Supporting Information: Evolutionary history determines population spread rate in a stochastic rather than deterministic way

Appendix 1: Experimental setup figures

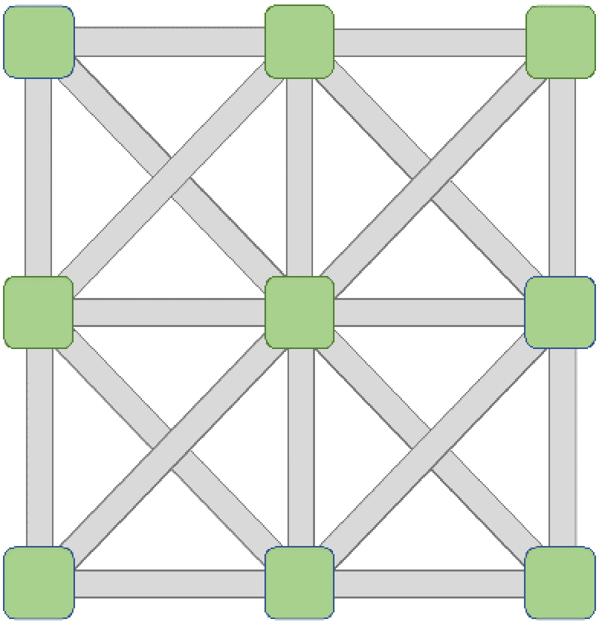

Figure S1.1: spatial configuration of the mesocosm landscape in the experimental evolution.. Green squares represent bean leaf patches and grey rectangles represent bridges.

