

Round-trip across the Sahara: Afrotropical Painted Lady butterflies recolonize the Mediterranean in early spring

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Table S1. Sampled *Vanessa cardui* specimens. Locality, date and $\delta^2\text{H}$ isotope values are shown. Individual assignments to each of the 6 natal groups based on a k-means clustering analysis are indicated. For those sites where migratory movements were observed, wind direction (a.g.l), migration direction and approximate migrant frequency of pass are also specified.

ID	Date collected	Locality data	Region	lat	long	Elevation (m asl)	$\delta^2\text{H}$	$\delta^2\text{H}_{\text{err}}$	Cluster	Wind direction (a.g.l)	Migration direction	Pass Frequency
RVcoll17A040	2017-02-24	Douar Sidi	Morocco	29.899687	-9.593989	50	-51	3.85	2	-	-	-
RVcoll17A080	2017-02-27	Sidi Abdel Jabbar	Morocco	29.740444	-8.868056	1305	-58	3.7	3	N	N	-
RVcoll17A094	2017-02-27	Tazrout	Morocco	30.127815	-8.886369	1122	-59	3.67	3	N	N	5 per minute
RVcoll17A097	2017-02-27	Tazrout	Morocco	30.127815	-8.886369	1122	-62	3.59	3	N	N	
RVcoll17A105	2017-02-27	Tazrout	Morocco	30.127815	-8.886369	1122	-74	3.34	4	N	N	
RVcoll17A107	2017-02-27	Tazrout	Morocco	30.127815	-8.886369	1122	-72	3.39	4	N	N	
RVcoll17A113	2017-02-27	Tazrout	Morocco	30.127815	-8.886369	1122	-70	3.42	4	N	N	
RVcoll17A114	2017-02-27	Tazrout	Morocco	30.127815	-8.886369	1122	-67	3.49	4	N	N	
RVcoll17A116	2017-02-27	Ait Ben Haoua	Morocco	30.149712	-8.915482	1010	-84	3.17	5	-	Hilltopping	-
RVcoll17A117	2017-02-27	Ait Ben Haoua	Morocco	30.149712	-8.915482	1010	-69	3.45	4	-	Hilltopping	-
RVcoll17A139	2017-02-28	Taroudant	Morocco	30.489348	-8.849704	261	-66	3.5	4	-	Feeding	-
RVcoll17A146	2017-02-28	Taroudant	Morocco	30.489348	-8.849704	261	-81	3.22	5	-	Feeding	-
RVcoll17A148	2017-02-28	Taroudant	Morocco	30.489348	-8.849704	261	-84	3.18	5	-	Feeding	-
RVcoll17A157	2017-02-28	Taroudant	Morocco	30.489348	-8.849704	261	-61	3.61	3	-	Feeding	-
RVcoll17A158	2017-02-28	Taroudant	Morocco	30.489348	-8.849704	261	-66	3.51	4	-	Feeding	-
RVcoll17A159	2017-02-28	Taroudant	Morocco	30.489348	-8.849704	261	-56	3.74	3	-	Feeding	-
RVcoll17A162	2017-02-28	Oulad Terma	Morocco	30.437764	-8.863105	232	-36	4.25	2	-	Feeding	-
RVcoll17A167	2017-02-28	Oulad Terma	Morocco	30.437764	-8.863105	232	-52	3.83	2	-	Feeding	-
RVcoll17A172	2017-02-28	Oulad Terma	Morocco	30.437764	-8.863105	232	-80	3.23	5	-	Feeding	-
RVcoll17A173	2017-02-28	Oulad Terma	Morocco	30.437764	-8.863105	232	-62	3.59	3	-	Feeding	-

