Sex-Biased Dispersal Obscures Species Boundaries in Integrative Species Delimitation Approaches

Supplementary files

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1 Supplementary Figures

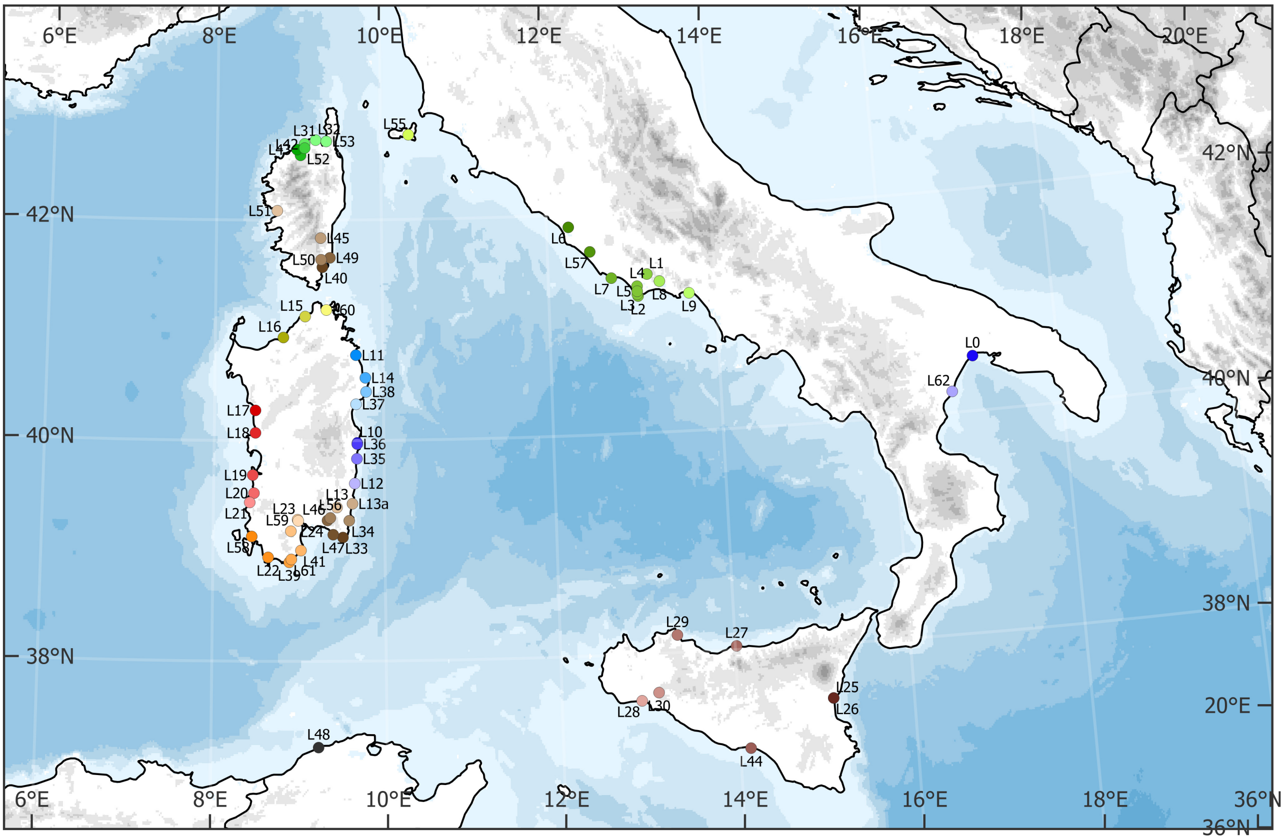

Figure A1: Map of the central Mediterranean Sea depicting sampling localities of all studied *Pachypus* specimens. Abbreviations refer to Supplementary Table A2.

