Stability

2022-07-27

For each plant species per site, stability (inverse of the coefficient of variation) of the visitation rate of pollinators (visitation rate calculated like frequency/flower abundance) and also of the fruit proportion and the seed numbers were calculated. Total of pollinator richness (sum) was obtained and furthermore, the log of variance ratio (Lepš et al., 2018) and Loreau & Mazancourt syncrony index were calculated.

Positive values of log var ratio signify synchronization, negative values indicate compensatory dynamics (Lepš et al., 2018). Loreau & Mazancourt index is standardized between 0 (perfect asynchrony) and 1 (perfect synchrony).

note: NA= one data per year

Plant_gen_sp	Site_ID	cv_1_fruit	cv_1_seed	cv_1_visitation	richness	log_VR	syncLM
Asphodelus fistulosus	Aznalcazar	8.5559	2.1917	1.1616	5.1667	-1.2321	0.0799
Asphodelus fistulosus	Niebla	55.6671	4.6731	3.7736	2.0000	-Inf	0.0000
Asphodelus fistulosus	Pino_del_cuervo	NA	NA	NA	4.0000	NA	NA
Cistus crispus	Aznalcazar	4.8190	20.0119	1.5352	6.1667	0.9197	0.4526
Cistus crispus	Bonares	NA	NA	NA	2.5000	NA	NA
Cistus crispus	Convento_de_la_luz	NA	NA	NA	2.0000	NA	NA
Cistus crispus	El_pozo	16.3280	8.7440	2.0208	5.0000	1.0586	0.2899
Cistus crispus	Esparragal	2.8856	5.0789	0.9322	9.7500	1.3225	0.4095
Cistus crispus	Niebla	4.9324	4.8314	2.2073	8.7500	0.5635	0.2675
Cistus crispus	Pino_del_cuervo	11.1785	6.0826	2.2325	6.7500	0.2285	0.2501
Cistus crispus	Urbanizaciones	4.1971	7.5309	0.8514	9.8333	1.5640	0.8184
Cistus crispus	Villamanrique_este	9.1615	6.7844	0.9950	12.3333	0.6190	0.3018
Cistus crispus	Villamanrique_sur	6.5795	3.4830	1.4137	11.2500	1.4654	0.3600
Cistus ladanifer	Aznalcazar	17.0519	2.3652	2.1561	11.0000	0.2231	0.1047
Cistus ladanifer	Bonares	56.5803	2.9434	1.1055	4.3333	-2.5649	0.0184
Cistus ladanifer	Convento_de_la_luz	8.9489	1.5985	1.9759	7.5000	0.1178	0.1699
Cistus ladanifer	El_pozo	NA	NA	NA	1.5000	NA	NA
Cistus ladanifer	Niebla	61.5000	3.0437	2.5189	9.6667	-0.1018	0.0652
Cistus ladanifer	Pino_del_cuervo	35.5000	2.4935	1.1411	5.1667	0.0000	0.1072
Cistus ladanifer	Villamanrique_este	Inf	1.5972	1.8385	4.0000	-1.0986	0.1111
Cistus ladanifer	Villamanrique_sur	3.1532	1.6655	1.2637	4.5000	0.5754	0.3265
Cistus libanotis	La_rocina	Inf	18.7942	1.8551	6.3333	-1.9459	0.0204
Cistus libanotis	Pinares_de_hinojos	41.5000	8.9856	3.0029	8.2500	1.3028	0.3579
Cistus monspeliensis	Aznalcazar	3.0125	10.6411	1.4132	4.3333	1.3471	0.6944
Cistus monspeliensis	Niebla	17.8819	2.1607	2.0344	9.1667	1.2098	0.3178
Cistus salviifolius	Aznalcazar	17.9953	2.3028	0.8583	9.6667	0.0667	0.1105
Cistus salviifolius	Bonares	12.6807	2.0828	0.7534	11.9167	0.2546	0.1521
Cistus salviifolius	Convento_de_la_luz	Inf	1.9740	0.8549	5.5000	0.7732	0.3611
Cistus salviifolius	El_pozo	NA	NA	NA	1.5000	NA	NA
Cistus salviifolius	Esparragal	10.8333	1.7647	1.4369	8.3333	0.7019	0.1704
Cistus salviifolius	La_cunya	120.6662	1.4736	1.3050	7.5000	1.7918	0.6391
Cistus salviifolius	Pinares_de_hinojos	25.9808	5.1085	1.3658	4.0000	1.2528	0.5833
Cistus salviifolius	Pino_del_cuervo	7.7782	1.2804	2.5927	3.0000	-1.0986	0.1111
Cistus salviifolius	Urbanizaciones	15.5000	11.2972	1.4624	5.0000	-0.1398	0.1380
Cistus salviifolius	Villamanrique_este	4.6188	5.9748	1.8597	9.0000	-1.0986	0.0502
Cistus salviifolius	Villamanrique_sur	NA	NA	NA	1.0000	NA	NA
Halimium calycinum	Bonares	Inf	4.9497	10.3835	2.6667	0.2809	1.0000
Halimium calycinum	Esparragal	Inf	1.8827	0.8015	5.5000	-1.7918	0.0278
Halimium calycinum	La_rocina	NA	NA	NA	3.0000	NA	NA

