e_{1,2}$	0.68 (0.46)	-0.33	-0.47	0.01	-0.66	-0.39	0.09	-0.13	0.08	0.06	-0.23
		$e_{1,3}$	0.05 (0.04)	-0.25	-0.12	0.06	-0.26	0.87	-0.13	-0.12	-0.16	0.09	-0.15
		$e_{1,4}$	0 (0)	0.61	-0.02	0.58	-0.11	-0.03	0.12	-0.11	-0.27	0.2	-0.37
		$e_{1,5}$	0 (0)	-0.67	0.27	0.42	0.29	-0.17	0.18	0.01	-0.34	0.17	-0.13
		$e_{1,6}$	0 (0)	0	0.51	0.21	-0.54	-0.08	-0.28	0.1	-0.21	-0.44	0.27
		$e_{1,7}$	0 (0)	0	0.29	-0.39	0.01	-0.04	-0.07	0.25	-0.06	-0.22	-0.8
		$e_{1,8}$	0 (0)	0	-0.44	0.07	0.22	0.04	0.25	-0.04	-0.34	-0.76	0
		$e_{1,9}$	0 (0)	0	-0.38	0.05	0.1	-0.1	-0.59	0.58	-0.34	0.18	0.05
		$e_{1,10}$	0 (0)	0	0	0.16	-0.17	0.18	0.55	0.74	0.25	0	0.08
Tensor 2	0.24 (0.34)	$e_{2,1}$	-0.77 (0.5)	-0.6	-0.26	-0.54	-0.46	0.12	0.09	-0.05	-0.14	0.06	0.13
		$e_{2,2}$	0.61 (0.39)	0.17	0.36	-0.31	0.33	0.57	0.08	0.07	-0.45	0.11	0.28
		$e_{2,3}$	0.17 (0.11)	0.39	-0.02	-0.12	-0.22	-0.54	0.41	-0.02	-0.51	0.26	0
		$e_{2,4}$	-0.01 (0)	-0.13	0.21	-0.43	0.41	-0.53	0	0.19	0.26	-0.2	0.4
		$e_{2,5}$	0 (0)	-0.49	0.71	0.14	-0.01	-0.18	0	-0.07	-0.17	0.1	-0.4
		$e_{2,6}$	0 (0)	0.46	0.36	-0.47	-0.44	0.06	-0.26	-0.09	0.31	-0.14	-0.24
		$e_{2,7}$	0 (0)	0	-0.35	-0.39	0.47	-0.07	-0.24	-0.02	-0.16	0.12	-0.64
		$e_{2,8}$	0 (0)	0	-0.01	-0.05	-0.01	0.16	0.62	0.45	0.05	-0.52	-0.34
		$e_{2,9}$	0 (0)	0	-0.01	-0.06	0.18	0.03	0.35	-0.86	0.06	-0.32	0
		$e_{2,10}$	0 (0)	0	-0.04	0.1	-0.11	-0.13	-0.44	0	-0.54	-0.68	0.08
Tensor 3	0.07 (0.10)	$e_{3,1}$	-0.71 (0.38)	-0.26	-0.43	0.23	-0.66	0.26	-0.02	-0.2	-0.05	0.12	-0.37
		$e_{3,2}$	0.57 (0.31)	0.22	0.23	0.19	0.23	0.85	-0.11	-0.03	-0.25	0.07	-0.04
		$e_{3,3}$	0.36 (0.19)	0.56	0.01	0.68	0.09	-0.31	-0.01	-0.04	0.12	0.02	-0.34
		$e_{3,4}$	-0.22 (0.12)	0.36	0.04	-0.21	-0.22	-0.17	0.41	-0.04	-0.69	0.33	0.04
		$e_{3,5}$	0 (0)	0	0.73	0.16	-0.56	0.01	0.07	-0.1	0.23	-0.02	0.26
		$e_{3,6}$	0 (0)	-0.67	0.27	0.42	0.29	-0.17	0.18	0.01	-0.34	0.17	-0.13
		$e_{3,7}$	0 (0)	0	-0.24	0.14	0.19	0.07	0.3	-0.56	0.29	0.42	0.46
		$e_{3,8}$	0 (0)	0	0.15	-0.16	0.07	-0.15	-0.35	-0.78	-0.25	-0.32	-0.15
		$e_{3,9}$	0 (0)	0	-0.25	0.37	-0.14	-0.09	-0.44	0.13	-0.36	-0.15	0.65
		$e_{3,10}$	0 (0)	0	-0.14	0.15	0	0.13	0.62	-0.06	-0.06	-0.73	0.11
A) g_2													