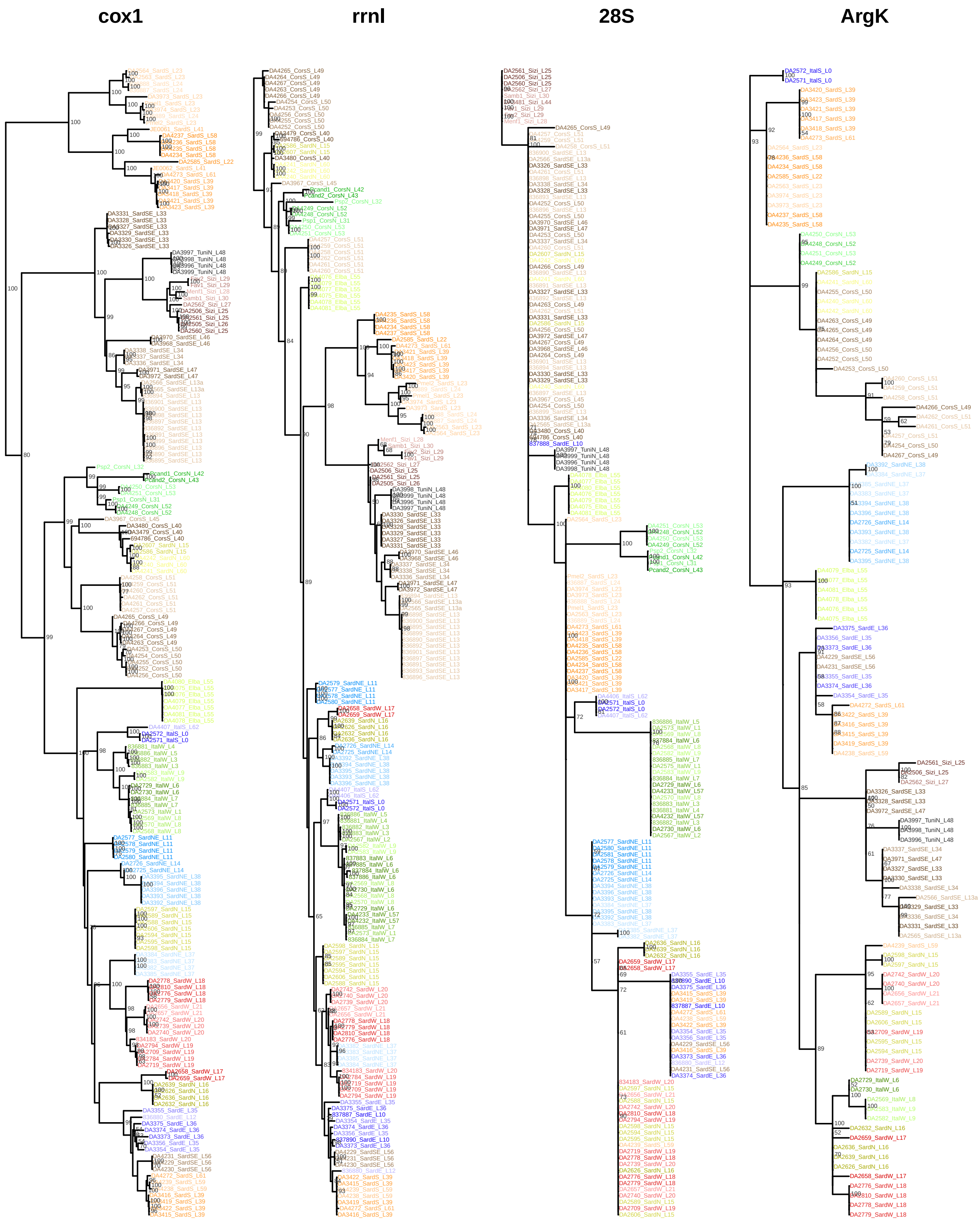

Figure A2: Maximum likelihood trees from the RAxML analyses using single markers. The trees were rooted using outgroup specimens, which are not shown here. RELL-bootstrap support values >50 are indicated at the nodes. Sampling localities are color-coded on the maps (Figs. 6, A1) and indicated at the tip-labels.