Halimium calycinum	Pino_del_cuervo	NA	NA	NA	1.5000	NA	NA
Halimium calycinum	Urbanizaciones	3.9260	12.3590	1.7005	2.0000	0.5596	0.9378
Halimium calycinum	Villamanrique_sur	NA	NA	NA	2.6667	NA	NA
Halimium halimifolium	Bonares	8.4309	2.7877	2.5561	4.7500	0.5108	0.2066
Halimium halimifolium	Convento_de_la_luz	7.1384	2.4892	0.9120	10.8333	1.6959	0.5913
Halimium halimifolium	El_pozo	4.3841	55.8614	0.7071	2.0000	1.1838	1.0000
Halimium halimifolium	Esparragal	3.9509	17.7275	3.2259	6.7500	0.2894	0.3763
Halimium halimifolium	La_rocina	NA	NA	NA	2.0000	NA	NA
Halimium halimifolium	Pinares_de_hinojos	2.6259	9.7607	2.6479	3.7500	1.4663	0.7511
Halimium halimifolium	Pino_del_cuervo	NA	NA	NA	1.6667	NA	NA
Halimium halimifolium	Urbanizaciones	18.3848	1.5120	1.7963	5.1667	-0.6286	0.0816
Lavandula pedunculata	Aznalcazar	6.1669	6.7342	1.5073	8.8333	0.6451	0.3904
Lavandula pedunculata	Bonares	NA	NA	NA	1.5000	NA	NA
Lavandula pedunculata	Convento_de_la_luz	NA	NA	NA	2.0000	NA	NA
Lavandula pedunculata	El_pozo	NA	NA	NA	2.0000	NA	NA
Lavandula pedunculata	Esparragal	31.9772	3.7680	1.2239	1.5000	-0.9163	0.2500
Lavandula pedunculata	La_cunya	25.1644	6.1782	1.4772	5.1667	0.4823	0.7153
Lavandula pedunculata	La_rocina	NA	NA	NA	2.7500	NA	NA
Lavandula pedunculata	Niebla	68.6603	20.7307	5.6340	8.0000	0.2296	0.0915
Lavandula pedunculata	Urbanizaciones	17.8374	6.5893	1.6767	7.6667	-1.3291	0.0422
Lavandula pedunculata	Villamanrique_sur	NA	NA	NA	2.0000	NA	NA
Lavandula stoechas	Aznalcazar	NA	NA	NA	2.0000	NA	NA
Lavandula stoechas	Bonares	13.4040	5.0783	2.4040	3.5000	-Inf	0.0000
Lavandula stoechas	Convento_de_la_luz	NA	NA	NA	0.0000	NA	NA
Lavandula stoechas	Esparragal	NA	NA	NA	1.0000	NA	NA
Lavandula stoechas	Niebla	3.1437	1.4785	1.2825	2.5000	-1.9459	0.0400
Lavandula stoechas	Pino_del_cuervo	10.9828	8.8375	0.6949	5.3333	1.3610	0.9068
Lavandula stoechas	Urbanizaciones	5.6550	4.7477	5.4540	5.5000	1.2730	0.5102
Lavandula stoechas	Villamanrique_sur	NA	NA	NA	2.0000	NA	NA
Salvia rosmarinus	Aznalcazar	NA	NA	NA	1.5000	NA	NA
Salvia rosmarinus	Convento_de_la_luz	NA	NA	NA	0.5000	NA	NA
Salvia rosmarinus	El_pozo	NA	NA	NA	2.0000	NA	NA
Salvia rosmarinus	La_cunya	NA	NA	NA	1.5000	NA	NA
Salvia rosmarinus	La_rocina	NA	NA	NA	1.0000	NA	NA
Salvia rosmarinus	Urbanizaciones	NA	NA	NA	2.0000	NA	NA
Salvia rosmarinus	Villamanrique_sur	NA	NA	NA	3.0000	NA	NA
Teucrium fruticans	Aznalcazar	7.6622	5.7363	4.7456	10.0000	0.5167	0.2935
Teucrium fruticans	Convento_de_la_luz	41.7193	4.2426	13.7054	8.0000	-Inf	0.0000

