Supplementary Information for:

Successive post-glacial colonization events with restricted gene flow in a widespread European carnation species

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The following Supporting Information is available for this article:

Table S1. Detailed information for *Dianthus carthusianorum* samples used in this study: species, sampling site (Site_ID), individual code (ID_Ind), number of SNPs, mean depth coverage before and after the filtering steps (N_SNPs_before_filtering and Mean_Depth_before-filtering), samples kept (1) or removed (0) after filtering, geographic coordinates (X and Y), and sampler names.

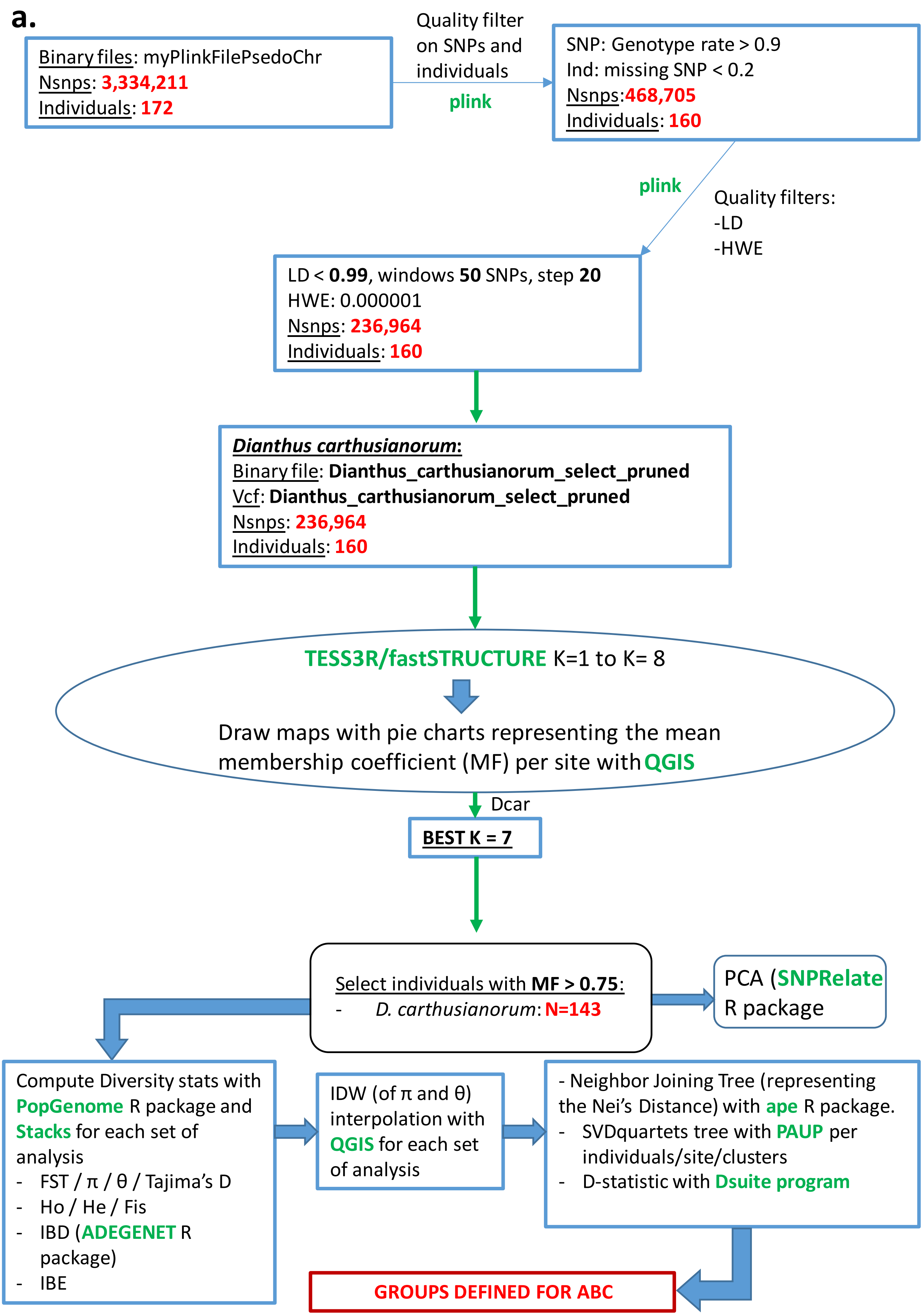
species	Site_ID	ID_Ind	N_SNPs_ before_ filtering	Mean depth before filtering	Remove after SNP filtering (0 ou 1)	X	Y	Sampler(s)
Dcar	Dcar_CZ_A	CZ_A1	1375328	17,2771	1	49.651066	14.216325	KK
Dcar	Dcar_CZ_A	CZ_A16	1403617	22,6892	1	49.650877	14.216467	KK
Dcar	Dcar_CZ_A	CZ_A17	1243812	16,1052	1	49.650926	14.216435	KK
Dcar	Dcar_CZ_A	CZ_A18	1409448	22,2074	1	49.650703	14.21664	KK
Dcar	Dcar_CZ_A	CZ_A2	1450981	22,8507	1	49.651034	14.216363	KK
Dcar	Dcar_CZ_A	CZ_A21	813258	4,4667	1	49.650868	14.216369	KK
Dcar	Dcar_CZ_A	CZ_A22	1179289	20,368	1	49.650739	14.216434	KK
Dcar	Dcar_CZ_A	CZ_A23	1391208	21,99	1	49.650691	14.216486	KK
Dcar	Dcar_CZ_A	CZ_A25	1220176	18,3917	1	49.650457	14.216635	KK
Dcar	Dcar_CZ_A	CZ_A3	1378042	19,0356	1	49.650985	14.216405	KK
Dcar	Dcar_CZ_B	CZ_B18	1282780	12,4377	1	49.643216	14.222171	KK
Dcar	Dcar_CZ_B	CZ_B19	1093696	10,3875	1	49.643226	14.222395	KK
Dcar	Dcar_CZ_B	CZ_B20	1381605	19,2867	1	49.643582	14.222766	KK
Dcar	Dcar_CZ_B	CZ_B21	1333371	14,7742	1	49.643555	14.222484	KK
Dcar	Dcar_CZ_B	CZ_B22	1230636	8,54319	1	49.643429	14.22274	KK
Dcar	Dcar_CZ_B	CZ_B23	1167613	8,15345	1	49.643284	14.222303	KK
Dcar	Dcar_CZ_B	CZ_B24	1285778	20,8311	1	49.643264	14.222068	KK
Dcar	Dcar_CZ_B	CZ_B25	1259718	10,409	1	49.643296	14.221879	KK
Dcar	Dcar_CZ_B	CZ_B26	1423634	20,1267	1	49.643346	14.221768	KK
Dcar	Dcar_CZ_B	CZ_B31	1310535	14,9776	1	49.643151	14.222471	KK
Dcar	Dcar_CZ_C	CZ_C19	1278670	12,1695	1	49.648024	14.204194	KK
Dcar	Dcar_CZ_C	CZ_C20	1262344	13,3154	1	49.64799	14.204056	KK
Dcar	Dcar_CZ_C	CZ_C22	1264185	11,0402	1	49.648249	14.203476	KK
Dcar	Dcar_CZ_C	CZ_C24	36919	1,365	0	49.648286	14.203531	KK
Dcar	Dcar_CZ_C	CZ_C25	1303251	12,0325	1	49.648229	14.203964	KK
Dcar	Dcar_CZ_C	CZ_C27	1264668	12,1967	1	49.648328	14.202932	KK
Dcar	Dcar_CZ_C	CZ_C28	1277980	14,4628	1	49.648388	14.202982	KK
Dcar	Dcar_CZ_C	CZ_C29	1290055	11,1691	1	49.647988	14.204153	KK
Dcar	Dcar_ESP	ESP_ESA_1	1334586	15,2169	1	42.70462	1.08792	Jean Luc Forremans
Dcar	Dcar_ESP	ESP_ESA_2	1458603	14,6728	1	42.70462	1.08792	Jean Luc Forremans
Dcar	Dcar_ESP	ESP_ESA_3	1263461	11,4885	1	42.70462	1.08792	Jean Luc Forremans
Dcar	Dcar_ESP	ESP_ESA_4	1288541	12,842	1	42.70462	1.08792	Jean Luc Forremans
Dcar	Dcar_FR_AL_11	FR_AL_11_1	1042932	6,39674	1	47.8886111 1	7.4480555 6	Henri Mathe
Dcar	Dcar_FR_AL_11	FR_AL_11_10	1320078	16,4745	1	47.8886111 1	7.4480555 6	Henri Mathe
Dcar	Dcar_FR_AL_11	FR_AL_11_2	1115490	7,09296	1	47.8886111 1	7.4480555 6	Henri Mathe
Dcar	Dcar_FR_AL_11	FR_AL_11_3	1167097	8,44538	1	47.8886111 1	7.4480555 6	Henri Mathe

Dcar	Dcar_FR_AL_11	FR_AL_11_4	1032132	5,63779	1	47.88861111	7.44805556	Henri Mathe
Dcar	Dcar_FR_AL_11	FR_AL_11_5	1191388	8,87322	1	47.88861111	7.44805556	Henri Mathe
Dcar	Dcar_FR_AL_11	FR_AL_11_6	1316412	18,9659	1	47.88861111	7.44805556	Henri Mathe
Dcar	Dcar_FR_AL_11	FR_AL_11_7	1341939	20,0497	1	47.88861111	7.44805556	Henri Mathe
Dcar	Dcar_FR_AL_11	FR_AL_11_8	1362651	22,1733	1	47.88861111	7.44805556	Henri Mathe
Dcar	Dcar_FR_AL_11	FR_AL_11_9	1256775	14,0183	1	47.88861111	7.44805556	Henri Mathe
Dcar	Dcar_FR_AL_7	FR_AL_7_2	1408956	26,3242	1	47.96388889	7.27083333	Henri Mathe
Dcar	Dcar_FR_AL_7	FR_AL_7_3	1380598	24,9074	1	47.96388889	7.27083333	Henri Mathe
Dcar	Dcar_FR_AL_7	FR_AL_7_4	1244290	14,4683	1	47.96388889	7.27083333	Henri Mathe
Dcar	Dcar_FR_AL_7	FR_AL_7_5	1364974	25,0445	1	47.96388889	7.27083333	Henri Mathe
Dcar	Dcar_FR_AL_8	FR_AL_8_5	1363091	21,7782	1	47.96833333	7.25333333	Henri Mathe
Dcar	Dcar_FR_AL_8	FR_AL_8_6	1372560	23,259	1	47.96833333	7.25333333	Henri Mathe
Dcar	Dcar_FR_AL_8	FR_AL_8_7	1384271	23,1962	1	47.96833333	7.25333333	Henri Mathe
Dcar	Dcar_FR_AL_8	FR_AL_8_8	1349872	22,6225	1	47.96833333	7.25333333	Henri Mathe
Dcar	Dcar_FR_AL_Nied	FR_AL_Nied_1	513905	3,93719	0	46.43844444	7.41281111	Thierry Schlienger
Dcar	Dcar_FR_AL_Nied	FR_AL_Nied_2	1088076	8,40688	1	46.43844444	7.41281111	Thierry Schlienger
Dcar	Dcar_FR_AL_Nied	FR_AL_Nied_3	1276037	13,662	1	46.43844444	7.41281111	Thierry Schlienger
Dcar	Dcar_FR_AL_Nied	FR_AL_Nied_4	705368	3,30058	0	46.43844444	7.41281111	Thierry Schlienger
Dcar	Dcar_FR_AL_Nied	FR_AL_Nied_5	1098605	10,8256	1	46.43844444	7.41281111	Thierry Schlienger
Dcar	Dcar_FR_AL_10	FR_AL10_1	1183870	9,02256	1	47.94583333	7.26888889	Henri Mathe
Dcar	Dcar_FR_AL_10	FR_AL10_2	1350447	22,1409	1	47.94583333	7.26888889	Henri Mathe
Dcar	Dcar_FR_AL_10	FR_AL10_3	1333180	19,9371	1	47.94583333	7.26888889	Henri Mathe
Dcar	Dcar_FR_AL_10	FR_AL10_4	1388779	25,1684	1	47.945833	7.268889	Henri Mathe
Dcar	Dcar_FR_AL_10	FR_AL10_5	1363157	22,5915	1	47.945833	7.268889	Henri Mathe
Dcar	Dcar_FR_AL_10	FR_AL10_6	1315583	19,3355	1	47.945833	7.268889	Henri Mathe
Dcar	Dcar_FR_AL_10	FR_AL10_7	1290581	13,2188	1	47.945833	7.268889	Henri Mathe
Dcar	Dcar_FR_AL_10	FR_AL10_8	1225945	9,85382	1	47.945833	7.268889	Henri Mathe
Dcar	Dcar_FR_AL_3	FR_AL3_1	1269977	15,3454	1	47.801667	7.156944	Henri Mathe
Dcar	Dcar_FR_AL_3	FR_AL3_2	1162503	10,8932	1	47.801667	7.156944	Henri Mathe
Dcar	Dcar_FR_AL_3	FR_AL3_3	799087	5,15698	1	47.801667	7.156944	Henri Mathe
Dcar	Dcar_FR_AL_3	FR_AL3_4	1275150	14,9689	1	47.801667	7.156944	Henri Mathe
Dcar	Dcar_FR_AL_4	FR_AL4_10	1190537	11,3116	1	47.965000	7.270000	Henri Mathe
Dcar	Dcar_FR_AL_4	FR_AL4_11	1515155	25,5737	1	47.965000	7.270000	Henri Mathe
Dcar	Dcar_FR_AL_4	FR_AL4_5	1253368	13,0686	1	47.965000	7.270000	Henri Mathe
Dcar	Dcar_FR_AL_4	FR_AL4_6	1072774	8,83879	1	47.965000	7.270000	Henri Mathe
Dcar	Dcar_FR_AL_4	FR_AL4_7	1316176	16,6471	1	47.965000	7.270000	Henri Mathe