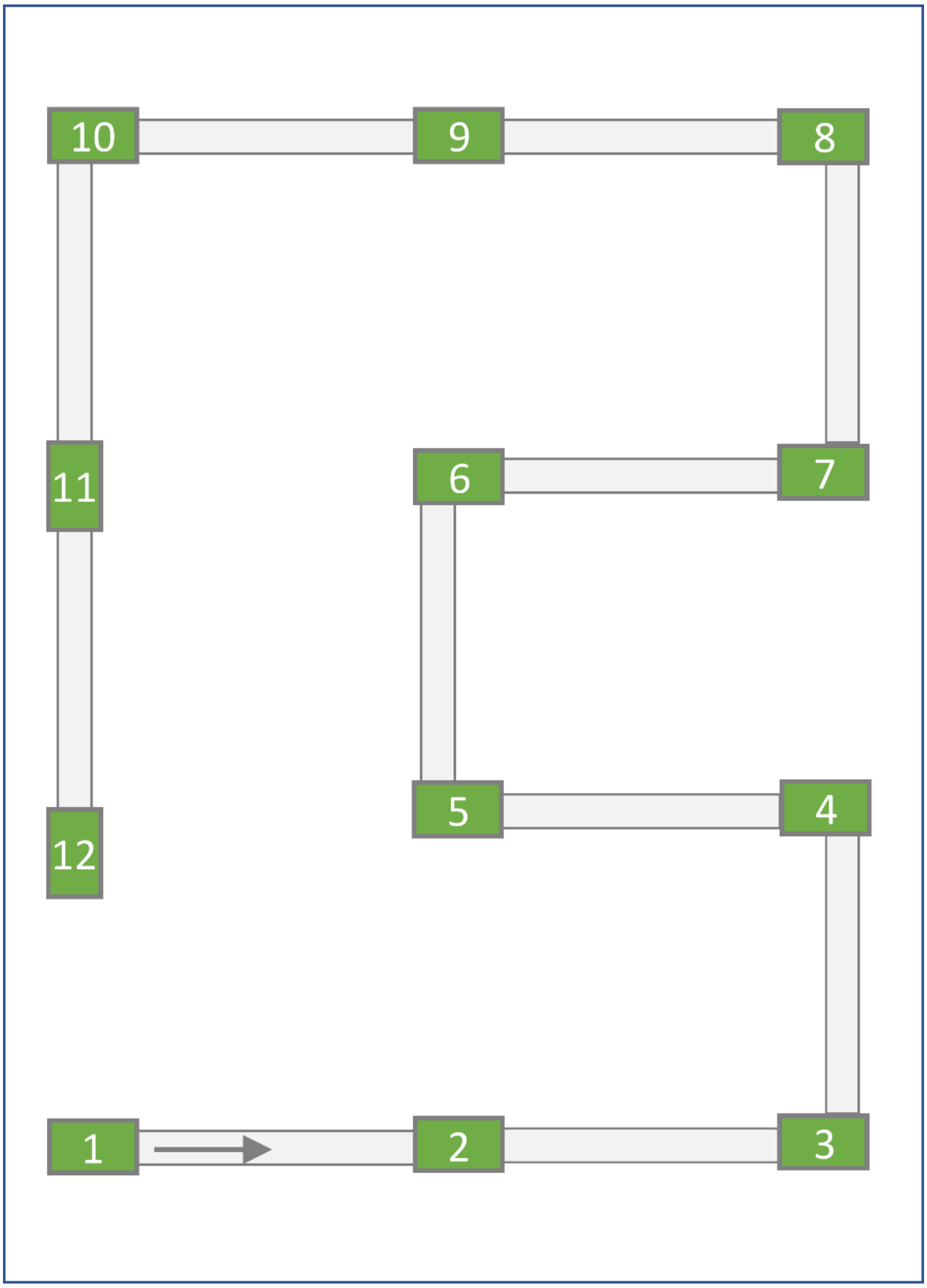

Figure S1.2: Spatial configuration of the range spread arena that consists of plant patches (green rectangles) that are connected to each other by parafilm® bridges (grey rectangles) in a linear sequence. Mites are introduced at the starting patch (upper right).

Appendix 2: Statistical model description and estimates

All models were run in R (3.6.3) using brms (2.12.0) and Hamiltonian Monte Carlo with two chains with each 5000 iteration from which 2000 were warmup

Model 1: Population spread depending on connectedness treatment

a) Model representation

edge ~ 0 + Intercept + treatment*day + (1 + day|mesoc)

prior = c(prior(normal(0,4), class = b),

prior(cauchy(0,2), class = sd),

prior(lkj(2), class = cor)

With *edge* the furthest occupied patch in a population spread test of a sample originating from an experimental mesocosm (*mesoc*) of a certain connectedness *treatment* spreading recorded at a certain point in time (in number of *day*s since the start). We modelled edge with a normally distributed error distribution and estimated it depending on *treatment*, time (*day*) and their interaction. We also modelled a varying intercept and slope in time for each tested mesocosm (*mesoc*). We used priors that are weakly regularizing. Of note, the used LKJ distribution is a Lewandowski-Kurowicka-Joe distribution that is regularly used a prior for a correlation matrix.

b) Model parameter estimates

	mean	se_mean	sd	2.5%	97.5%	n_eff	Rhat
b_Int	1.49	0.01	0.31	0.88	2.12	3492	1
b_treatment8	0.48	0.01	0.45	-0.39	1.34	4291	1
b_treatment16	0.51	0.01	0.49	-0.48	1.42	3963	1
b_day	0.12	0.00	0.05	0.02	0.21	2173	1
b_treatment8:day	0.02	0.00	0.07	-0.12	0.15	2434	1
b_treatment16:day	0.05	0.00	0.07	-0.08	0.19	2566	1
sd_mesoc__Int	0.38	0.01	0.24	0.02	0.94	2151	1
sd_mesoc__day	0.10	0.00	0.02	0.06	0.16	1947	1
cor_mesoc_Int_day	-0.41	0.01	0.38	-0.91	0.52	931	1
sigma	1.74	0.00	0.05	1.64	1.85	10190	1
r_mesoc[16.1,Int]	-0.02	0.00	0.35	-0.79	0.67	6434	1
r_mesoc[16.2,Int]	0.30	0.01	0.40	-0.28	1.29	3808	1
r_mesoc[16.3,Int]	-0.03	0.00	0.36	-0.78	0.74	5675	1
r_mesoc[16.4,Int]	-0.12	0.01	0.39	-1.05	0.56	5146	1