Correlation

	cv_1_fruit	cv_1_seed	cv_1_visitation	richness
cv_1_fruit	1.0000	0.1014	0.3278	0.3131
cv_1_seed	0.1014	1.0000	0.2020	0.1583
cv_1_visitation	0.3278	0.2020	1.0000	0.3149
richness	0.3131	0.1583	0.3149	1.0000
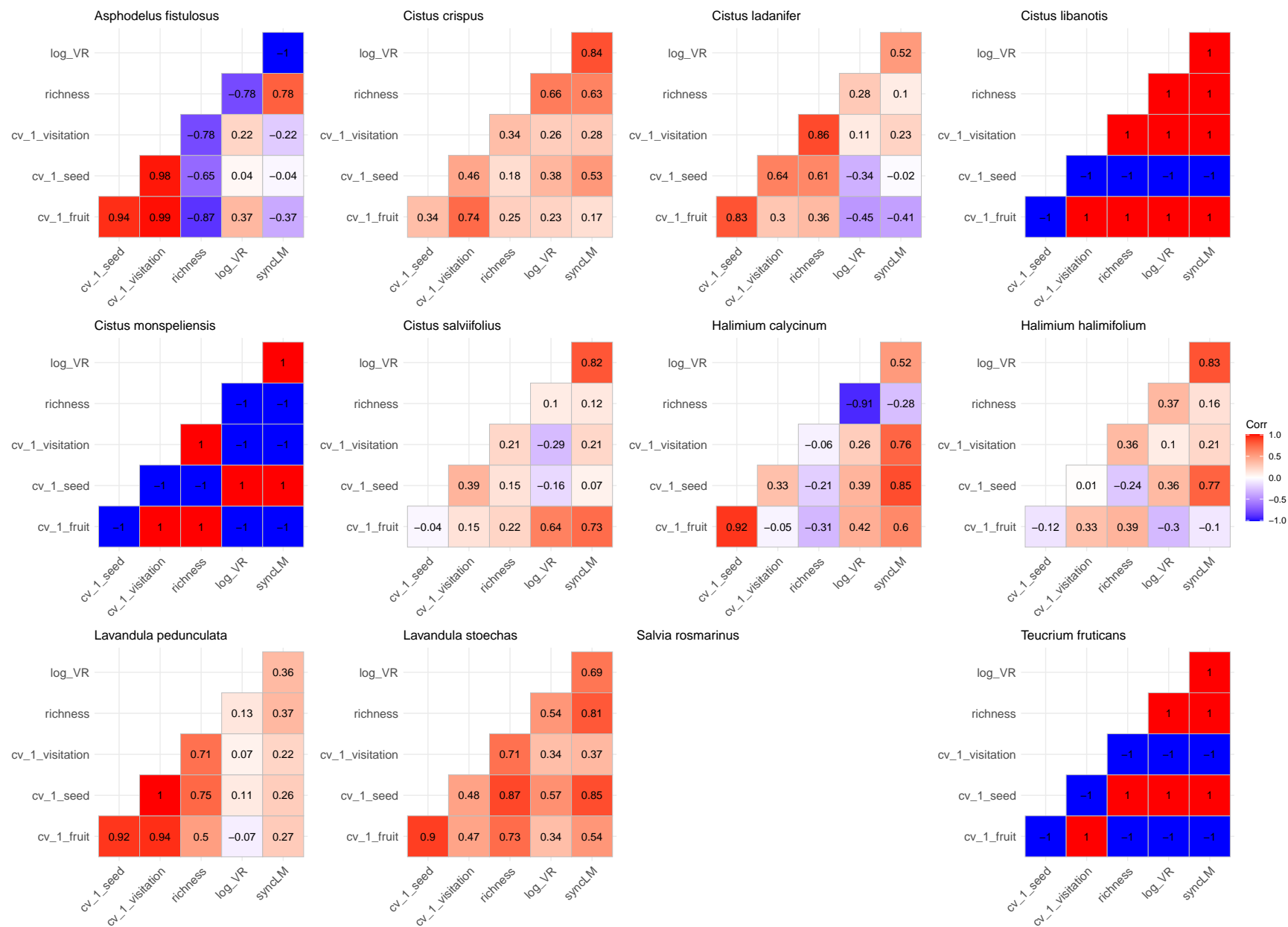