Dcar	Dcar_FR_AL_4	FR_AL4_8	1306905	15,9888	1	47.965000	7.270000	Henri Mathe
Dcar	Dcar_FR_AL_4	FR_AL4_9	1115067	8,98659	1	47.965000	7.270000	Henri Mathe
Dcar	Dcar_FR_JUR_ORG	FR_JUR_ORG_1	1276067	15,8996	1	43.822638	4.361572	Anne Corriol
Dcar	Dcar_FR_JUR_ORG	FR_JUR_ORG_2	1373558	24,1005	1	43.822638	4.361572	Anne Corriol
Dcar	Dcar_FR_JUR_ORG	FR_JUR_ORG_3	1390279	23,7902	1	43.822638	4.361572	Anne Corriol
Dcar	Dcar_FR_JUR_ORG	FR_JUR_ORG_4	1427680	29,2392	1	43.822638	4.361572	Anne Corriol
Dcar	Dcar_FR_JUR_ORG	FR_JUR_ORG_5	1380207	22,9793	1	43.822638	4.361572	Anne Corriol
Dcar	Dcar_FR_JUR_ORG	FR_JUR_ORG_6	1313460	17,9012	1	43.822638	4.361572	Anne Corriol
Dcar	Dcar_FR_JUR_ORG	FR_JUR_ORG_7	1378901	23,5719	1	43.822638	4.361572	Anne Corriol
Dcar	Dcar_FR_JUR_VAL	FR_JUR_VAL_1	1421888	21,8835	1	46.540000	6.010000	Madeleine Dugois
Dcar	Dcar_FR_JUR_VAL	FR_JUR_VAL_10	1409879	20,4503	1	46.540000	6.010000	Madeleine Dugois
Dcar	Dcar_FR_JUR_VAL	FR_JUR_VAL_2	1417682	21,843	1	46.540000	6.010000	Madeleine Dugois
Dcar	Dcar_FR_JUR_VAL	FR_JUR_VAL_3	1359353	18,0007	1	46.540000	6.010000	Madeleine Dugois
Dcar	Dcar_FR_JUR_VAL	FR_JUR_VAL_4	1327944	22,908	1	46.540000	6.010000	Madeleine Dugois
Dcar	Dcar_FR_JUR_VAL	FR_JUR_VAL_5	1395277	18,4563	1	46.540000	6.010000	Madeleine Dugois
Dcar	Dcar_FR_JUR_VAL	FR_JUR_VAL_6	1516311	24,4005	1	46.540000	6.010000	Madeleine Dugois
Dcar	Dcar_FR_JUR_VAL	FR_JUR_VAL_7	1459588	26,659	1	46.54	6.01	Madeleine Dugois
Dcar	Dcar_FR_JUR_VAL	FR_JUR_VAL_8	1366570	18,0001	1	46.54	6.01	Madeleine Dugois
Dcar	Dcar_FR_JUR_VAL	FR_JUR_VAL_9	1398303	17,3929	1	46.54	6.01	Madeleine Dugois
Dcar	Dcar_FR_PY_1	FR_Py_1_1	1140777	18,3074	1	42.86545	0.33005	Cyril Denise
Dcar	Dcar_FR_PY_1	FR_Py_1_10	1186937	14,2981	1	42.86544	0.33006	Cyril Denise
Dcar	Dcar_FR_PY_1	FR_Py_1_2	1275983	18,7221	1	42.86545	0.33005	Cyril Denise
Dcar	Dcar_FR_PY_1	FR_Py_1_3	1217670	14,6662	1	42.86544	0.33002	Cyril Denise
Dcar	Dcar_FR_PY_1	FR_Py_1_4	1410657	26,5948	1	42.86545	0.33006	Cyril Denise
Dcar	Dcar_FR_PY_1	FR_Py_1_5	1225980	14,7162	1	42.86545	0.33007	Cyril Denise
Dcar	Dcar_FR_PY_1	FR_Py_1_6	1309955	19,3078	1	42.86548	0.3301	Cyril Denise
Dcar	Dcar_FR_PY_1	FR_Py_1_7	1307671	21,2148	1	42.86546	0.33007	Cyril Denise
Dcar	Dcar_FR_PY_1	FR_Py_1_8	1114840	11,0315	1	42.86543	0.33009	Cyril Denise
Dcar	Dcar_FR_PY_1	FR_Py_1_9	1196338	13,7153	1	42.86544	0.33002	Cyril Denise
Dcar	Dcar_FR_PY_2	FR_py_2_1	1139336	13,6435	1	**42.83467**	**0.32209**	Cyril Denise
Dcar	Dcar_FR_PY_2	FR_py_2_10	1271231	17,6481	1	42.83467	0.32211	Cyril Denise
Dcar	Dcar_FR_PY_2	FR_py_2_2	1110031	12,5338	1	42.83466	0.32215	Cyril Denise
Dcar	Dcar_FR_PY_2	FR_py_2_3	1202929	16,6911	1	42.83466	0.32214	Cyril Denise
Dcar	Dcar_FR_PY_2	FR_py_2_4	1224166	16,4045	1	42.83465	0.32216	Cyril Denise
Dcar	Dcar_FR_PY_2	FR_py_2_5	1160923	16,718	1	42.83465	0.32217	Cyril Denise
Dcar	Dcar_FR_PY_2	FR_py_2_6	1253664	19,1973	1	42.83467	0.32218	Cyril Denise

Dcar	Dcar_FR_PY_2	FR_py_2_7	1173441	20,7105	1	42.83464	0.32216	Cyril Denise
Dcar	Dcar_FR_PY_2	FR_py_2_8	1267000	18,5604	1	42.83461	0.32215	Cyril Denise
Dcar	Dcar_FR_PY_2	FR_py_2_9	1113622	13,6414	1	42.83462	0.32213	Cyril Denise
Dcar	Dcar_FR_SEY	FR_SEY_1	1391361	14,1451	1	45.56163	4.8292	Huques Savay-Guerraz
Dcar	Dcar_FR_SEY	FR_SEY_10	1060717	6,03164	1	45.56163	4.8292	Huques Savay-Guerraz
Dcar	Dcar_FR_SEY	FR_SEY_2	1349239	12,4256	1	45.56163	4.8292	Huques Savay-Guerraz
Dcar	Dcar_FR_SEY	FR_SEY_3	1419475	16,8098	1	45.56163	4.8292	Huques Savay-Guerraz
Dcar	Dcar_FR_SEY	FR_SEY_4	1263353	10,1193	1	45.56163	4.8292	Huques Savay-Guerraz
Dcar	Dcar_FR_SEY	FR_SEY_5	1379724	12,9907	1	45.56163	4.8292	Huques Savay-Guerraz
Dcar	Dcar_FR_SEY	FR_SEY_6	1193212	9,69532	1	45.56163	4.8292	Huques Savay-Guerraz
Dcar	Dcar_FR_SEY	FR_SEY_7	1356371	10,8816	1	45.56163	4.8292	Huques Savay-Guerraz
Dcar	Dcar_FR_SEY	FR_SEY_8	1479026	21,2324	1	45.56163	4.8292	Huques Savay-Guerraz
Dcar	Dcar_FR_SEY	FR_SEY_9	1065685	7,07059	1	45.56163	4.8292	Huques Savay-Guerraz
Dcar	Dcar_RO_PALT	RO_Palt_307	1298527	14,5699	1	45.697007	24.001228	AR & TU
Dcar	Dcar_RO_PALT	RO_Palt_308	1334387	11,8694	1	45.696952	24.001339	AR & TU
Dcar	Dcar_RO_PALT	RO_Palt_309	1368746	11,5206	1	45.696934	24.001526	AR & TU
Dcar	Dcar_RO_PALT	RO_Palt_310	1406958	16,2248	1	45.696853	24.001873	AR & TU
Dcar	Dcar_RO_PALT	RO_Palt_311	805161	4,42942	0	45.696855	24.002057	AR & TU
Dcar	Dcar_RO_PALT	RO_Palt_312	1106704	10,4338	1	45.697028	24.002133	AR & TU
Dcar	Dcar_RO_PALT	RO_Palt_313	1408419	15,6968	1	45.697173	24.001936	AR & TU
Dcar	Dcar_RO_PALT	RO_Palt_314	1332619	15,3116	1	45.697373	24.001681	AR & TU
Dcar	Dcar_RO_PALT	RO_Palt_315	1370874	12,1075	1	45.697337	24.001623	AR & TU
Dcar	Dcar_RO_PALT	RO_Palt_316	1324046	14,8672	1	45.69744	24.001472	AR & TU
Dcar	Dcar_RO_PALT	RO_Palt_317	1270578	12,7428	1	45.69744	24.001472	AR & TU
Dcar	Dcar_RO_Intorsura_Buzaului	RO_Intorsura Buzaului_402	1319497	12,0343	1	45.676096	25.97028	AR & TU
Dcar	Dcar_RO_Intorsura_Buzaului	RO_Intorsura Buzaului_403	1276256	11,3963	1	45.676094	25.970238	AR & TU
Dcar	Dcar_RO_Intorsura_Buzaului	RO_Intorsura Buzaului_404	1384476	13,5855	1	45.676025	25.970221	AR & TU
Dcar	Dcar_RO_Intorsura_Buzaului	RO_Intorsura Buzaului_405	1443097	21,4094	1	45.675836	25.970339	AR & TU
Dcar	Dcar_RO_Intorsura_Buzaului	RO_Intorsura Buzaului_406	46950	2,32812	0	45.675679	25.970192	AR & TU
Dcar	Dcar_RO_Intorsura_Buzaului	RO_Intorsura Buzaului_407	934611	5,98508	1	45.675574	25.97015	AR & TU
Dcar	Dcar_RO_Intorsura_Buzaului	RO_Intorsura Buzaului_408	1350944	12,87	1	45.675511	25.970018	AR & TU

Dcar	Dcar_RO_Intorsura_ Buzaului	RO_Intorsura Buzaului_409	1320526	12,8677	1	45.675494	25.969972	AR & TU
Dcar	Dcar_RO_Intorsura_ Buzaului	RO_Intorsura Buzaului_410	1417854	16,7698	1	45.675485	25.96985	AR & TU
Dcar	Dcar_RO_Intorsura Buzaului	RO_Intorsura_ Buzaului_411	1398419	16,132	1	45.675469	25.969817	AR & TU
Dcar	Dcar_RO_SuatuLow	RO_SuatuLow_P1	1486196	22,8545	1	46.73025	23.96822	AR & TU
Dcar	Dcar_RO_SuatuLow	RO_SuatuLow_P1 0	1408398	19,7832	1	46.72965	23.9678	AR & TU
Dcar	Dcar_RO_SuatuLow	RO_SuatuLow_P2	1351890	17,436	1	46.73016	23.96622	AR & TU
Dcar	Dcar_RO_SuatuLow	RO_SuatuLow_P3	1377946	15,3005	1	46.73022	23.969	AR & TU
Dcar	Dcar_RO_SuatuLow	RO_SuatuLow_P4	1432178	16,3674	1	46.72983	23.96898	AR & TU
Dcar	Dcar_RO_SuatuLow	RO_SuatuLow_P5	1319709	9,30933	1	46.72971	23.96862	AR & TU
Dcar	Dcar_RO_SuatuLow	RO_SuatuLow_P6	1436758	13,9008	1	46.72962	23.96854	AR & TU
Dcar	Dcar_RO_SuatuLow	RO_SuatuLow_P7	1426358	17,7184	1	46.72961	23.96838	AR & TU
Dcar	Dcar_RO_SuatuLow	RO_SuatuLow_P8	1370721	15,9267	1	46.72962	23.96817	AR & TU
Dcar	Dcar_RO_SuatuLow	RO_SuatuLow_P9	1388597	15,0714	1	46.72998	23.96789	AR & TU
Dcar	Dcar_SWI_LEUKI	SWI_LEUKI_1	1429070	29,5447	1	46.317	7.633	AC
Dcar	Dcar_SWI_LEUKI	SWI_LEUKI_10	1223890	11,0642	1	46.317	7.633	AC
Dcar	Dcar_SWI_LEUKI	SWI_LEUKI_2	1341736	17,969	1	46.317	7.633	AC
Dcar	Dcar_SWI_LEUKI	SWI_LEUKI_3	1298374	17,1268	1	46.317	7.633	AC
Dcar	Dcar_SWI_LEUKI	SWI_LEUKI_4	1410121	20,7692	1	46.317	7.633	AC
Dcar	Dcar_SWI_LEUKI	SWI_LEUKI_5	187417	5,34368	0	46.317	7.633	AC
Dcar	Dcar_SWI_LEUKI	SWI_LEUKI_6	1246638	14,5306	1	46.317	7.633	AC
Dcar	Dcar_SWI_LEUKI	SWI_LEUKI_7	1382030	23,4122	1	46.317	7.633	AC
Dcar	Dcar_SWI_LEUKI	SWI_LEUKI_8	1201583	11,2949	1	46.317	7.633	AC
Dcar	Dcar_SWI_LEUKI	SWI_LEUKI_9	1394319	16,0033	1	46.317	7.633	AC
Dcar	Dcar_UKR	UKR_1	430855	2,28325	0	48.05	24.2	VM
Dcar	Dcar_UKR	UKR_10	150925	1,59087	0	48.65072	22.33984	VM
Dcar	Dcar_UKR	UKR_2	742308	5,11561	0	48.2124333 3	23.754866 7	VM
Dcar	Dcar_UKR	UKR_3	152859	1,61207	0	48.1569444 4	25.305555 6	VM
Dcar	Dcar_UKR	UKR_4	142648	1,48642	0	51.3981083 3	27.894422 2	VM
Dcar	Dcar_UKR	UKR_5	1020533	4,14362	1	48.149725	24.282422 2	VM
Dcar	Dcar_UKR	UKR_6	1040100	6,36063	1	45.7499583 3	28.991927 8	VM
Dcar	Dcar_UKR	UKR_7	904097	4,37704	1	49.4019833 3	24.658341 7	VM
Dcar	Dcar_UKR	UKR_8	828973	4,65294	1	48.4644444 4	23.648888 9	VM
Dcar	Dcar_UKR	UKR_9	29479	1,34053	0	49.8074916 7	24.903061 1	VM


a.
Binary files: myPlinkFilePsedoChr
Nsnps: 3,334,211
Individuals: 172
Quality filter on SNPs and individuals
plink
SNP: Genotype rate > 0.9
Ind: missing SNP < 0.2
Nsnps:468,705
Individuals: 160
plink
Quality filters:
-LD
-HWE
LD < 0.99, windows 50 SNPs, step 20
HWE: 0.000001
Nsnps: 236,964
Individuals: 160
Dianthus carthusianorum:
Binary file: Dianthus_carthusianorum_select_pruned
Vcf: Dianthus_carthusianorum_select_pruned
Nsnps: 236,964
Individuals: 160
TESS3R/fastSTRUCTURE K=1 to K= 8
Draw maps with pie charts representing the mean membership coefficient (MF) per site with QGIS
Dcar
BEST K = 7
Select individuals with MF > 0.75:
- D. carthusianorum: N=143
PCA (SNPRelate R package
Compute Diversity stats with PopGenome R package and Stacks for each set of analysis
- FST / π / θ / Tajima's D
- Ho / He / Fis
- IBD (ADEGENET R package)
- IBE
IDW (of π and θ) interpolation with QGIS for each set of analysis
- Neighbor Joining Tree (representing the Nei's Distance) with ape R package.
- SVDquartets tree with PAUP per individuals/site/clusters
- D-statistic with Dsuite program
GROUPS DEFINED FOR ABC