r_mesoc[16.5,Int]	-0.12	0.00	0.37	-0.95	0.57	6040	1
r_mesoc[4.1,Int]	-0.19	0.01	0.35	-1.03	0.42	3459	1
r_mesoc[4.2,Int]	-0.20	0.01	0.36	-1.07	0.40	3686	1
r_mesoc[4.3,Int]	-0.02	0.01	0.34	-0.72	0.73	4025	1
r_mesoc[4.4,Int]	0.08	0.00	0.33	-0.58	0.79	4367	1
r_mesoc[4.5,Int]	0.32	0.01	0.42	-0.31	1.33	3326	1
r_mesoc[8.1,Int]	-0.40	0.01	0.44	-1.38	0.25	2575	1
r_mesoc[8.2,Int]	0.22	0.01	0.41	-0.44	1.23	4728	1
r_mesoc[8.3,Int]	0.03	0.00	0.33	-0.65	0.72	6780	1
r_mesoc[8.4,Int]	0.18	0.00	0.34	-0.42	0.99	5345	1
r_mesoc[8.5,Int]	-0.02	0.00	0.33	-0.74	0.64	6535	1
r_mesoc[16.1,day]	-0.05	0.00	0.05	-0.15	0.05	4165	1
r_mesoc[16.2,day]	-0.03	0.00	0.05	-0.13	0.07	3799	1
r_mesoc[16.3,day]	0.07	0.00	0.05	-0.03	0.18	4427	1
r_mesoc[16.4,day]	-0.03	0.00	0.05	-0.14	0.07	4278	1
r_mesoc[16.5,day]	0.04	0.00	0.05	-0.07	0.15	4464	1
r_mesoc[4.1,day]	0.08	0.00	0.05	-0.02	0.18	2449	1
r_mesoc[4.2,day]	0.01	0.00	0.05	-0.09	0.11	2439	1
r_mesoc[4.3,day]	0.09	0.00	0.05	-0.01	0.19	2473	1
r_mesoc[4.4,day]	-0.07	0.00	0.05	-0.17	0.03	2473	1
r_mesoc[4.5,day]	-0.10	0.00	0.05	-0.21	-0.01	2650	1
r_mesoc[8.1,day]	0.17	0.00	0.05	0.08	0.28	3401	1
r_mesoc[8.2,day]	-0.07	0.00	0.05	-0.19	0.03	3882	1
r_mesoc[8.3,day]	-0.03	0.00	0.05	-0.13	0.06	4027	1
r_mesoc[8.4,day]	-0.03	0.00	0.05	-0.13	0.07	4047	1
r_mesoc[8.5,day]	-0.04	0.00	0.05	-0.13	0.06	4064	1

Model 2: Population spread variance

a) Model representation

edge ~ edge ~ 0 + Intercept + repr*day + (1+day|mesoc)

prior = c(prior(normal(0,4), class = b),

prior(cauchy(0,2), class = sd),

prior(lkj(2), class = cor)

With *edge* the furthest occupied patch in a population spread test of a sample originating from an experimental mesocosm (*mesoc*) that exhibited a certain reproductive success (*repr*) recorded at a certain point in time (in number of *day*s since the start). We modelled edge with a normally distributed error distribution and estimated it depending on *repr*oductive success, time (*day*) and their interaction. We also modelled a varying intercept and slope in time for each tested mesocosm (*mesoc*). We used priors that are weakly regularizing. Of note, the used LKJ distribution is a Lewandowski-Kurowicka-Joe distribution that is regularly used a prior for a correlation matrix.