Data with species in more than 3 sites. I removed 4 plant species (A.fistulosus, C.libanotis, c.monspeliensis, T.fructicans)
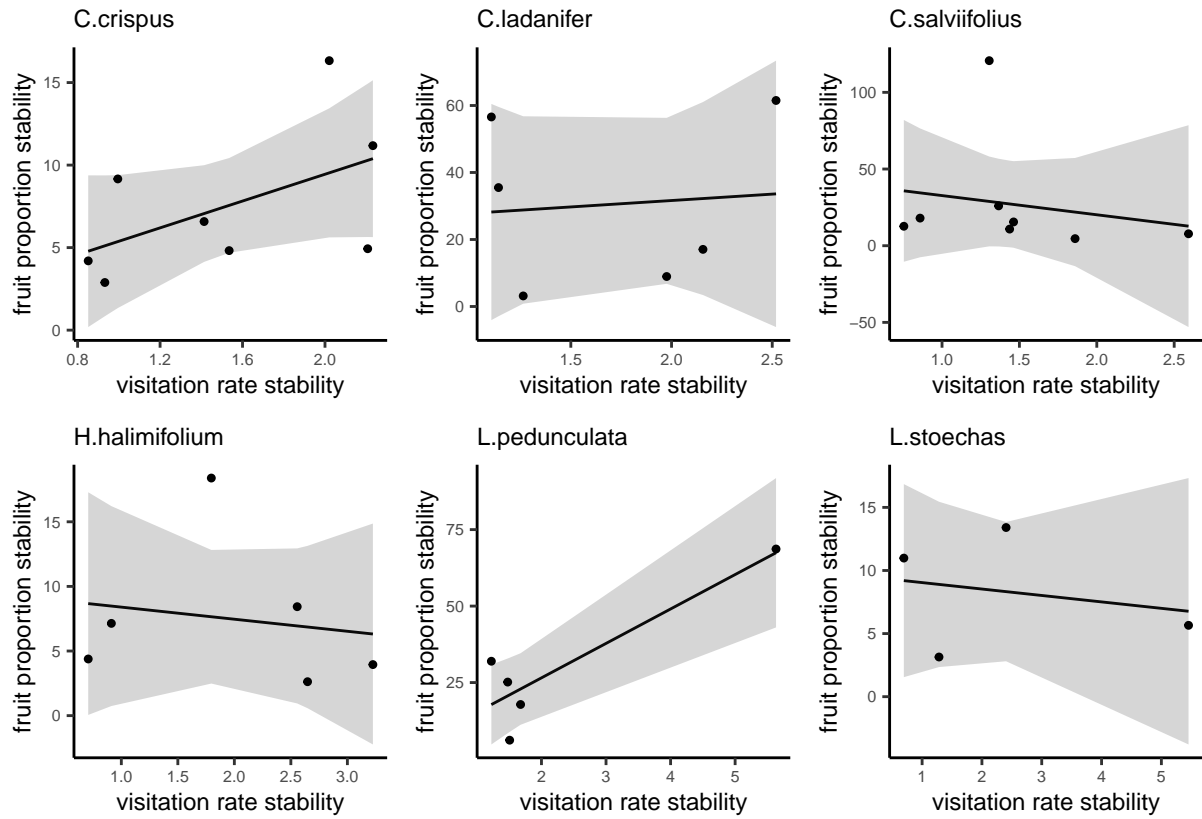
Salvia rosmarinus = only one year per site (remove)