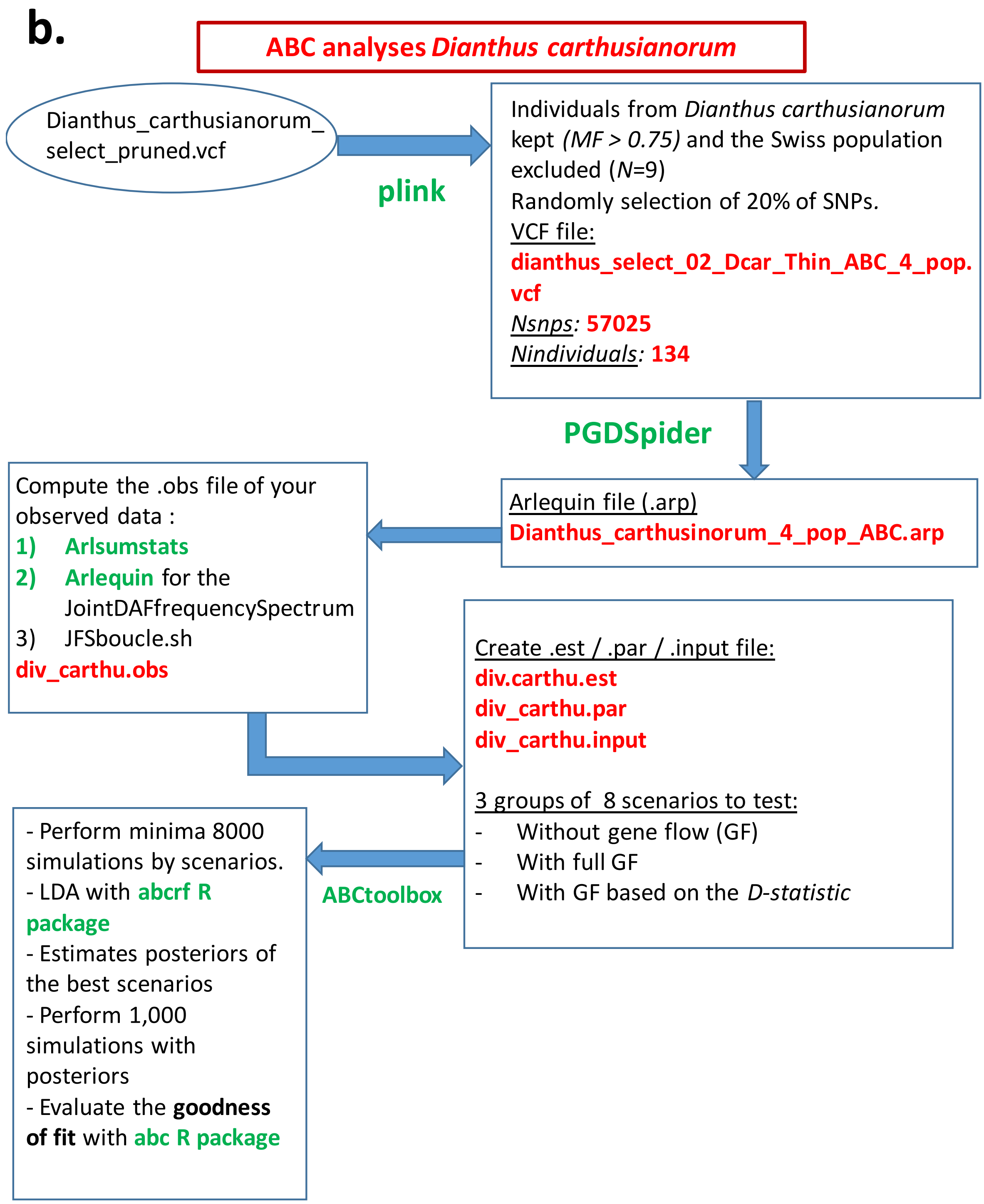


Figure S1. Pipeline used to analyze the *Dianthus carthusianorum* RAD-seq dataset. Software, R packages are in green, and the input file names are in red. a) SNP filtering and quality control steps, population structure analyses, genomic diversity and differentiation estimates, hybridization testing, and phylogenetic analyses. b) Approximate Bayesian computation pipeline used to reconstruct the demographic and divergence history of *Dianthus carthusianorum*. MF: Membership coefficient.

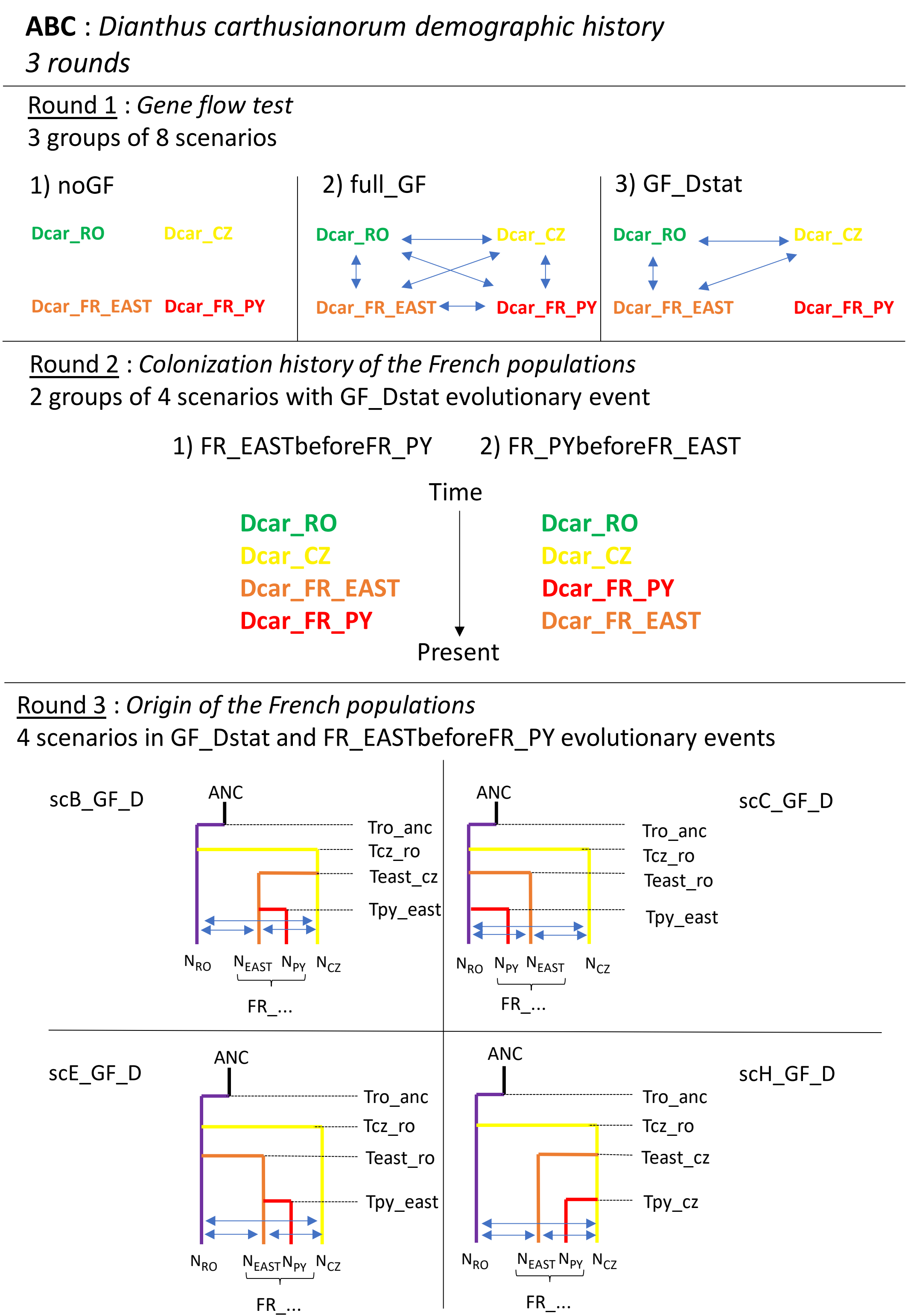
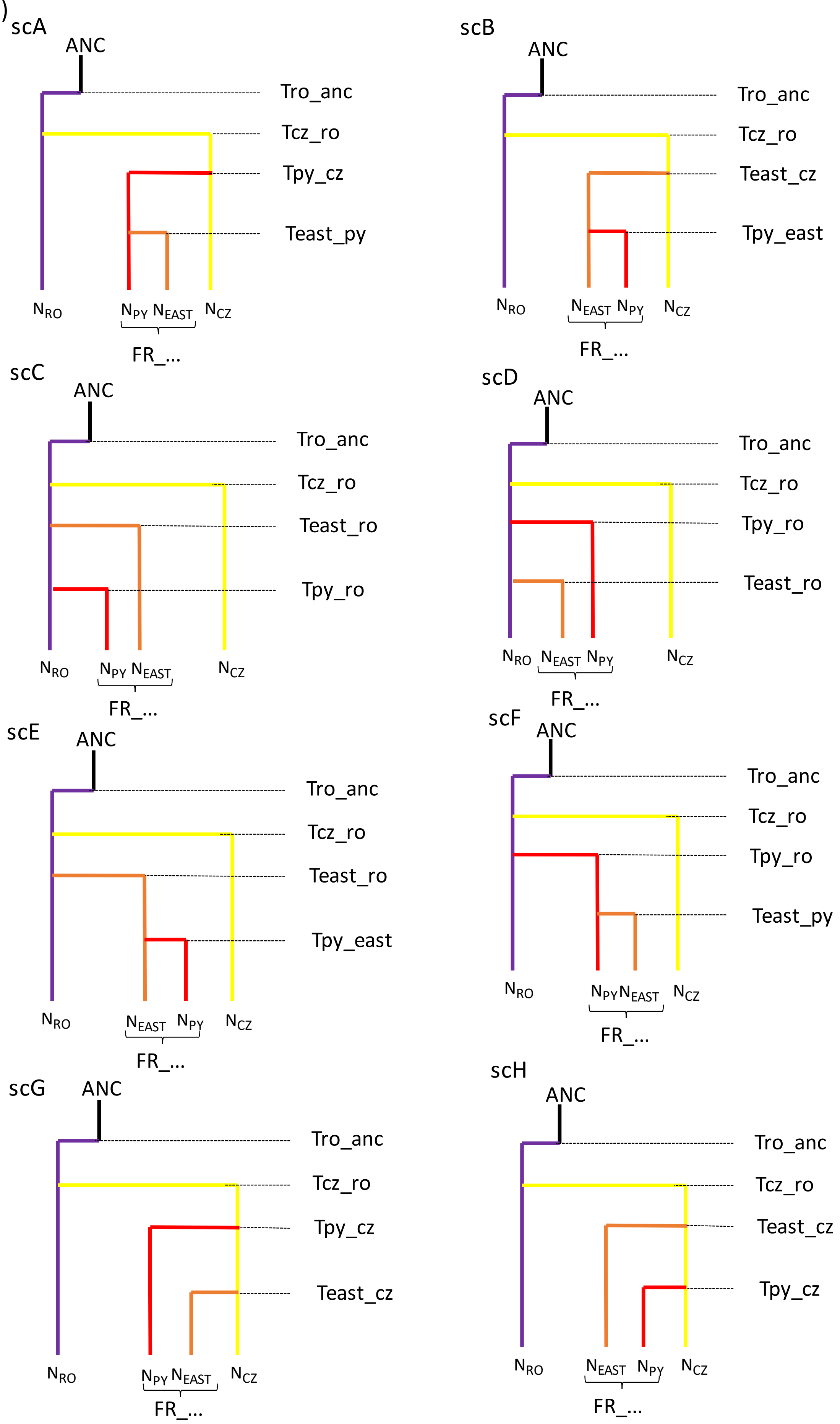
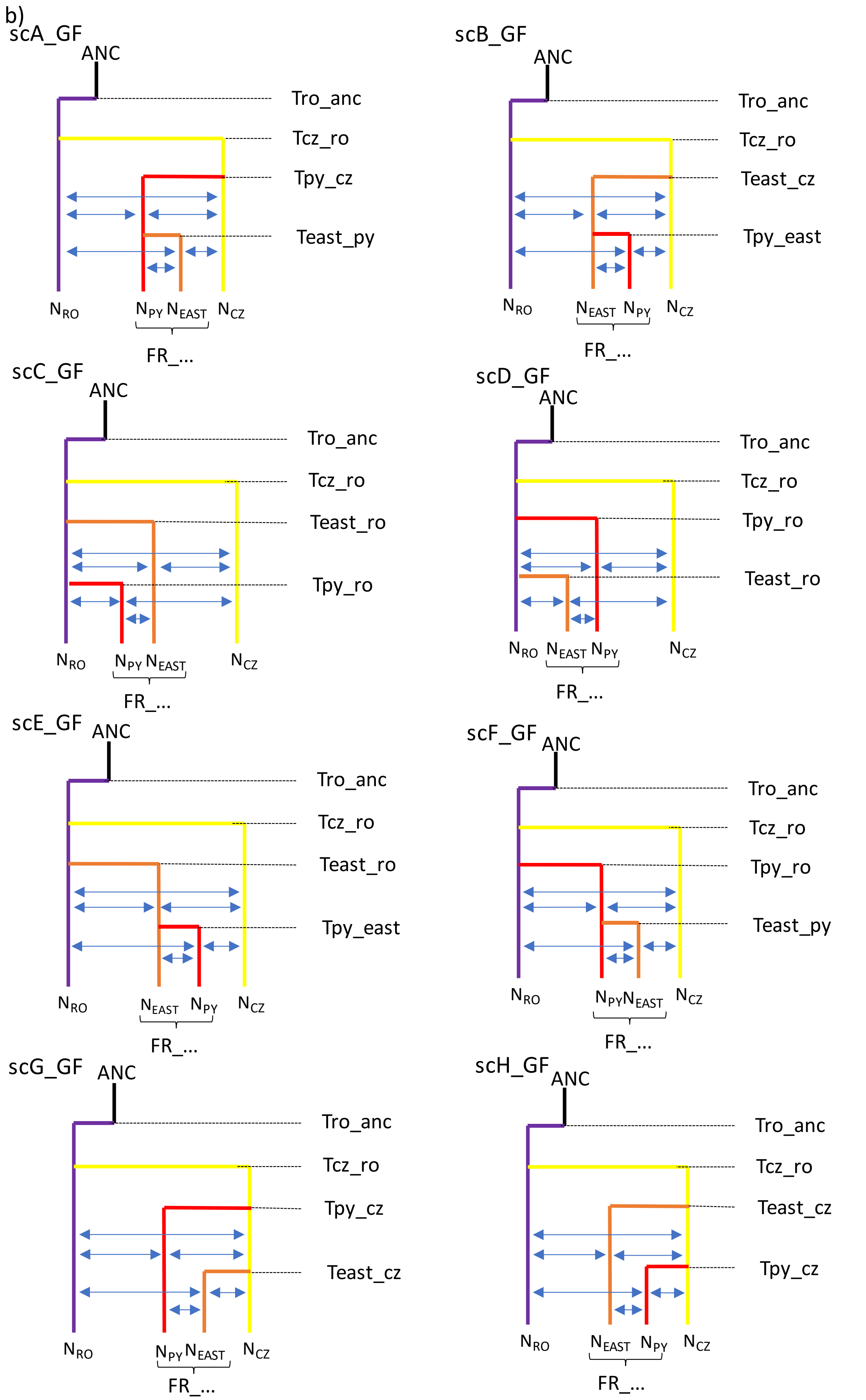