b) Model parameter estimates

	mean	se_mean	sd	2.5%	97.5%	n_eff	Rhat
b_Int	1.39	0.02	0.86	-0.37	3.06	3023	1
b_repr	0.01	0.00	0.02	-0.03	0.05	3067	1
b_day	0.19	0.00	0.13	-0.08	0.46	2304	1
b_repr:day	0.00	0.00	0.00	-0.01	0.00	2229	1
sd_mesoc__Int	0.39	0.01	0.27	0.02	0.99	2015	1
sd_mesoc__day	0.10	0.00	0.03	0.06	0.17	1722	1
cor_mesoc_Int_day	-0.20	0.01	0.40	-0.83	0.65	832	1
sigma	1.81	0.00	0.06	1.70	1.93	6092	1
r_mesoc[16.1,Int]	-0.03	0.00	0.32	-0.70	0.64	6130	1
r_mesoc[16.2,Int]	0.32	0.01	0.41	-0.24	1.33	3071	1
r_mesoc[16.3,Int]	0.05	0.01	0.37	-0.66	0.92	4343	1
r_mesoc[16.4,Int]	-0.18	0.01	0.41	-1.19	0.52	4290	1
r_mesoc[4.2,Int]	-0.25	0.01	0.40	-1.22	0.38	3609	1
r_mesoc[4.3,Int]	-0.07	0.00	0.33	-0.85	0.56	4510	1
r_mesoc[4.4,Int]	-0.06	0.01	0.34	-0.85	0.63	4295	1
r_mesoc[4.5,Int]	0.16	0.01	0.39	-0.53	1.12	3056	1
r_mesoc[8.1,Int]	-0.25	0.01	0.40	-1.17	0.41	2592	1
r_mesoc[8.2,Int]	0.17	0.01	0.42	-0.55	1.19	4230	1
r_mesoc[8.3,Int]	0.00	0.00	0.33	-0.74	0.71	5642	1
r_mesoc[8.4,Int]	0.27	0.01	0.43	-0.35	1.35	2636	1
r_mesoc[8.5,Int]	-0.08	0.01	0.35	-0.86	0.62	4466	1
r_mesoc[16.1,day]	0.00	0.00	0.04	-0.08	0.07	4052	1
r_mesoc[16.2,day]	0.02	0.00	0.04	-0.06	0.09	3312	1
r_mesoc[16.3,day]	0.11	0.00	0.04	0.03	0.20	4053	1
r_mesoc[16.4,day]	0.02	0.00	0.05	-0.08	0.12	3815	1
r_mesoc[4.2,day]	-0.03	0.00	0.06	-0.15	0.09	2723	1
r_mesoc[4.3,day]	0.06	0.00	0.04	-0.02	0.14	3436	1
r_mesoc[4.4,day]	-0.10	0.00	0.04	-0.19	-0.02	3199	1
r_mesoc[4.5,day]	-0.12	0.00	0.04	-0.22	-0.04	3489	1
r_mesoc[8.1,day]	0.17	0.00	0.04	0.10	0.26	3422	1
r_mesoc[8.2,day]	-0.05	0.00	0.06	-0.17	0.05	3022	1
r_mesoc[8.3,day]	-0.02	0.00	0.05	-0.11	0.07	3135	1
r_mesoc[8.4,day]	-0.04	0.00	0.07	-0.19	0.10	2494	1
r_mesoc[8.5,day]	-0.01	0.00	0.06	-0.13	0.10	2726	1

Model 3: Total population size

a) Model representation

edge ~ edge ~ 0 + Intercept + disp*day + (1+day|mesoc)

prior = c(prior(normal(0,4), class = b),

prior(cauchy(0,2), class = sd),

prior(lkj(2), class = cor)