We analysed the relationship between fruit proportion stability and visitation rate stability

Plant__gen__sp	term	estimate	std.error	statistic	p.value
Cistus crispus	(Intercept)	1.3233	4.4025	0.3006	0.7739
	cv__1__visitation	4.0610	2.7251	1.4902	0.1868
Cistus ladanifer	(Intercept)	23.9666	36.4338	0.6578	0.5466
	cv__1__visitation	3.8317	20.4638	0.1872	0.8606
Cistus salviifolius	(Intercept)	45.2096	41.3436	1.0935	0.3161
	cv__1__visitation	-12.5168	26.6478	-0.4697	0.6551
Halimium calycinum	(Intercept)	3.9260			
	cv__1__visitation				
Halimium halimifolium	(Intercept)	9.3305	6.1102	1.5271	0.2015
	cv__1__visitation	-0.9344	2.8031	-0.3334	0.7556
Lavandula pedunculata	(Intercept)	4.0291	9.5139	0.4235	0.7005
	cv__1__visitation	11.2562	3.3427	3.3674	**0.0435**
Lavandula stoechas	(Intercept)	9.5504	4.7042	2.0302	0.1795
	cv__1__visitation	-0.5100	1.5332	-0.3326	0.7711

Goodness of fit measures, p-values for hypothesis tests on residuals, and model convergence information.

Plant__gen_sp	r.squared	adj.r.squared	sigma	statistic	p.value	df	logLik	AIC	BIC	deviance	df.residual	nobs
C.crispus	0.270	0.148	4.142	2.221	0.187	1	-21.571	49.141	49.380	102.950	6	8
C.ladanifer	0.009	-0.239	27.535	0.035	0.861	1	-27.190	60.380	59.755	3032.736	4	6
C.salviifolius	0.035	-0.125	40.740	0.221	0.655	1	-39.858	85.717	85.955	9958.348	6	8
H. calycinum	0.000	0.000					Inf	-Inf	-Inf	0.000	0	1
H.halimifolium	0.027	-0.216	6.346	0.111	0.756	1	-18.384	42.767	42.143	161.062	4	6
L.pedunculata	0.791	0.721	12.492	11.340	0.043	1	-18.443	42.886	41.715	468.181	3	5
L.stoechas	0.052	-0.421	5.627	0.111	0.771	1	-11.200	28.400	26.559	63.328	2	4