Figure S2. Nested approach used for approximate Bayesian computation (ABC) analyses to infer *the Dianthus carthusianorum* demographic history. The analysis was conducted in three rounds. The first round included 24 scenarios with eight scenarios of divergence, simulated with i) no gene flow (noGF), ii) bidirectional gene flow among populations (full_GF), or iii) gene flow between each population pair with significant D-statistics (GF_D) (the scenarios are described in Figure S3). The second round tested the colonization history of French populations (*i.e.*, the Pyrenean and French Eastern). The third round tested the origin of colonization of the French populations. In total, 24 scenarios were compared in the first round, eight in the second round and four in the third round. N_X: Effective population size of population X; bidirectional arrows represent gene flow between populations X and Y, $m_{X\text{-}Y}$; $T_{X\text{-}Y}$: divergence time between populations X and Y. CZ: Czech population inferred with TESS3R (yellow); FR_EAST: French Eastern population (*i.e.*, the Southern French Jurassian, the Northern French Jurassian and the French Alsatian inferred with TESS3R, grouped together, orange); FR_PY: the Pyrenean population inferred with TESS3R (red), RO: population from Romania inferred with TESS3R (purple); branches were coloured accordingly.

a)



(cf. legend hereafter)



(cf. legend hereafter)

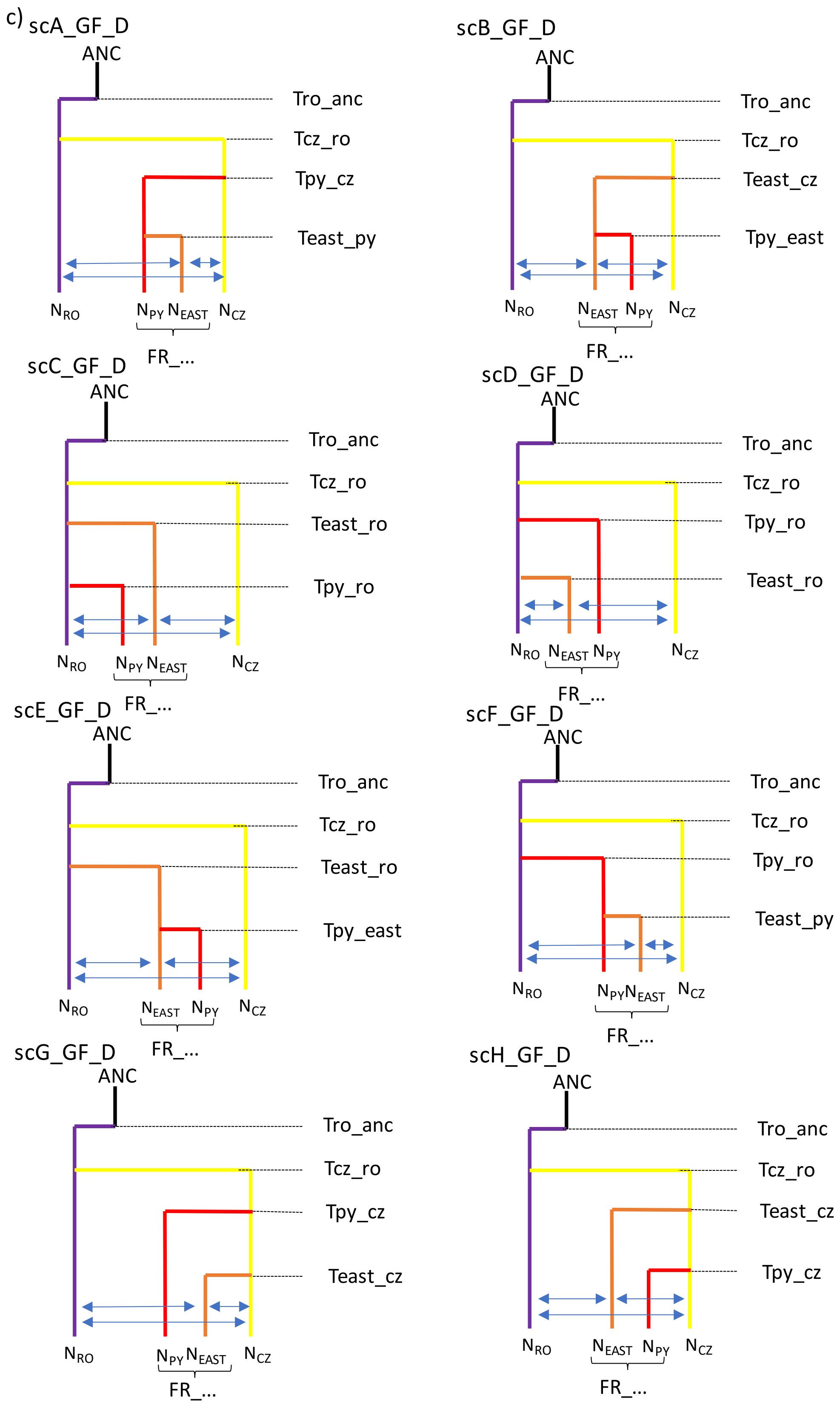


Figure S3. **Details of the scenarios tested with approximate Bayesian computation for reconstructing *Dianthus carthusianorum* colonization history** with a) no gene flow between populations (noGF), b) gene flow among the four populations (GF), and c) gene flow between each population pair with significant D-statistics (GF_D). A total of 24 scenarios were compared. N_X: Effective population size of population X; $m_{X\text{-}Y}$: bidirectional arrows representing gene flow between populations X and Y; $T_{X\text{-}Y}$: divergence time between populations X and Y. CZ: Czech population inferred with TESS3R (yellow); FR_EAST: French Eastern population (*i.e.*, the Southern French Jurassian, the Northern French Jurassian and the French Alsatian inferred with TESS3R grouped together, orange); FR_PY: the Pyrenean population inferred with TESS3R (red), RO: population from Romania inferred with TESS3R (purple); branches were coloured accordingly.

Table S2. Prior distributions used for approximate Bayesian computations to infer *Dianthus carthusianorum* demographic and divergence history.

	Parameter	Distribution	Lower bound	Upper bound
ABC analyses SET 1 and SET 2	N_X*	uniform	50	100,000
	$T_{X\text{-}ANC}$	log uniform	36-72	1,800,000-3,600,000
	$T_{X\text{-}Y}$	log uniform	36-72	1,800,000-3,600,000
	$m_{X\text{-}Y}$	uniform	0	0.1

Prior distributions are uniform and log-uniform between lower and upper bound. Parameters are introduced in Figures S2 and S3. *Nx*: effective population size of population *X*; $T_{X\text{-}ANC}$: Divergence time between population *X* and an unknown ancestral population ANC; Divergence time were calculated by multiplying the lower and the upper bound by the lower and the upper bound of the generation time estimates (Bruns, Hood, et Antonovics 2015) (*i.e.*, 3.6-7.2 years) ; *mX-Y*: migration rates from populations *X* to *Y*; $T_{X\text{-}Y}$: Divergence time between populations *X* and *Y*. * *Nx* were log-transformed for fastsimcoal2 simulations.

Table S3. Description of each round and hypothesis tested with approximate Bayesian computation to reconstruct the divergence and demographic history of *Dianthus carthusianorum* in Europe.

Species	ABC round	Focal populations	Scenario name	Tested hypotheses
Dianthus carthusianorum	**round 1: Gene flow test**	Romanian Czech French Eastern Pyrenean	scDcar_noGF	Scenarios assuming no gene flow among the four populations of *D. carthusianorum.*
			scDcar_fullGF	Scenarios assuming gene flow among the four populations of *D. carthusianorum.*
			scDcar_GF_Dstat	Scenarios assuming 1) gene flow among populations showing significant introgressions with the D-statistic
	round 2: Colonization history of the French populations	French Eastern Pyrenean	scDcar_FR_PYbeforeFR_EAST_GF_Dstat	Scenarios assuming 1) gene flow among populations showing significant introgressions with the D-statistic and 2) the Pyrenean coalescing before the French Eastern
			scDcar_FR_EASTbeforeFR_PY_GF_Dstat	Scenarios assuming 1) gene flow among populations showing significant introgressions with the D-statistic, and with 2) the French Eastern coalescing before the Pyrenean
	round 3: Successive from a single ancestral population vs. two independent colonisations from two	Romanian Czech French Eastern Pyrenean	scB_GF_D = scDcar_PYinEAST_EASTinCZ_CZinRO_ROinANC_GF_Dstat	Pyrenean coalesced in French Eastern, French Eastern coalesced in Czech, Czech in Romanian, Romanian in the ancestral population.

	ancestral populations			Gene flow were assumed among populations showing significant introgressions with the D-statistic
			scC_GF_D = scDcar_PYinRO_EASTinRO_CZinRO_ROinANC_GF_Dstat	Scenario with Pyrenean, French Eastern and Czech coalesced in Romanian, Romanian in an ancestral population. Gene flow were assumed among populations showing significant introgressions with the D-statistic
			scE_GF_D = scDcar_PYinEAST_EASTinRO_CZinRO_ROinANC_GF_Dstat	Scenario with Pyrenean that coalesced in French Eastern, French Eastern that coalesced in Romanian, Czech in Romanian, Romanian in the ancestral population. Gene flow were assumed among populations showing significant introgressions with the D-statistic
			scH_GF_D = scDcar_PYinCZ_EASTinCZ_CZinRO_ROinANC_GF_Dstat	Scenario with Pyrenean that coalesced in Czech, French Eastern that coalesced in Czech, Czech in Romanian, Romanian in the ancestral population. Gene flow were assumed among populations showing significant introgressions with the D-statistic