RVcoll17A174	2017-02-28	Oulad Terma	Morocco	30.437764	-8.863105	232	-67	3.49	4	-	Feeding	-
RVcoll17A175	2017-02-28	Oulad Terma	Morocco	30.437764	-8.863105	232	-61	3.62	3	-	Feeding	-
RVcoll17A179	2017-02-28	Oulad Terma	Morocco	30.437764	-8.863105	232	-61	3.61	3	-	Feeding	-
RVcoll17A184	2017-02-28	El Koudia	Morocco	30.372084	-9.140299	169	-47	3.97	2	N	N	40 per minute
RVcoll17A187	2017-02-28	El Koudia	Morocco	30.372084	-9.140299	169	-46	3.98	2	N	N	
RVcoll17A209	2017-02-24	Douar Sidi	Morocco	29.899687	-9.593989	50	-58	3.69	3	-	-	-
RVcoll17A503	2017-03-23	Archea Poli Festos	Crete	35.051636	24.811049	96	-95	3.03	6	-	Hilltopping	-
RVcoll17A504	2017-03-23	Archea Poli Festos	Crete	35.051636	24.811049	96	-79	3.26	5	-	Hilltopping	-
RVcoll17A507	2017-03-23	Archea Poli Festos	Crete	35.051636	24.811049	96	-62	3.59	3	-	Hilltopping	-
RVcoll17A508	2017-03-23	Archea Poli Festos	Crete	35.051636	24.811049	96	-98	3	6	-	Hilltopping	-
RVcoll17A511	2017-03-21	Ampelouzos	Crete	35.061448	24.935674		-86	3.14	5	W	W	
RVcoll17A518	2017-03-23	Ampelouzos	Crete	35.061448	24.935674		-102	2.96	6	W	W	< 1 per minute
RVcoll17A521	2017-03-23	Ampelouzos	Crete	35.061448	24.935674		-98	3	6	W	W	
RVcoll17A528	2017-03-23	Choustoulia	Crete	35.043699	24.941551	126	-86	3.14	5	-	-	-
RVcoll17A534	2017-03-23	Pombia	Crete	35.043699	24.941551	129	-56	3.74	3	-	-	-
RVcoll17A535	2021-03-24	Archea Poli Festos	Crete	35.050938	24.796815	129	-88	3.12	5	-	Hilltopping	-
RVcoll17A538	2017-03-23	Archea Poli Festos	Crete	35.050938	24.796815	129	-75	3.33	4	-	Hilltopping	-
RVcoll17A539	2017-03-23	Archea Poli Festos	Crete	35.050938	24.796815	129	-83	3.18	5	-	Hilltopping	-
RVcoll17A541	2017-03-23	Archea Poli Festos	Crete	35.050938	24.796815	129	-99	2.99	6	-	Hilltopping	-
RVcoll17A543	2017-03-23	Archea Poli Festos	Crete	35.050938	24.796815	129	-69	3.46	4	-	Hilltopping	-
RVcoll17A545	2017-03-23	Archea Poli Festos	Crete	35.050938	24.796815	129	-72	3.4	4	-	Hilltopping	-
RVcoll16E185	2016-3-26	Marsa Alam, Red Sea	Egypt	25.345409	34.735321		-71	3.4	4	NW	N	< 1 per minute
RVcoll16E186	2016-4-2	Marsa Alam, Red Sea	Egypt	25.344028	34.7355	-28	110	4.52	1	NW	N	
RVcoll16E187	2016-4-2	Rosh Pina, Galilee	Israel	32.968889	35.540861	407	-56	3.99	3	-	-	-
RVcoll16E200	2016-4-6	Kiriat Gat	Israel	31.619192	34.767192	110	-57	3.97	3	-	-	-
RVcoll16E201	2016-2-19	Hirbet Za'ak N. Negev	Israel	31.414722	34.866861	394	-8	5.3	1	-	-	-
RVcoll16E202	2016-2-19	Hirbet Za'ak N. Negev	Israel	31.414722	34.866861	394	-19	4.97	1	-	-	-
RVcoll16E203	2016-2-19	Hirbet Za'ak N. Negev	Israel	31.414722	34.866861	394	-67	3.75	4	-	-	-
RVcoll16E204	2016-2-19	Hirbet Za'ak N. Negev	Israel	31.414722	34.866861	394	-4	5.41	1	-	-	-
RVcoll16E205	2016-2-19	Hirbet Za'ak N. Negev	Israel	31.414722	34.866861	394	-65	3.8	4	-	-	-
RVcoll16E206	2016-2-19	Hirbet Za'ak N. Negev	Israel	31.414722	34.866861	394	-72	3.66	4	-	-	-
RVcoll14L416	2014-03-15	Uvda, S. Negev	Israel	29.93866	34.957784	434	-53	4.07	3	-	-	-
RVcoll14L417	2014-03-22	Avivim	Israel	33.082683	35.458307	637	-37	4.46	2	-	-	-
RVcoll14L420	2014-03-19	Kiriat Gat	Israel	31.680879	34.845764	-48		3.92	2	-	-	-
RVcoll14L429	2014-03-19	Ein Yahav, Araba Rift Valley	Israel	30.704816	35.220757	-97	-45	4.25	2	-	-	-
RVcoll16D616	2014-03-18	Nahal Hiyon, Uvda valley, S. Negev	Israel	29.93866	34.957784	-52	405	4.09	2	-	-	-