We analysed the relationship between seed number stability and visitation rate stability

Plant_gen_sp	term	estimate	std.error	statistic	p.value
Cistus crispus	(Intercept)	7.7093	5.9637	1.2927	0.2437
	cv_1_visitation	0.0716	3.6915	0.0194	0.9852
Cistus ladanifer	(Intercept)	2.1129	0.9097	2.3226	0.0678
	cv_1_visitation	0.0764	0.5086	0.1502	0.8865
Cistus salviifolius	(Intercept)	2.9282	3.2078	0.9128	0.3917
	cv_1_visitation	0.5529	2.1525	0.2569	0.8047
Halimium calycinum	(Intercept)	7.0497	6.1315	1.1498	0.4557
	cv_1_visitation	-0.1519	1.0064	-0.1510	0.9046
Halimium halimifolium	(Intercept)	31.7071	20.5742	1.5411	0.1981
	cv_1_visitation	-8.4509	9.4385	-0.8954	0.4212
Lavandula pedunculata	(Intercept)	0.4927	0.6344	0.7767	0.4940
	cv_1_visitation	3.6059	0.2229	16.1769	**0.0005**
Lavandula stoechas	(Intercept)	5.6537	3.0339	1.8635	0.2034
	cv_1_visitation	-0.2514	0.9888	-0.2543	0.8230

| Plant_gen_sp	r.squared	adj.r.squared	sigma	statistic	p.value	df	logLik	AIC	BIC	deviance	df.residual	nobs
C.crispus	0.000	-0.167	5.611	0.000	0.985	1	-23.999	53.998	54.236	188.914	6	8
C.ladanifer	0.004	-0.195	0.688	0.023	0.886	1	-6.134	18.268	18.105	2.365	5	7
C.salviifolius	0.009	-0.132	3.509	0.066	0.805	1	-22.936	51.872	52.464	86.167	7	9
H. calycinum	0.022	-0.955	7.532	0.023	0.905	1	-8.666	23.333	20.628	56.727	1	3
H.halimifolium	0.167	-0.041	21.367	0.802	0.421	1	-25.668	57.336	56.712	1826.129	4	6
L.pedunculata	0.989	0.985	0.833	261.691	0.001	1	-4.904	15.809	14.637	2.082	3	5
L.stoechas	0.031	-0.453	3.629	0.065	0.823	1	-9.445	24.891	23.050	26.341	2	4
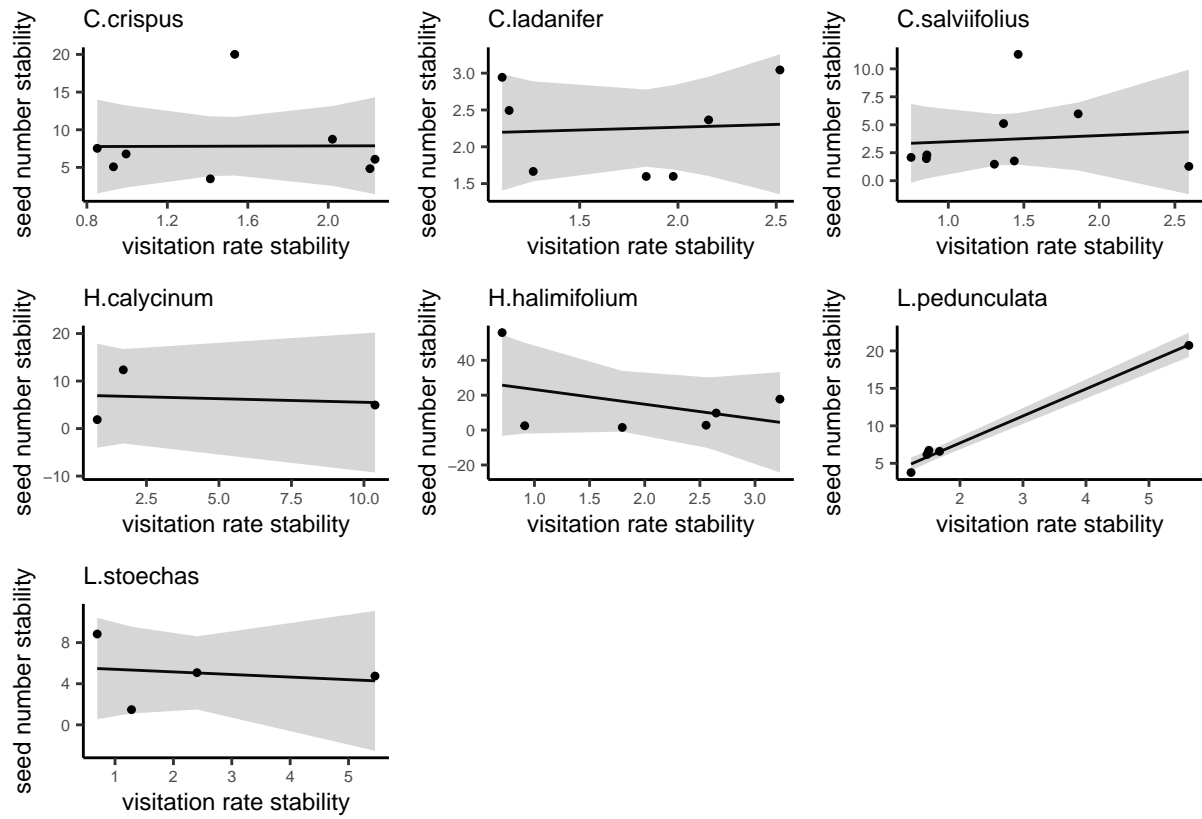
Relationship between richness-synchrony with different synchrony indice.