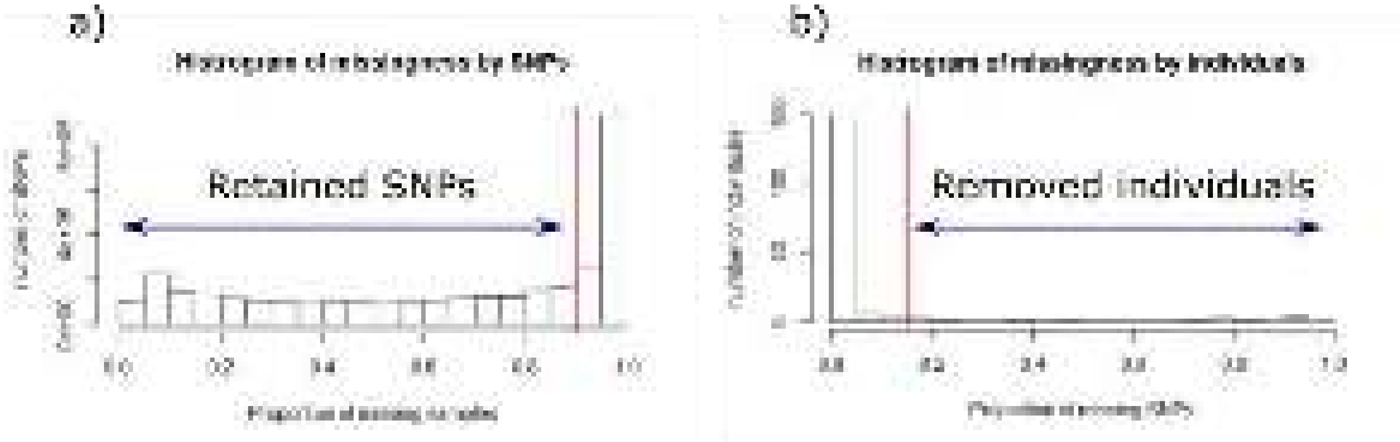
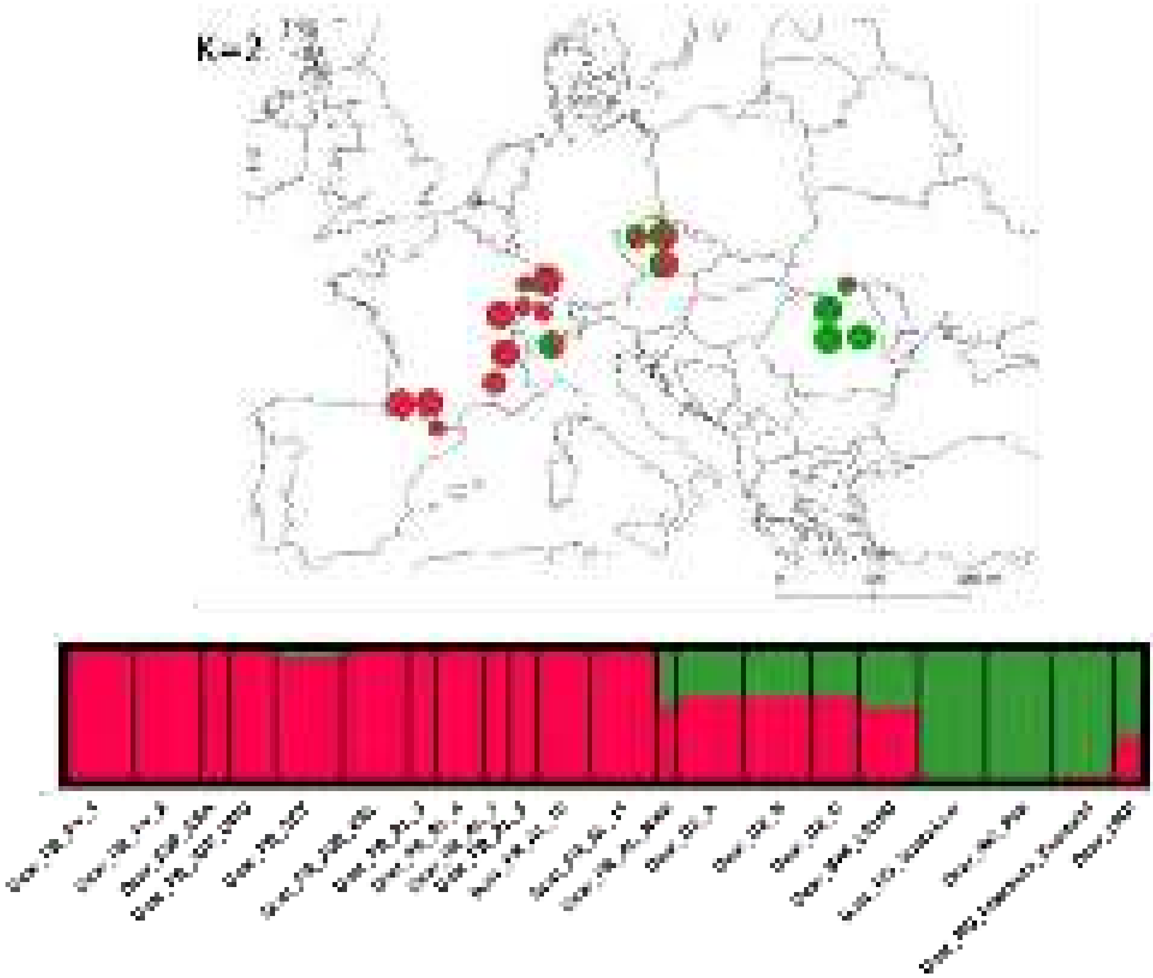
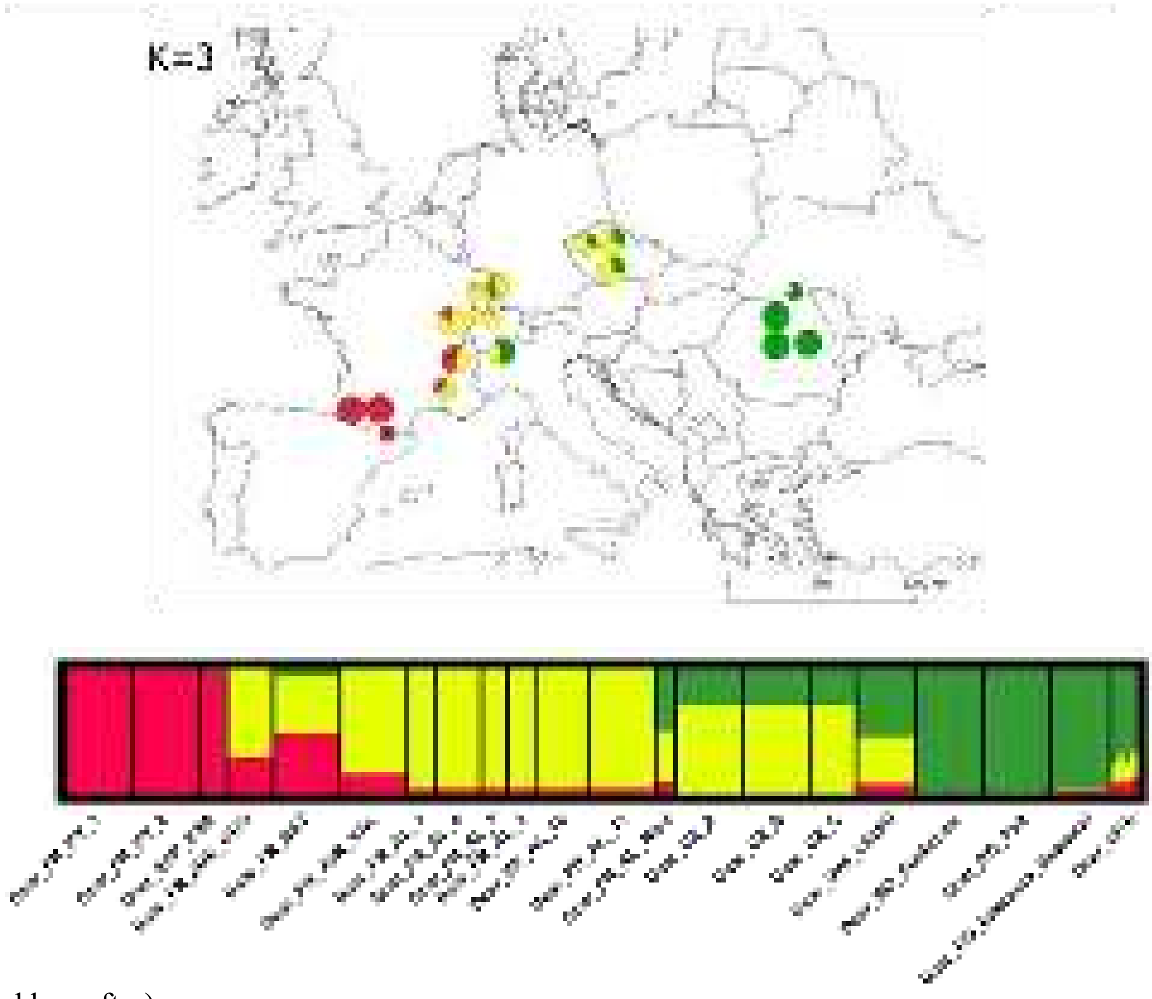
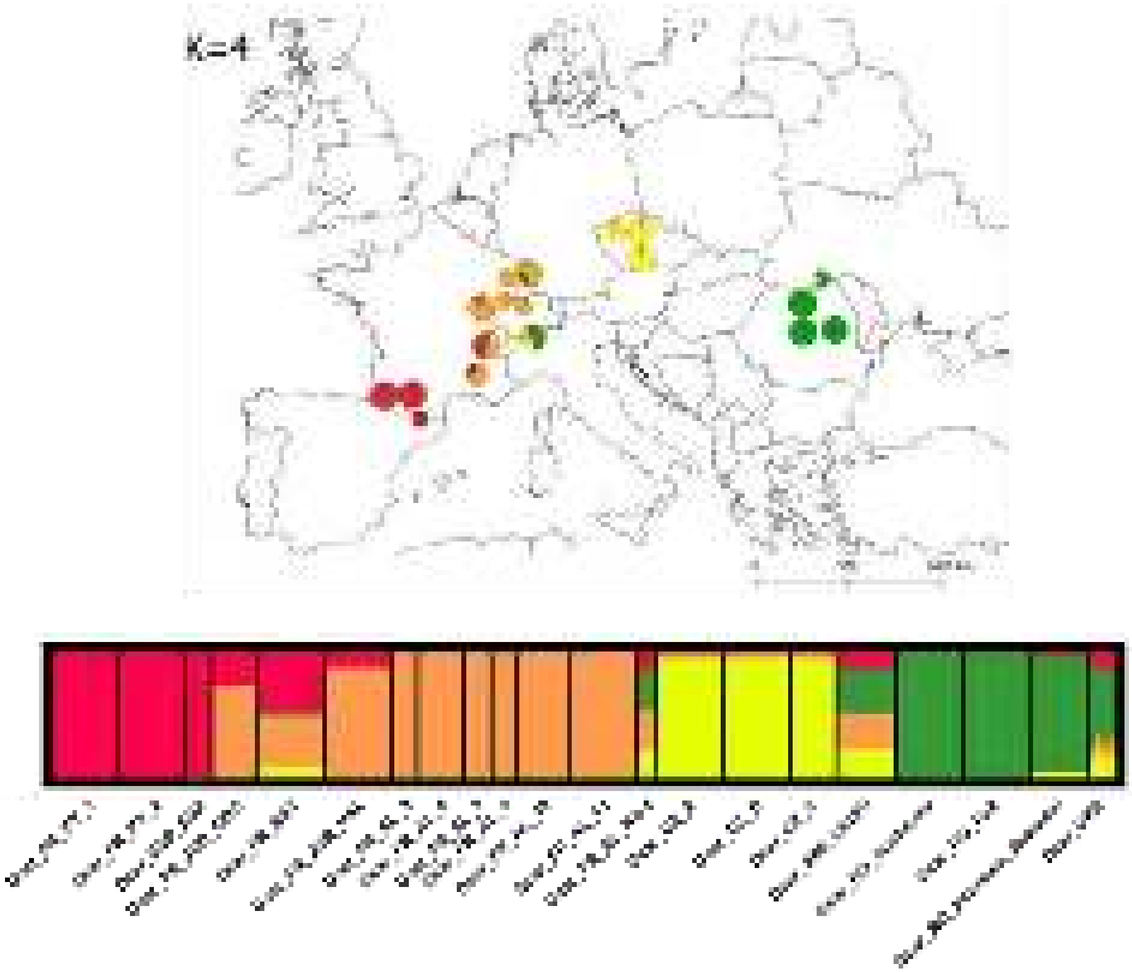


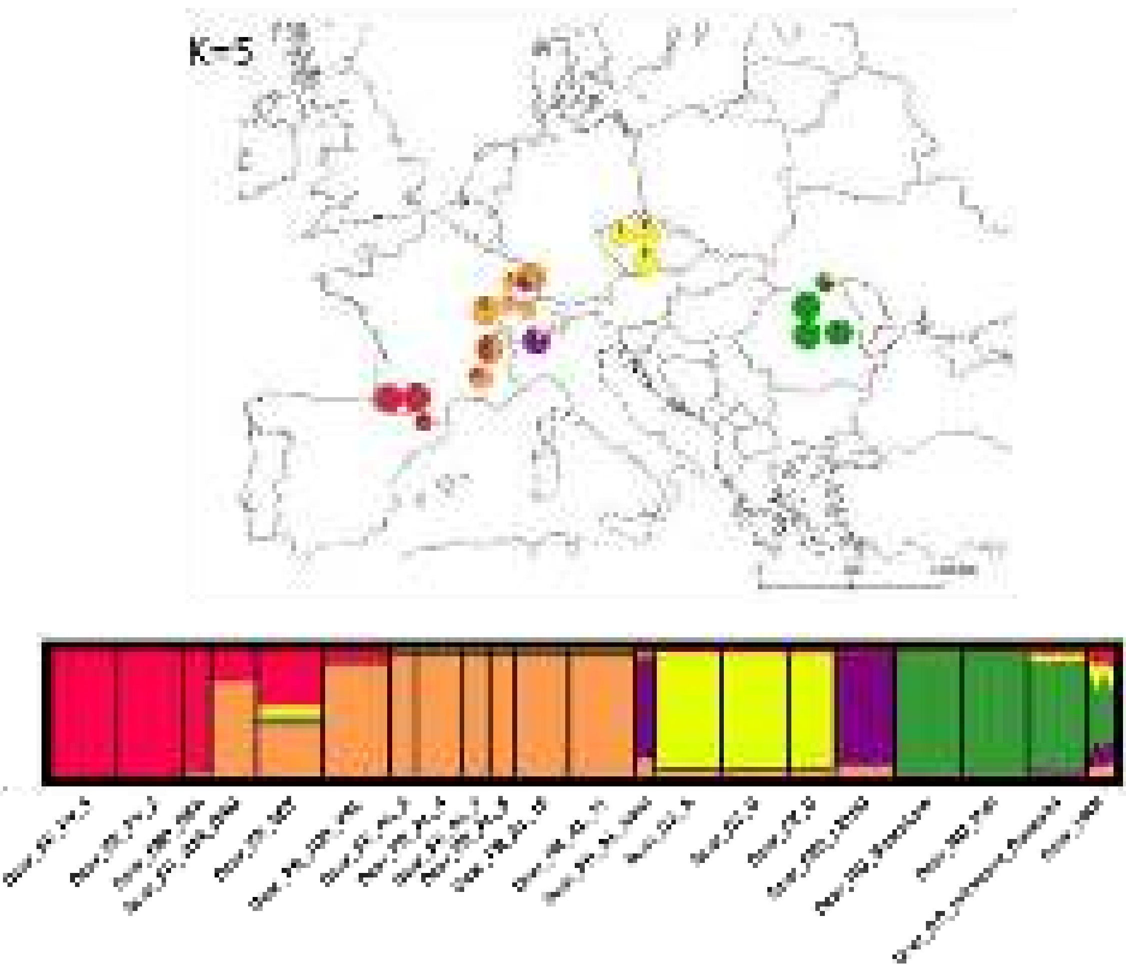
Figure S4. Missingness statistics a) over 3,334,211 SNPs mapped onto the *Dianthus carthusianorum* reference genome, and b) 172 individuals of *Dianthus carthusianorum*. The vertical red line represents the threshold from which the SNPs or individuals were retained for further analysis.