RVcoll16D617	2015-02-25	Nahal Hiyon, Uvda valley, S. Negev	Israel	29.93866	34.957784	-72	405	3.66	4	-	-	-
RVcoll16D628	2016-02-12	Nahal Shita S. Arava	Israel	30.143903	35.125221	240	-63	3.85	3	-	-	-
RVcoll16D629	2016-02-12	Nahal Shita S. Arava	Israel	30.143903	35.125221	240	-63	3.83	3	-	-	-
RVcoll16D633	2016-02-16	Hirbat Za'ak N. Negev	Israel	31.414722	34.866861	400	-69	3.72	4	-	-	-
RVcoll16D634	2016-02-16	Hirbat Za'ak N. Negev	Israel	31.414722	34.866861	400	-84	3.47	5	-	-	-
RVcoll16D635	2016-02-16	Hirbat Za'ak N. Negev	Israel	31.414722	34.866861	400	-79	3.54	5	-	-	-
RVcoll16D643	2016-02-12	Nahal Shita S. Arava	Israel	30.143903	35.125221	240	-69	3.72	4	-	-	-
RVcoll16D644	2016-02-16	Hirbat Za'ak N. Negev	Israel	31.414722	34.866861	400	-70	3.69	4	-	-	-
RVcoll16D645	2016-02-16	Hirbat Za'ak N. Negev	Israel	31.414722	34.866861	400	-40	4.4	2	-	-	-
RVcoll16D646	2016-02-16	Hirbat Za'ak N. Negev	Israel	31.414722	34.866861	400	-61	3.88	3	-	-	-
RVcoll16D647	2016-02-16	Hirbat Za'ak N. Negev	Israel	31.414722	34.866861	400	-82	3.49	5	-	-	-
RVcoll14M260	2012-04-27	Delta del Llobregat	Catalonia	41.274706	2.063474	0	-66	3.78	4	NW	NW	-
RVcoll14M261	2012-04-27	Delta del Llobregat	Catalonia	41.274706	2.063474	0	-68	3.75	4	NW	NW	-
RVcoll14M265	2012-04-27	Delta del Llobregat	Catalonia	41.274706	2.063474	0	-62	3.86	3	NW	NW	-
RVcoll14M266	2012-04-27	Delta del Llobregat	Catalonia	41.274706	2.063474	0	-78	3.56	5	NW	NW	-
RVcoll14M270	2012-04-28	Delta del Llobregat	Catalonia	41.274706	2.063474	0	-58	3.94	3	NW	NW	-
RVcoll14M274	2012-04-28	Delta del Llobregat	Catalonia	41.274706	2.063474	0	-65	3.54	4	NW	NW	-
RVcoll14M275	2012-04-28	Delta del Llobregat	Catalonia	41.274706	2.063474	0	-72	3.66	4	NW	NW	-
RVcoll14M276	2012-04-28	Delta del Llobregat	Catalonia	41.274706	2.063474	0	-71	3.67	4	NW	NW	-
RVcoll14M281	2012-04-28	Delta del Llobregat	Catalonia	41.274706	2.063474	0	-61	3.88	3	NW	NW	-
RVcoll14M282	2012-04-28	Delta del Llobregat	Catalonia	41.274706	2.063474	0	-63	3.84	3	NW	NW	-
RVcoll16C400	2016-02-23	Maro, Málaga	Andalusia	36.753828	-3.844969	-80	3.53	5	-	-	-	-
RVcoll16C403	2016-02-24	Bédar, Almería	Andalusia	37.186352	-1.980592	-71	3.67	4	-	-	-	-
RVcoll16C404	2016-02-23	Frigiliana, Málaga	Andalusia	36.784991	-3.899151	-60	3.65	3	-	-	-	-
RVcoll16C407	2016-02-23	Maro, Málaga	Andalusia	36.753828	-3.844969	-72	3.38	4	-	-	-	-
RVcoll16C409	2016-02-25	Mojácar, Almería	Andalusia	37.102125	-1.848237	-50	3.9	2	-	-	-	-
RVcoll16C412	2016-02-24	Bédar, Almería	Andalusia	37.186352	-1.980592	-40	4.17	2	-	-	-	-
RVcoll16C413	2016-02-16	Mojácar, Almería	Andalusia	37.102125	-1.848237	-36	4.28	2	-	-	-	-
RVcoll16C416	2016-02-25	Mojácar, Almería	Andalusia	37.102125	-1.848237	-60	3.65	3	-	-	-	-
RVcoll16C423	2016-02-25	Mojácar, Almería	Andalusia	37.102125	-1.848237	-77	3.29	5	-	-	-	-
RVcoll16C425	2016-02-16	Mojácar, Almería	Andalusia	37.102125	-1.848237	-47	3.98	2	-	-	-	-

10 per minute

Sudden increase on 2016-02-21 (occurrences by hundreds at some localities)