A- Richness ~ log VR

Plant_gen_sp	term	estimate	std.error	statistic	p.value
Cistus crispus	(Intercept)	7.339	2.267	3.238	**0.018**
	log_VR	1.437	2.130	0.675	0.525
Cistus ladanifer	(Intercept)	7.071	1.129	6.262	**0.002**
	log_VR	1.170	1.044	1.120	0.313
Cistus salviifolius	(Intercept)	7.081	1.088	6.506	**0.000**
	log_VR	0.074	1.128	0.065	0.950
Halimium calycinum	(Intercept)	2.931	0.113	25.831	**0.025**
	log_VR	-1.443	0.104	-13.933	**0.046**
Halimium halimifolium	(Intercept)	5.075	1.879	2.700	0.054
	log_VR	0.620	1.719	0.361	0.737
Lavandula pedunculata	(Intercept)	6.459	1.459	4.428	**0.021**
	log_VR	1.270	1.794	0.708	0.530
Lavandula stoechas	(Intercept)	4.240	0.101	41.879	**0.015**
	log_VR	0.892	0.065	13.712	**0.046**

Plant_gen_sp	r.squared	adj.r.squared	sigma	statistic	p.value	df	logLik	AIC	BIC	deviance	df.residual	nobs
C.crispus	0.070	-0.084	2.669	0.455	0.525	1	-18.056	42.111	42.349	42.754	6	8
C.ladanifer	0.201	0.041	2.768	1.255	0.313	1	-15.883	37.765	37.603	38.317	5	7
C.salviifolius	0.001	-0.142	3.127	0.004	0.950	1	-21.899	49.798	50.390	68.428	7	9
H. calycinum	0.995	0.990	0.188	194.116	0.046	1	2.403	1.195	-1.509	0.035	1	3
H.halimifolium	0.031	-0.211	3.337	0.130	0.737	1	-14.527	35.054	34.430	44.535	4	6
L.pedunculata	0.143	-0.142	3.183	0.501	0.530	1	-11.607	29.214	28.042	30.397	3	5
L.stoechas	0.995	0.989	0.173	188.007	0.046	1	2.647	0.706	-1.998	0.030	1	3
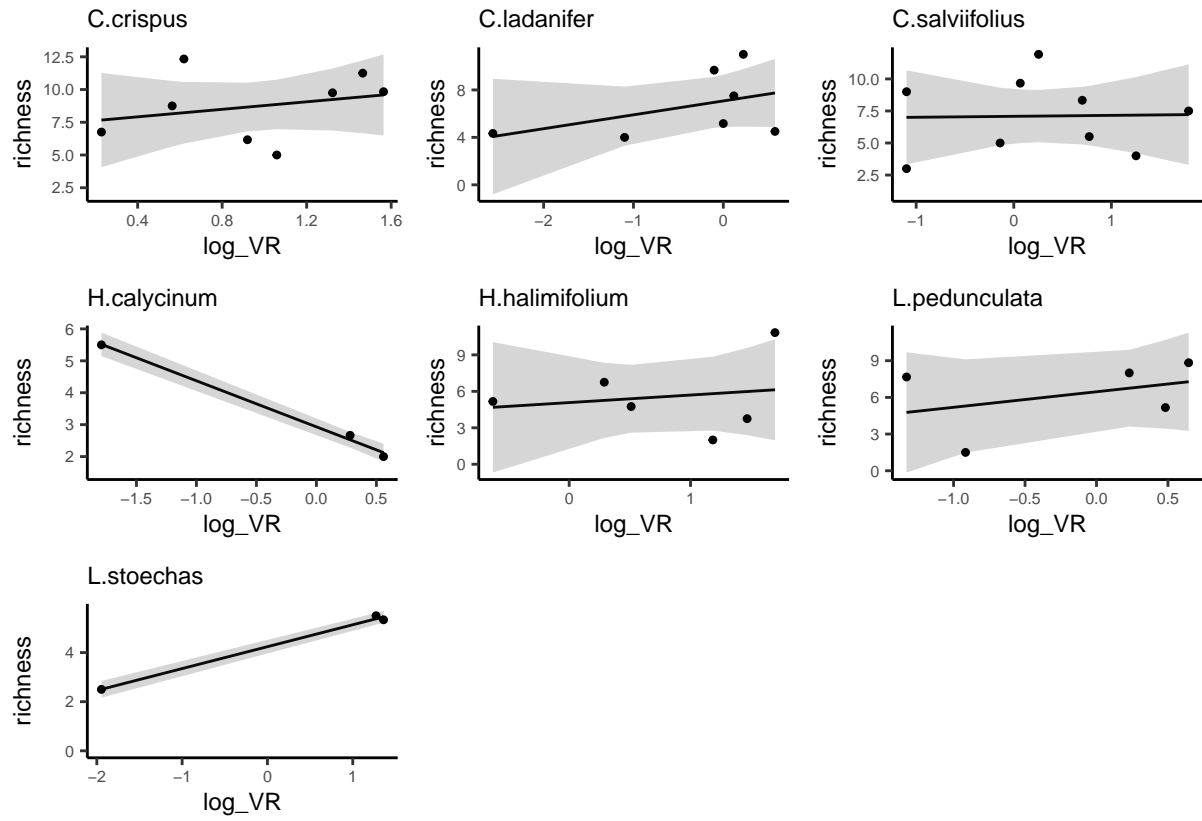
A- Richness ~ Loreau & Mazancourt syncrony index