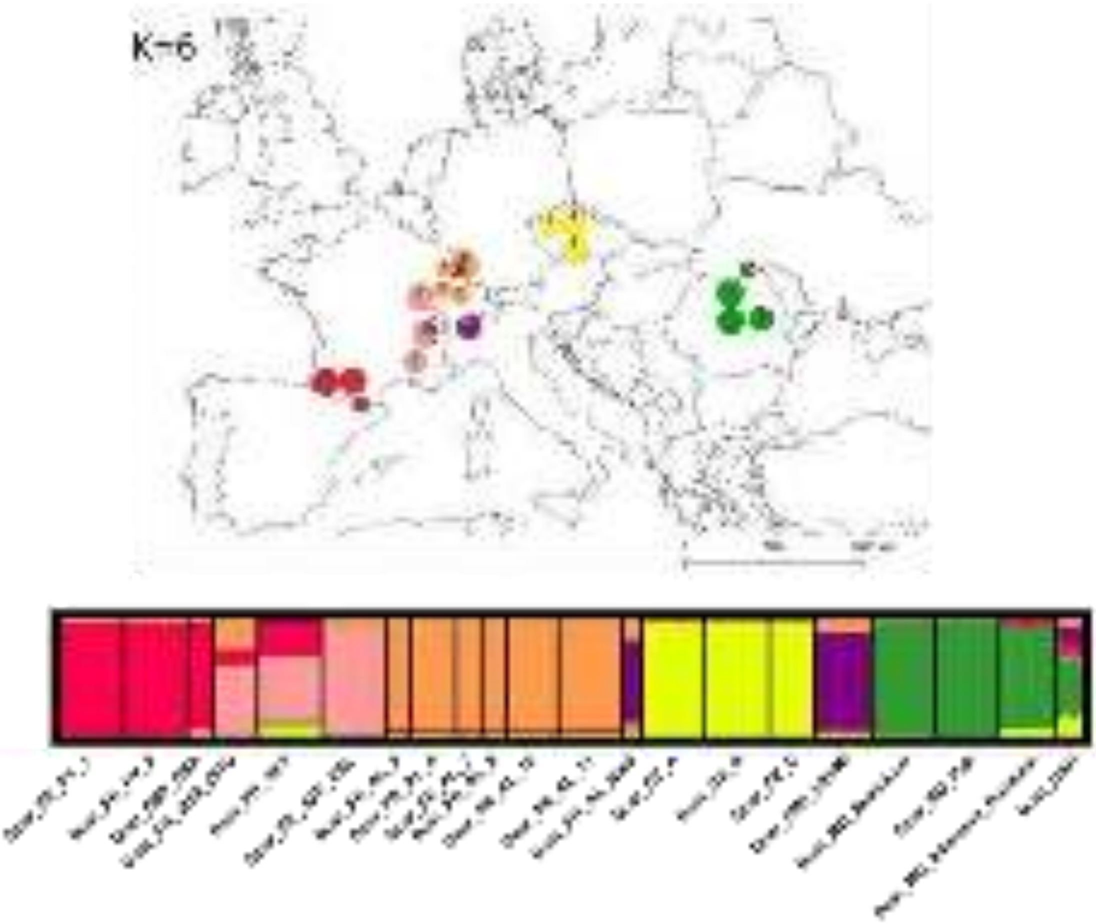


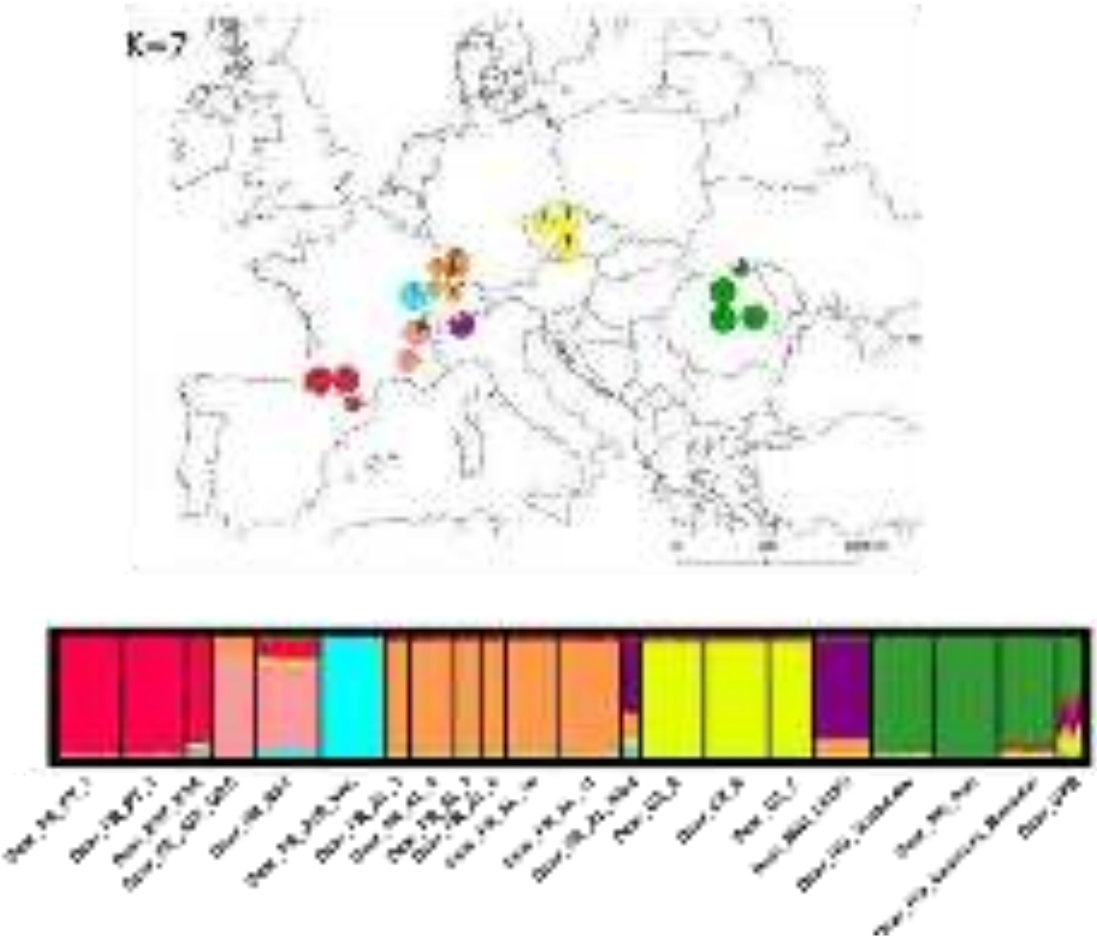
(cf. legend hereafter)





(cf. legend hereafter)





(cf. legend hereafter)

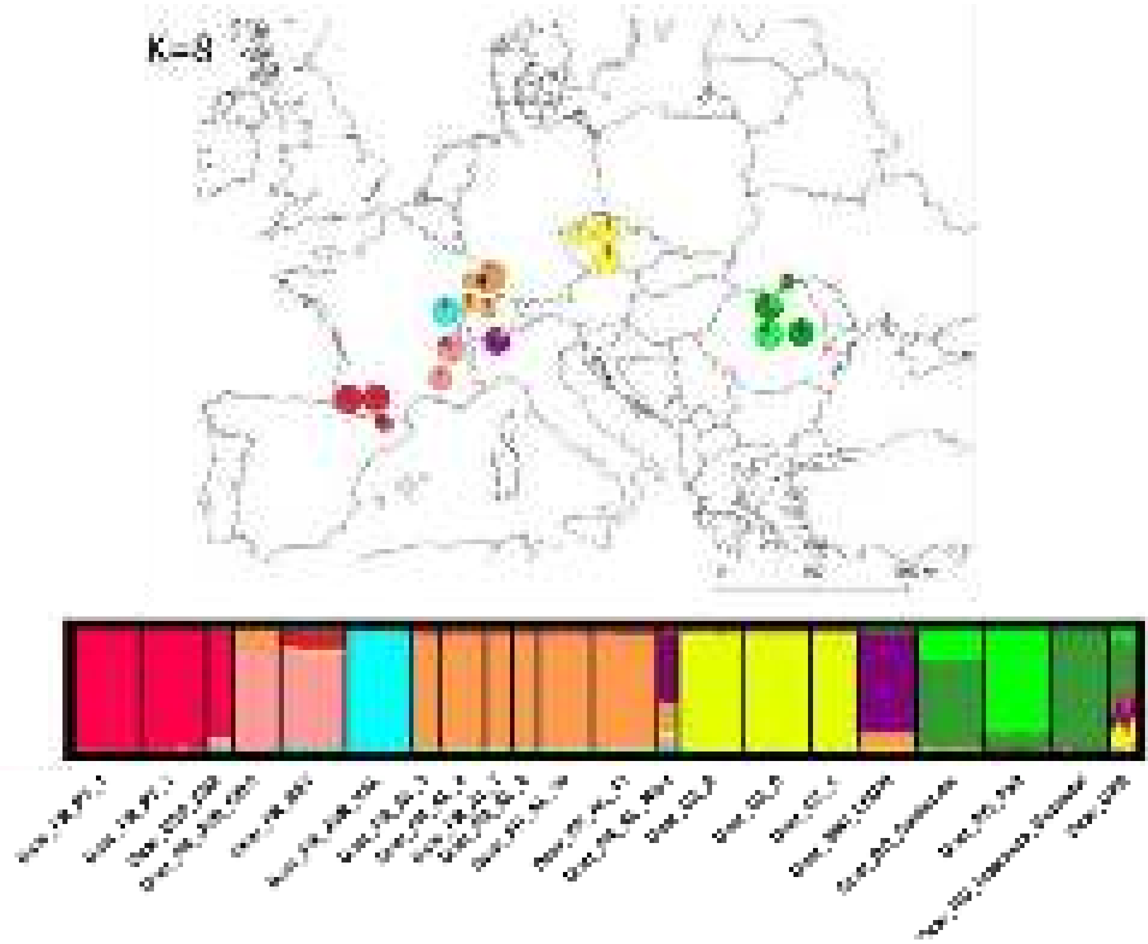


Figure S5. **Spatial population structure inferred with TESS3R from *K*=2 to *K*=8 for *Dianthus carthusianorum* (*N*=160, 21 sites across Europe, 236,964 unlinked SNPs).** For each *K* value: map representing the mean membership proportions for *K* clusters, for samples of *Dianthus carthusianorum* collected from the same site, and bar plots representing the population structure inferred with TESS3R. Each individual is represented by a vertical bar partitioned into *K* segments, representing the proportion of ancestry of its genome in *K* clusters.

Figure S6. Cross-validation score for each *K* computed with TESS3R for *Dianthus carthusianorum* (*N*=160 individuals and 236,964 SNPs). The lowest value was obtained at *K*=8.

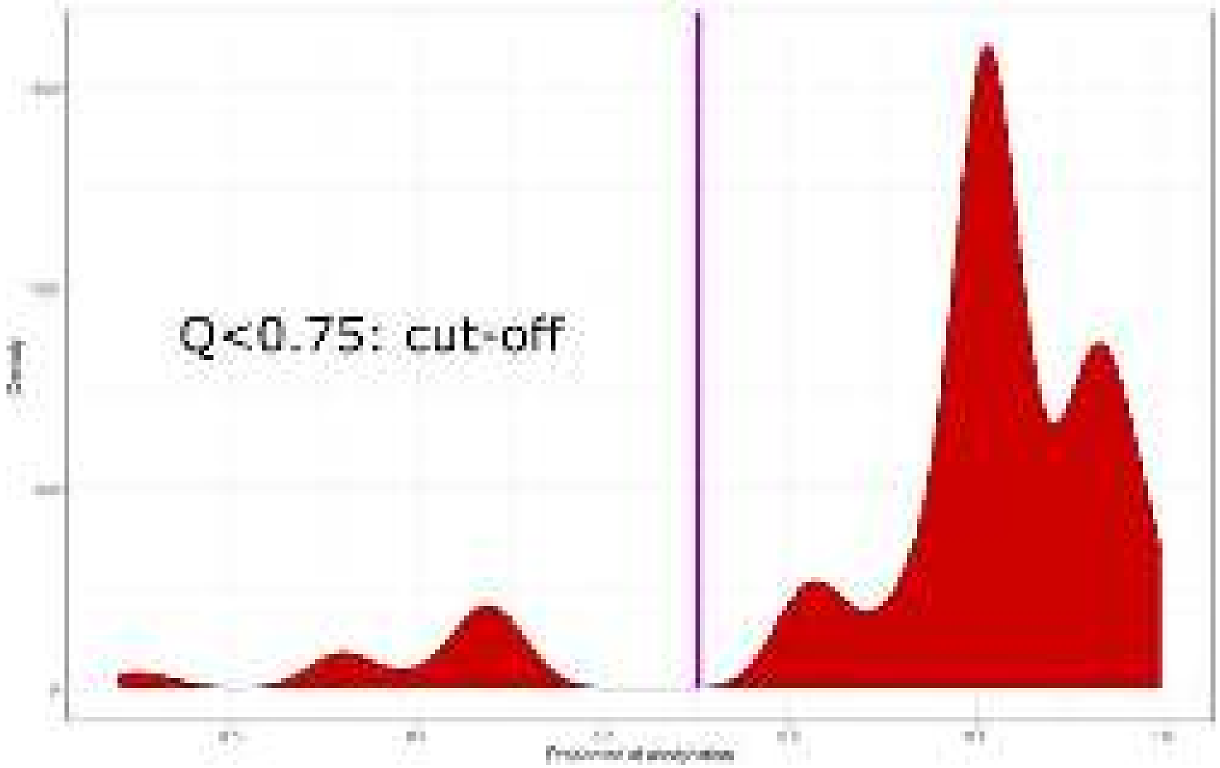


Figure S7. Distribution of the membership coefficient inferred with TESS3R for the 160 individuals of *Dianthus carthusianorum* for *K*=7. The vertical line at 0.75 represents the threshold used to assign an individual to a given cluster. Individuals with a membership coefficient > 0.75 were considered as admixed genotypes.

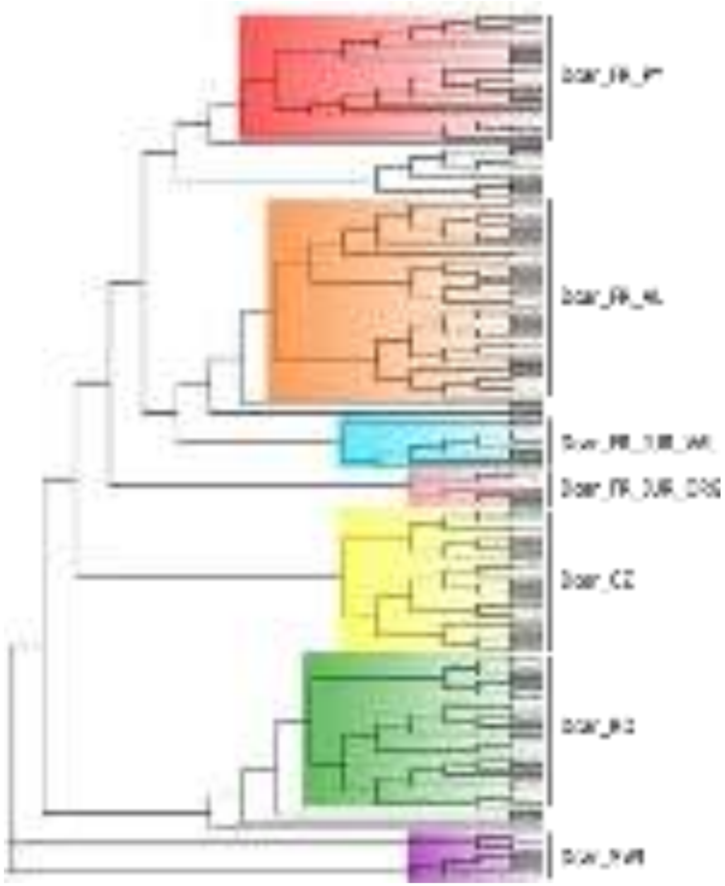


Figure S8. Phylogenetic tree for *Diantha carthusianorum* (*N*=160, 236,964 SNPs) built using SVDquartets. Each individual was colored according to its assigned population and detected using TESS3R for *K*=7. Individuals that are not colored are unassigned hybrids (i.e., individuals with a membership coefficient < 0.75 for any given genetic cluster). The Swiss population was considered as an outgroup.