Tensor 1	0.39 (0.48)	$e_{1,1}$	0.77 (0.5)	-0.09	0.19	-0.1	-0.47	0.33	0	0.35	-0.22	-0.14	0.65
		$e_{1,2}$	-0.63 (0.41)	0.08	-0.36	-0.87	0.17	0.16	-0.13	0.12	0.01	-0.16	-0.07
		$e_{1,3}$	-0.1 (0.06)	0.19	-0.22	-0.21	-0.15	-0.29	0.44	-0.3	-0.3	0.56	0.28
		$e_{1,4}$	-0.04 (0.02)	-0.2	0.28	-0.02	0.82	0.03	0.15	0.1	-0.22	0.05	0.35
		$e_{1,5}$	0 (0)	0.45	-0.62	0.38	0.22	0.16	-0.13	0.06	0.15	-0.1	0.38
		$e_{1,6}$	0 (0)	0.84	0.5	-0.09	0.04	0.01	0.02	0.09	-0.09	-0.07	-0.11
		$e_{1,7}$	0 (0)	0	0.19	-0.07	0.02	0.37	-0.61	-0.47	0.1	0.45	0.15
		$e_{1,8}$	0 (0)	0	-0.13	0.14	0.03	0.43	0.07	0.53	-0.21	0.54	-0.38
		$e_{1,9}$	0 (0)	0	-0.06	0.01	0	-0.62	-0.61	0.35	-0.32	0.12	0.06
		$e_{1,10}$	0 (0)	0	0.13	-0.13	0	-0.22	0.09	0.36	0.79	0.34	0.2
Tensor 2	0.27 (0.33)	$e_{2,1}$	0.81 (0.5)	-0.05	-0.05	-0.44	0.81	-0.06	0.19	-0.04	-0.2	0.16	0.17
		$e_{2,2}$	-0.55 (0.34)	0.02	-0.23	-0.68	-0.16	0.34	-0.3	0.29	0.1	-0.39	-0.04
		$e_{2,3}$	-0.2 (0.12)	0.11	-0.26	0.01	0.26	-0.21	-0.17	-0.26	0.34	-0.05	-0.77
		$e_{2,4}$	-0.06 (0.04)	0.28	-0.41	-0.38	-0.44	-0.24	0.28	-0.29	-0.15	0.43	0.04
		$e_{2,5}$	0 (0)	0.95	0.15	0.1	0.14	0.08	-0.05	0.11	-0.01	-0.1	0.08
		$e_{2,6}$	0 (0)	0	-0.55	0.3	0.13	0.08	-0.62	0.11	-0.27	0.29	0.17
		$e_{2,7}$	0 (0)	0	0.6	-0.29	-0.11	-0.19	-0.5	0.04	-0.2	0.41	-0.21
		$e_{2,8}$	0 (0)	0	0.13	-0.04	0.01	0.44	-0.21	-0.84	-0.09	-0.14	0.14
		$e_{2,9}$	0 (0)	0	0.03	0.05	0.02	0.73	0.25	0.18	0.08	0.51	-0.31
		$e_{2,10}$	0 (0)	0	0.03	-0.07	0.05	-0.06	-0.17	-0.05	0.83	0.31	0.42
Tensor 3	0.15 (0.18)	$e_{3,1}$	-0.74 (0.45)	0.22	-0.45	-0.77	-0.2	-0.05	0.15	-0.1	-0.15	0.22	0.1
		$e_{3,2}$	0.64 (0.38)	-0.12	-0.03	-0.45	0.36	0.33	-0.37	0.32	0.18	-0.5	-0.17
		$e_{3,3}$	0.19 (0.12)	0.1	-0.12	0.11	-0.84	0.13	-0.26	0.08	0.23	-0.24	-0.24
		$e_{3,4}$	-0.08 (0.05)	0.14	-0.27	0.06	0.26	-0.3	-0.06	-0.35	0.28	0.09	-0.73
		$e_{3,5}$	0 (0)	-0.1	-0.82	0.41	0.14	0.15	0.13	0.15	-0.11	-0.19	0.16
		$e_{3,6}$	0 (0)	0.95	0.07	0.14	0.16	0.1	-0.03	0.12	-0.02	-0.12	0.1
		$e_{3,7}$	0 (0)	0	0.1	-0.06	-0.08	-0.35	0.58	0.57	-0.14	-0.24	-0.33
		$e_{3,8}$	0 (0)	0	0.11	-0.04	-0.01	0.59	0.63	-0.38	0.24	-0.18	-0.1
		$e_{3,9}$	0 (0)	0	0.03	0.08	0	0.52	-0.09	0.25	-0.47	0.49	-0.45
		$e_{3,10}$	0 (0)	0	0.06	0	-0.05	-0.09	-0.1	-0.44	-0.71	-0.51	-0.13