Plant_gen_sp	term	estimate	std.error	statistic	p.value
Cistus crispus	(Intercept)	7.771	2.389	3.253	**0.017**
	syncLM	2.433	5.552	0.438	0.677
Cistus ladanifer	(Intercept)	7.373	1.980	3.724	**0.014**
	syncLM	-6.030	12.527	-0.481	0.651
Cistus salviifolius	(Intercept)	8.153	1.589	5.130	**0.001**
	syncLM	-4.085	4.822	-0.847	0.425
Halimium calycinum	(Intercept)	5.563	0.636	8.747	0.072
	syncLM	-3.319	0.803	-4.131	0.151
Halimium halimifolium	(Intercept)	6.797	2.489	2.731	0.052
	syncLM	-2.506	4.202	-0.596	0.583
Lavandula pedunculata	(Intercept)	6.954	2.379	2.924	0.061
	syncLM	-2.420	6.197	-0.391	0.722
Lavandula stoechas	(Intercept)	3.148	0.639	4.929	**0.039**
	syncLM	2.910	1.227	2.372	0.141

Plant_gen_sp	r.squared	adj.r.squared	sigma	statistic	p.value	df	logLik	AIC	BIC	deviance	df.residual	nobs
C.crispus	0.031	-0.130	2.725	0.192	0.677	1	-18.222	42.444	42.682	44.570	6	8
C.ladanifer	0.044	-0.147	3.027	0.232	0.651	1	-16.508	39.016	38.854	45.814	5	7
C.salviifolius	0.093	-0.037	2.979	0.718	0.425	1	-21.463	48.925	49.517	62.103	7	9
H. calycinum	0.945	0.889	0.618	17.067	0.151	1	-1.167	8.333	5.629	0.382	1	3
H.halimifolium	0.082	-0.148	3.249	0.356	0.583	1	-14.368	34.735	34.111	42.229	4	6
L.pedunculata	0.048	-0.269	3.355	0.153	0.722	1	-11.869	29.739	28.567	33.761	3	5
L.stoechas	0.738	0.607	0.913	5.628	0.141	1	-3.924	13.848	12.007	1.666	2	4
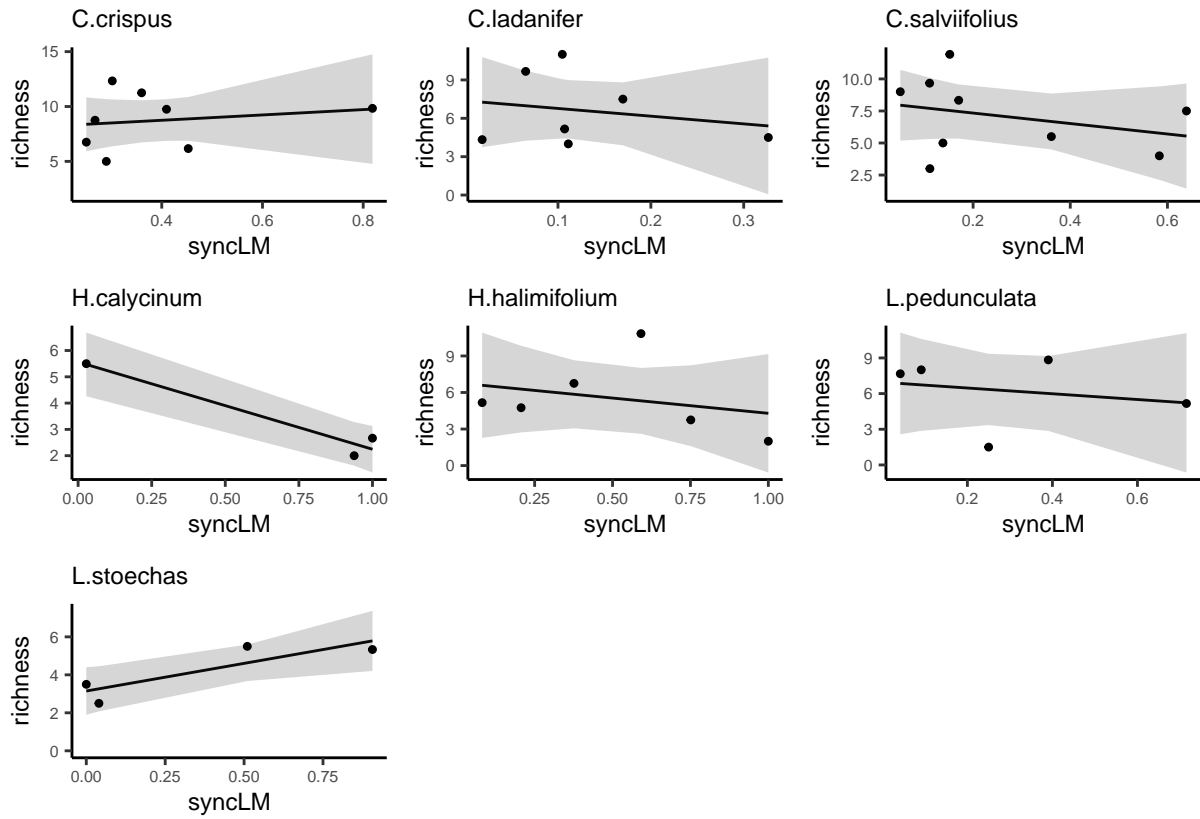
We analysed whether the visitation rate stability is affected by richness and synchrony for each plant species separately

A) richness + log VR

Plant_gen_sp	term	estimate	std.error	statistic	p.value
Cistus crispus	(Intercept)	3.148	0.544	5.788	**0.002**
	richness	-0.118	0.059	-1.989	0.103
	log_VR	-0.618	0.320	-1.934	0.111
Cistus ladanifer	(Intercept)	0.667	0.494	1.351	0.248
	richness	0.158	0.066	2.401	0.074
	log_VR	-0.012	0.172	-0.071	0.947
Cistus salviifolius	(Intercept)	2.256	0.369	6.109	**0.001**
	richness	-0.109	0.048	-2.262	0.064
	log_VR	-0.331	0.144	-2.295	0.062
Halimium calycinum	(Intercept)	-97.402			
	richness	34.906			
	log_VR	52.340			
Halimium halimifolium	(Intercept)	2.313	1.158	1.997	0.140
	richness	-0.006	0.183	-0.033	0.976
	log_VR	-0.406	0.641	-0.633	0.571
Lavandula pedunculata	(Intercept)	0.958	3.025	0.317	0.782
	richness	0.223	0.436	0.511	0.660
	log_VR	0.249	1.464	0.170	0.881
Lavandula stoechas	(Intercept)	-80.721			
	richness	19.595			
	log_VR	-16.967			

Plant_gen_sp	r.squared	adj.r.squared	sigma	statistic	p.value	df	logLik	AIC	BIC	deviance	df.residual	nobs
C.crispus	0.677	0.548	0.386	5.238	0.059	2	-1.864	11.728	12.046	0.746	5	8
C.ladanifer	0.637	0.456	0.407	3.514	0.132	2	-1.684	11.369	11.152	0.663	4	7
C.salviifolius	0.640	0.519	0.400	5.322	0.047	2	-2.689	13.377	14.166	0.958	6	9
H. calycinum	1.000					2	Inf	-Inf	-Inf	0.000	0	3
H.halimifolium	0.124	-0.461	1.224	0.211	0.821	2	-7.645	23.290	22.457	4.492	3	6
L.pedunculata	0.172	-0.656	2.405	0.208	0.828	2	-9.191	26.382	24.820	11.564	2	5
L.stoechas	1.000					2	Inf	-Inf	-Inf	0.000	0	3