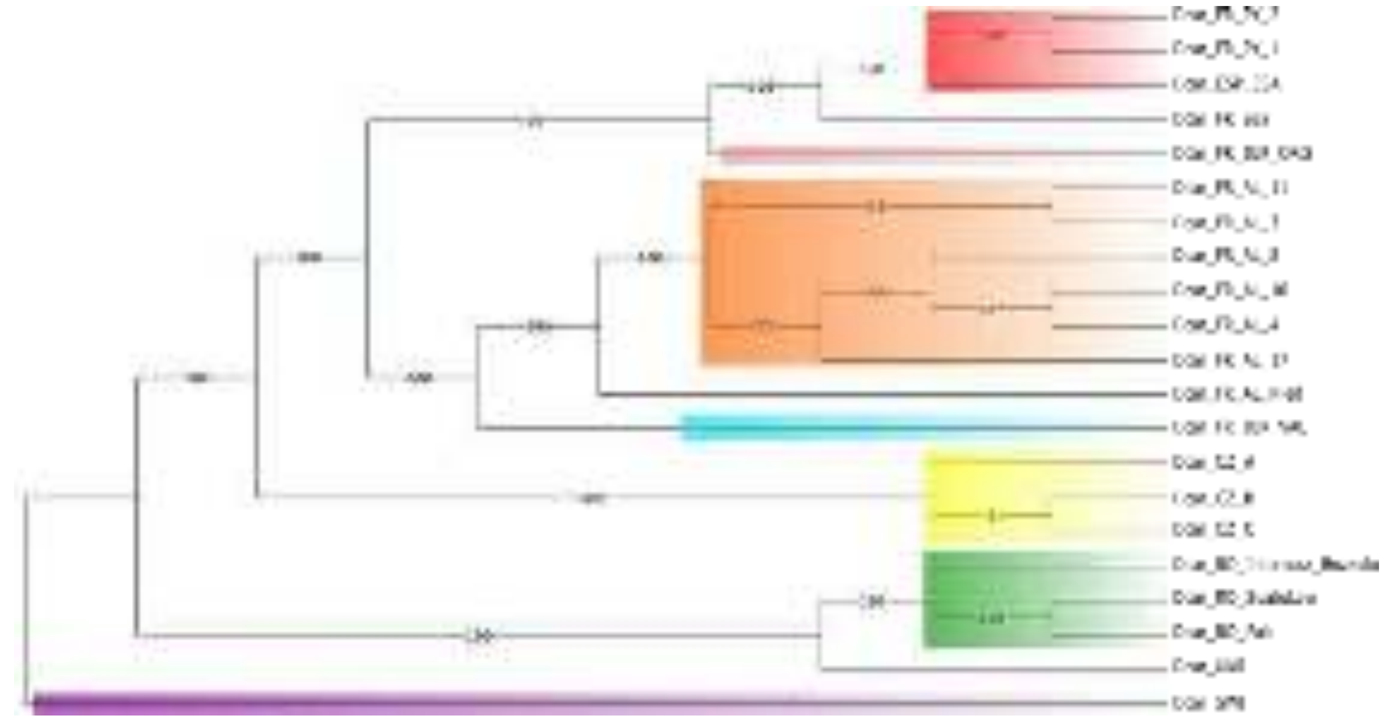


Figure S9. **Phylogenetic tree for *Dianthus carthusianorum* (*N*=160) built using SVD quartets.** Colors represent the population detected with TESS3R at each site (*N*=21). Only the sites named "Dcar_FR_SEY", "Dcar_FR_AL_Nied" and "Dcar_UKR" are not colored because all individuals from these sites were admixed individuals (*i.e.*, individual with a membership coefficient < 0.75 to a genetic cluster). The Swiss population was considered as an outgroup. Site names are listed in Table S1.

Table S4. Adjusted p-values from the Wilcoxon signed-rank test to compare Nei diversity (π) among the seven populations inferred with TESS3R for *Dianthus carthusianorum*.

	Czech	**Romanian**	**North French Jurassian**	**Sourth French Jurassian**	**Swiss**	**French Alsatian**	**Pyrenean**
Czech							
Romanian	3,2E-298						
North French Jurassian	0,0E+00	0,0E+00					
South French Jurassian	0,0E+00	0,0E+00	3,3E-04				
Swiss	0,0E+00	0,0E+00	2,1E-38	1,1E-98			
French Alsatian	0,0E+00	0,0E+00	0,0E+00	0,0E+00	6,4E-112		
Pyrenean	0,0E+00	0,0E+00	1,7E-180	1,7E-31	4,2E-08	3,9E-92	

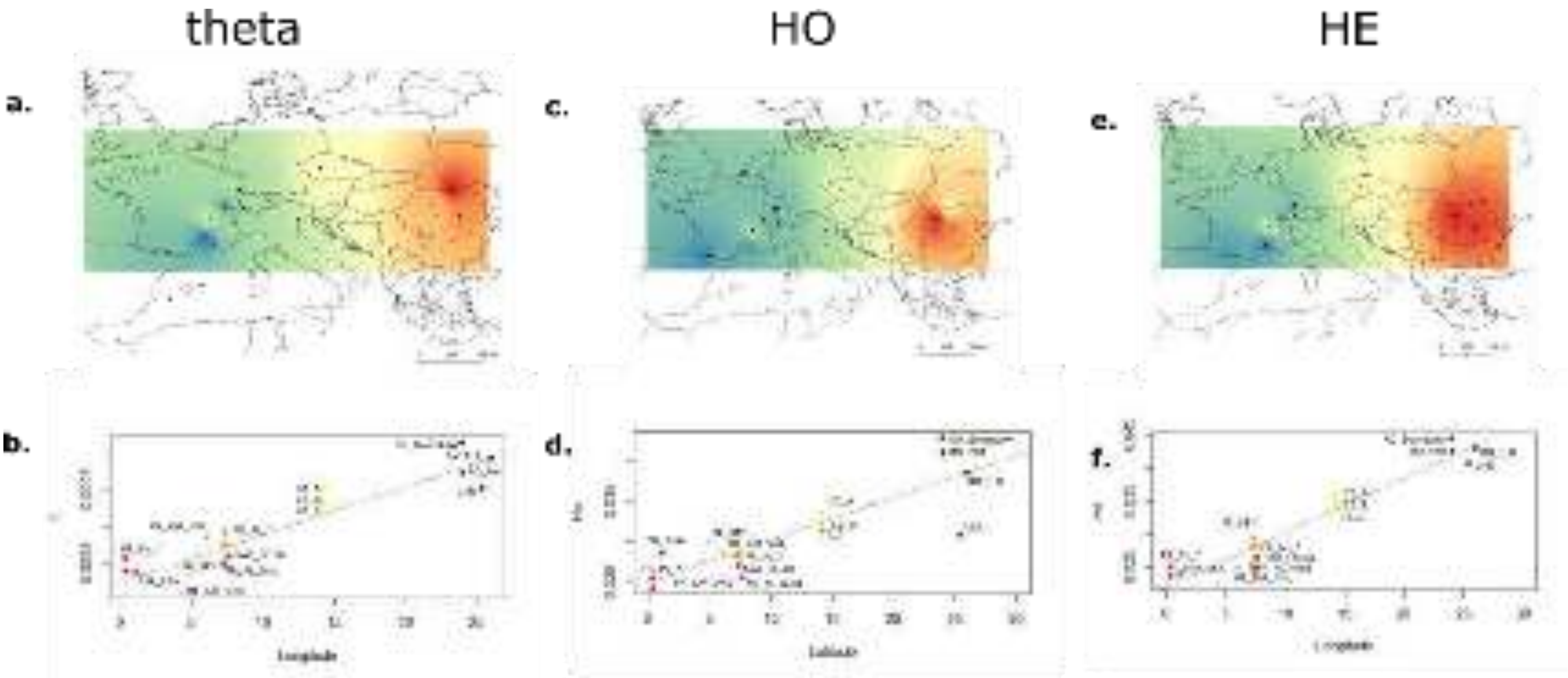


Figure S10. Spatial genetic variation in *Dianthus carthusianorum* (*N*=160, 21 sample sites) in Europe. a, c, e. Maps of mean interpolated diversities (Watterson 's θ, *Ho, He*, respectively) per site. b, d, f. Relationships between each genetic diversity estimate and longitude. Each dot representing a sampling site is colored according to its respective assigned population inferred using TESS for *K*=7. The red dotted line represents the linear regression line and the adjusted R-squared and associated p-values are presented in Table S4. RO_I_B is the abbreviation for Ro_Intorsura_Buzaului

Table S5. Relationship between genetic diversity estimates (Watterson 's *θ,* Nei's *π* diversity*, Ho, He*, respectively) **per site and latitude or longitude for *Dianthus carthusianorum* in Europe.**

	Latitude		Longitude	
	r	p-value	r	p-value
Watterson's θ	0.072	0.126	0.835	$4.5\ 10^{-09}$
π	0.055	0.158	0.931	$1.02\ 10^{-12}$
He	0.038	0.196	0.898	$8.738\ 10^{-12}$
Ho	-0.002	0.341	0.715	8.5^{-07}

r: the adjusted R-squared and associated p-value

Table S6. Patterson's *D* (ABBA-BABA statistic) estimated with *D-suite* used to assess evidence of gene flow among the four populations (*i.e.*, the Pyrenean, the French Eastern, the Czech and the Romanian) used in ABC analyses to reconstruct the demographic and divergence history of *Dianthus carthusianorum*.

P1	P2	P3	Dstatistic	p-value	se
Pyrenean	French Eastern	Czech	0.0861436	0,00	0.1076385
French Eastern	Czech	Romanian	0.0302745	8.75966e-13	0.0199119
Pyrenean	Czech	Romanian	0.0515677	7.9825e-13	0.0340887
Pyrenean	French Eastern	Romanian	0.0242608	0.000779824	0.0151203

P1, P2, P3: three populations used in the test, details of the populations are described in Table 1; se: standard error associated with the D-statistics computed over 20 jackknife blocks divided the dataset. Corrected P-value: p-value after Benjamini and Yekutieli correction (Benjamini and Yekutieli 2001).

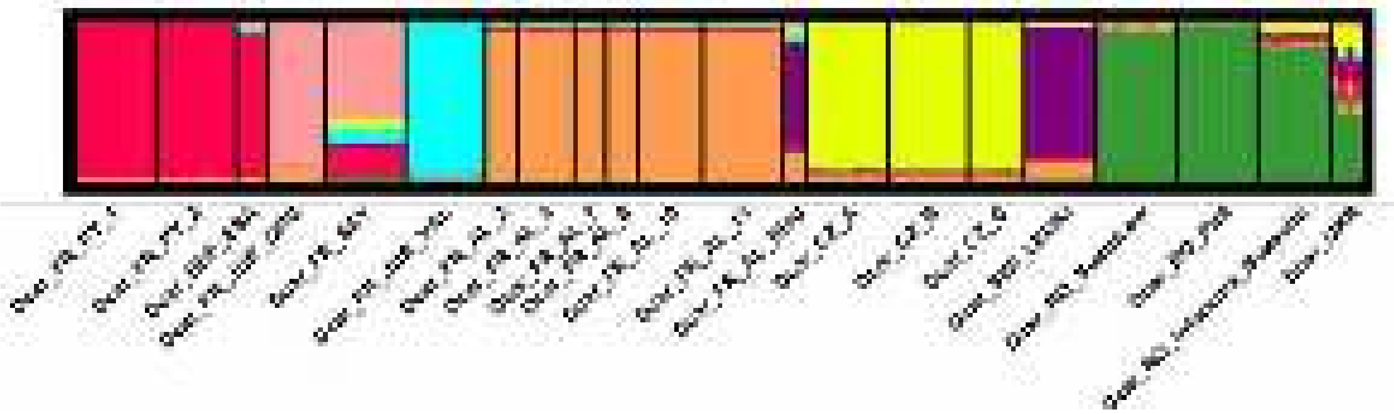


Figure S11. Barplots representing the population structure inferred using TESS3R for *Dianthus carthusianorum* for *K*=7 (39,346 unlinked SNPs, *N*=160, 21 sites across Europe). Each individual is represented by a vertical bar partitioned into *K* segments, representing the proportion of ancestry of its genome in *K* clusters. There were no differences compared to the population structure inferred from the 236,964 SNPs.