With edge the furthest occupied patch in a population spread test of a sample originating from an experimental mesocosm (*mesoc*) that exhibited a certain dispersal propensity (*disp*) recorded at a certain point in time (in number of *day*s since the start). We modelled edge with a normally distributed error distribution and estimated it depending on *disp*ersal propensity, time (day) and their interaction. We also modelled a varying intercept and slope in time for each tested mesocosm (*mesoc*). We used priors that are weakly regularizing. Of note, the used LKJ distribution is a Lewandowski-Kurowicka-Joe distribution that is regularly used a prior for a correlation matrix.

b) Model estimates

	mean	se_mean	sd	2.5%	97.5%	n_eff	Rhat
b_Int	1.44	0.01	0.59	0.28	2.60	3348	1
b_disp	1.14	0.03	1.58	-1.98	4.29	3301	1
b_day	0.27	0.00	0.08	0.12	0.42	2472	1
b_disp:day	-0.36	0.00	0.20	-0.78	0.05	2471	1
sd_mesoc_Int	0.42	0.01	0.27	0.02	1.01	2015	1
sd_mesoc_day	0.08	0.00	0.02	0.05	0.14	1674	1
cor_mesoc_Int_day	-0.27	0.01	0.39	-0.85	0.64	908	1
sigma	1.79	0.00	0.06	1.67	1.91	6491	1
r_mesoc[16.1,Int]	-0.06	0.00	0.34	-0.80	0.62	6241	1
r_mesoc[16.2,Int]	0.40	0.01	0.45	-0.18	1.46	3128	1
r_mesoc[16.3,Int]	0.10	0.01	0.40	-0.64	1.02	4696	1
r_mesoc[16.4,Int]	-0.16	0.01	0.41	-1.13	0.53	5122	1
r_mesoc[4.1,Int]	-0.30	0.01	0.41	-1.24	0.34	3206	1
r_mesoc[4.2,Int]	-0.24	0.01	0.43	-1.30	0.46	3261	1
r_mesoc[4.3,Int]	0.02	0.01	0.36	-0.75	0.81	5038	1
r_mesoc[4.5,Int]	0.13	0.01	0.41	-0.66	1.10	4222	1
r_mesoc[8.1,Int]	-0.28	0.01	0.43	-1.25	0.46	2233	1
r_mesoc[8.2,Int]	0.21	0.01	0.43	-0.50	1.30	4049	1
r_mesoc[8.3,Int]	0.05	0.00	0.33	-0.63	0.78	6463	1
r_mesoc[8.4,Int]	0.20	0.01	0.36	-0.40	1.09	4528	1
r_mesoc[8.5,Int]	-0.05	0.00	0.34	-0.80	0.61	6011	1
r_mesoc[16.1,day]	0.01	0.00	0.04	-0.07	0.08	4392	1
r_mesoc[16.2,day]	-0.03	0.00	0.04	-0.11	0.05	3626	1
r_mesoc[16.3,day]	0.05	0.00	0.05	-0.04	0.15	3116	1
r_mesoc[16.4,day]	0.00	0.00	0.04	-0.08	0.08	5085	1
r_mesoc[4.1,day]	0.07	0.00	0.04	-0.01	0.16	3139	1
r_mesoc[4.2,day]	-0.08	0.00	0.05	-0.19	0.02	3052	1
r_mesoc[4.3,day]	-0.01	0.00	0.05	-0.10	0.08	3115	1
r_mesoc[4.5,day]	-0.07	0.00	0.06	-0.19	0.04	3233	1
r_mesoc[8.1,day]	0.16	0.00	0.04	0.10	0.24	2822	1
r_mesoc[8.2,day]	-0.05	0.00	0.05	-0.15	0.04	4371	1
r_mesoc[8.3,day]	-0.04	0.00	0.03	-0.10	0.03	5204	1
r_mesoc[8.4,day]	-0.01	0.00	0.04	-0.09	0.06	4290	1
r_mesoc[8.5,day]	-0.01	0.00	0.04	-0.08	0.07	4271	1