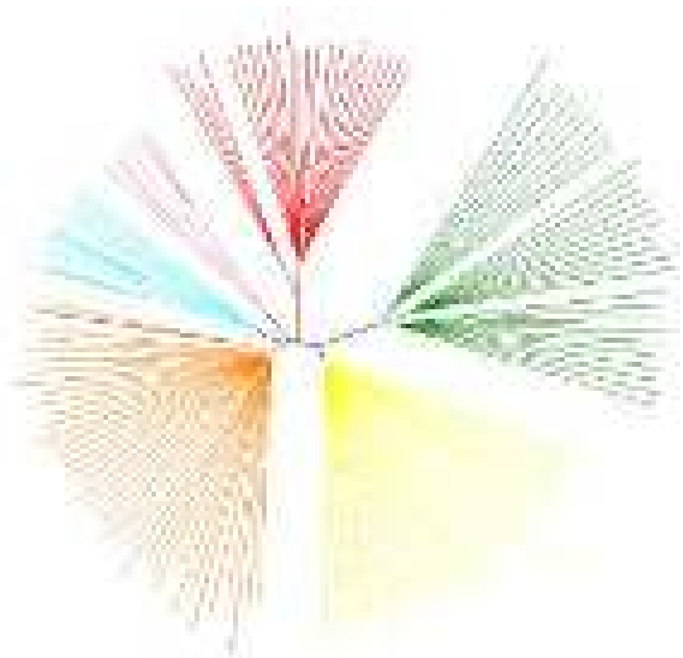
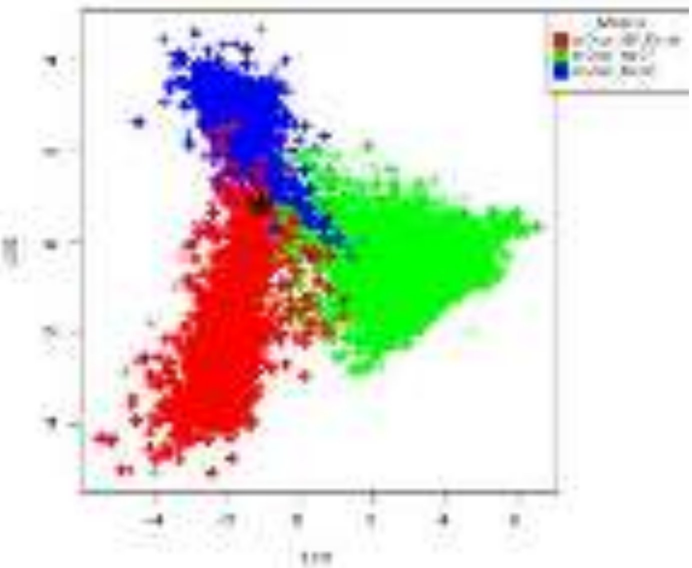


Figure S12. Neighbor-joining trees representing Nei's pairwise distance among the 160 *Dianthus carthusianorum* individuals using the 39,346 SNPs used for ABC analyses.

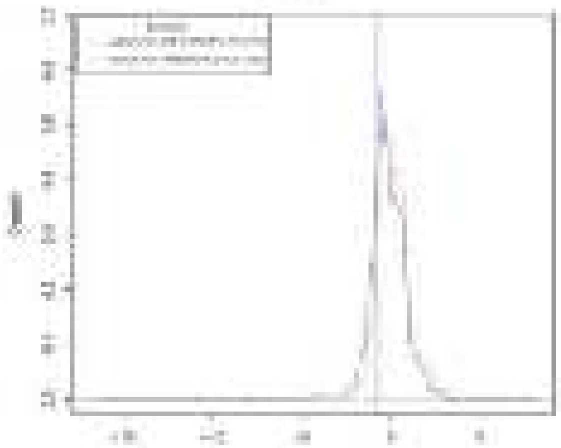


a) **<u>SET 1 - Round 1:</u>** Gene flow test

3 groups of eight scenarios:

- scDcar_GF_Dstat (red)
- scDcar_noGF (green)
- scDcar_fullGF (blue)

<u>BEST MODEL</u>: scDcar_GF_Dstat
<u>Posterior proba:</u> 0.98
<u>Prior error rate:</u> 0.05
<u>Number of votes</u> (79%) = 385

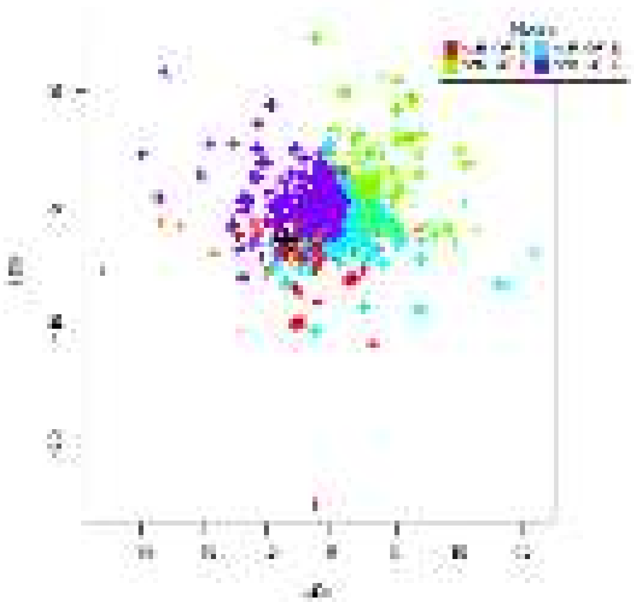


b) **<u>SET 1 - Round 2:</u>** Colonization history of the French populations

2 groups of four scenarios:

- scDcar_FR_EASTbeforeFR_PY_Dstat (blue)
- scDcar_FR_PYbeforeFR_EAST_Dstat (yellow)

<u>BEST MODEL</u>: scDcar_FR_EASTbeforeFR_PY_Dstat
<u>Posterior proba:</u> 0.99
<u>Prior error rate:</u> 0.29
<u>Number of votes</u> (79%) = 360



c) **<u>SET 1 - Round 3:</u>** Origin of the French populations

4 Scenarios:

- scB_GF_D (red)
- scC_GF_D (green)
- scE_GF_D (blue)
- scH_GF_D (purple)

<u>BEST MODEL</u>: scB_GF_D
<u>Posterior proba:</u> 0.91
<u>Prior error rate:</u> 1.90
Number of votes (39%) = 195

Figure S13. Linear Discriminant analysis (LDA 1 and 2) for the three rounds of ABC analysis to infer *Dianthus carthusianorum* divergence and demographic history. a. round 1 "Gene flow test"; b. round 2, "Colonization history of the French population"; c. round 3 "Origin of the French populations". A total of 24 scenarios were simulated. Each scenario was simulated 7,500 times; the black star represents the observed data, and each cross represents one simulation.

Table S7. Results of the ABC-RF algorithm comparing *Dianthus carthusianorum* demographic scenarios for round 1. The scenarios assumed gene flow among populations (fullGF), no gene flow (noGF), or gene flow between each population pair with significant D-statistics (GF_Dstat)**.** In this table, we report the repartition of votes among the three groups of scenarios for each replicate, the mean and standard deviations over replicates for each group of scenarios, posterior probability, and prior error rate for the best scenario, that is, the scenario with the highest number of votes. respectively. The most likely model is highlighted in bold (10 of 10 votes for scDcar_GF_Dstat).

Replicate	**scDcar_GF_Dstat**	scDcar_noGF	scDcar_fullGF	Posterior probability	Prior error rate
1	**399**	26	75	0.976	0.054
2	**407**	20	73	0.989	0.053
3	**393**	21	86	0.983	0.053
4	**389**	23	88	0.989	0.051
5	**393**	33	74	0.987	0.049
6	**376**	36	88	0.977	0.051
7	**398**	28	74	0.982	0.054
8	**404**	30	66	0.976	0.052
9	**408**	26	66	0.981	0.051
10	**388**	24	88	0.982	0.049
mean	**395.5**	26.7	77.8	0.982	0.052
sd	9.8	5.1	8.9	0.005	0.002

Table S8. Results of the ABC-RF algorithm comparing *Dianthus carthusianorum* demographic scenarios for Round 2. The scenarios assumed gene flow between each population pair with significant D-statistics, in which the Pyrenean colonized before the French Eastern population (*i.e.,* scDcar_FR_PYbeforeFR_EAST_GF_Dstat) and vice-versa (*i.e.,* scDcar_FR_EASTbeforeFR_PY_GF_Dstat). In this table, we report the repartition of votes among the three groups of scenarios for each replicate, and the mean and standard deviations over replicates for each group of scenarios; posterior probability and prior error rate for the best scenario, that is, the scenario with the highest number of votes. respectively. The most likely model is highlighted in bold (10/10 for scDcar_FR_EASTbeforeFR_PY_GF_Dstat).

Replicate	scDcar_FR_PYbeforeFR_EAST_GF_Dstat	**scDcar_FR_EASTbeforeFR_PY_GF_Dstat**	Posterior probability	Prior error rate
1	141	**359**	0.99	0.29
2	117	**383**	0.99	0.29
3	142	**358**	1.00	0.28
4	138	**362**	0.98	0.29
5	152	**348**	0.99	0.29
6	145	**355**	0.99	0.29
7	150	**350**	1.00	0.28
8	144	**356**	1.00	0.28
9	127	**373**	0.97	0.29
10	143	**357**	0.99	0.29
mean	139.9	**360.1**	0.99	0.29
Standard-deviation	10.6	10.5	0.01	0.01

Table S9. Results of the ABC-RF algorithm comparing *Dianthus carthusianorum* demographic scenarios for round 3. The scenarios assumed different modalities of colonization of the Pyrenean and French Eastern populations (round 3). In this table, we report the repartition of votes among the three groups of scenarios for each replicate, and the mean and standard deviations over replicates for each group of scenarios; posterior probability and prior error rate for the best scenario, that is, the scenario with the highest number of votes. respectively. The most likely model is highlighted in bold (9/10 for scB_GF_D, and 1/10 for scH_GF_D).

Replicate	**scB_GF_D**	scC_GF_D	scE_GF_D	scH_GF_D	Posterior probability	Prior error rate
1	**188**	63	68	181	0.87	1.9
2	**201**	71	67	161	0.94	1.9
3	170	81	78	**171**	0.89	1.9
4	**191**	72	71	166	0.93	1.9
5	**215**	72	55	158	0.90	1.9
6	**188**	72	54	186	0.93	1.9
7	**200**	86	73	141	0.91	1.9
8	**195**	72	64	169	0.90	1.9
9	**197**	73	57	173	0.91	1.9
10	**185**	80	64	171	0.90	1.9
mean	**193**	74,2	65,1	167,7	0.91	1.9
sd	**11.8**	6.5	7.9	12.5	0.02	0.0

Table S10. Parameter estimates for *Dianthus carthusianorum* demographic history, computed with the most likely demographic and divergence scenario (scB_GF_D).

Parameter	**Priors used**	**posterior_prob_mean**	**posterior_prob_mean in years**	**posterior_prob_me**
m12	Unif 0 - 0.1	0,069	x	0.0791127
m13	Unif 0 - 0.1	0,042	x	0.0332042
m21	Unif 0 - 0.1	0,029	x	0.0357462
m23	Unif 0 - 0.1	0,037	x	0.0217249
m31	Unif 0 - 0.1	0,029	x	0.014636341619475
m32	Unif 0 - 0.1	0,046	x	0.0409366
Nanc	Unif 50 - 100,000	13010,175	x	2675
Ncz	Unif 50 - 100,000	5999,863	x	1124
Nfr	Unif 50 - 100,000	20713,614	x	23905
Npy	Unif 50 - 100,000	24287,239	x	1021
Nro	Unif 50 - 100,000	4024,170	x	495
Tpy_east	Log unif 10 -500,000	250,620	[902 ; 1,804]	54
Teast_cz	Tpy_east + Teast_czplusdiv	2912,459	[10,485 ; 20,970]	402
Tcz_ro	Teast_cz + Tcz_roplusdiv	10902,240	[39,248 ; 78,496]	1793
Tro_anc	Tcz_ro + Tro_ancplusdiv	138335,390	[498,007 ; 996,015]	34266

Priors: Prior set used for each parameter with its distribution (with $T_{X\text{-}Y}$= Logunif 50 -500 000). We computed the median and mean posterior probability, posterior variance probability, 90% confidence interval (q5% and q95%), and NMAE which significates the facility of estimating the associate parameter. Divergence time estimates were multiplied by the lower (3.6) and upper (7.2) bounds of the generation time estimates to transform them in years.

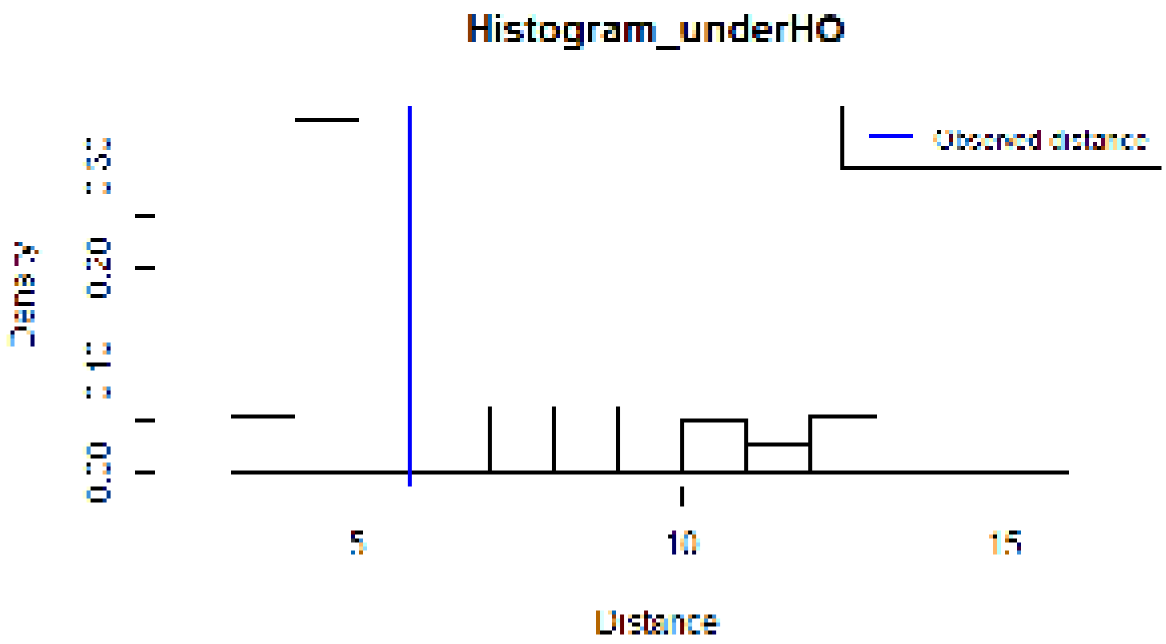


Figure S14. Histogram of the 1000 simulations of the most likely scenario of intra-specific divergence and demographic history for *Dianthus carthusianorum* inferred with ABC (*i.e.*, scB_GF_D, Figure 3). The pseudo-observed dataset was obtained using prior distributions drawn from the 90% confidence interval of the parameters previously estimated for scB_GF_D (Table S11). This histogram is plotted under H0 (*i.e.*, the simulated dataset fits the observed dataset), and results were obtained using the goodness-of-fit test from the abc R package (*P*=0.429).

References

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