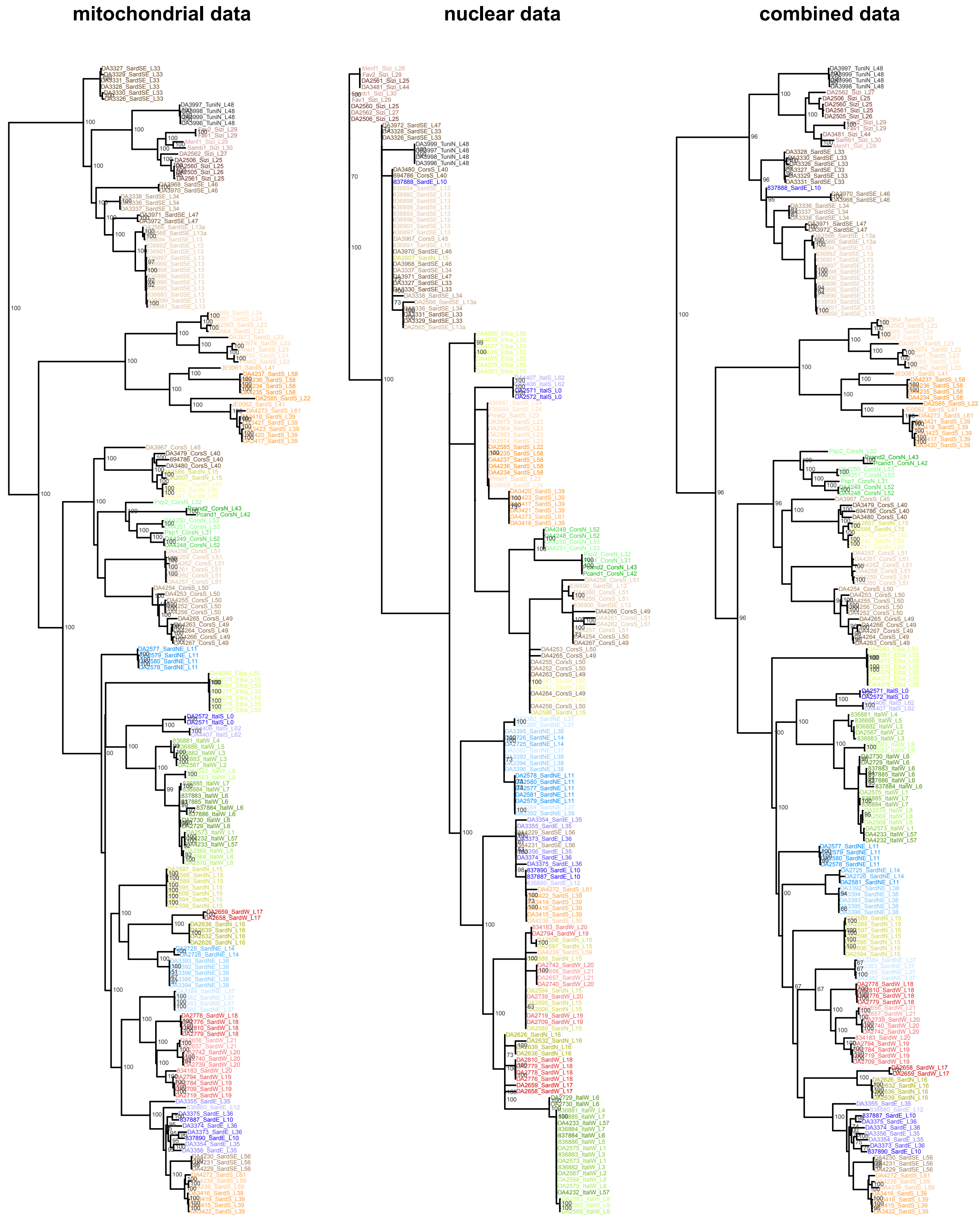

Figure A3: Maximum likelihood trees from the RAxML analyses using combined partitioned mitochondrial *(cox1, rrnl)*, combined partitioned nuclear (28S, ArgK), and all combined partitioned loci. The trees were rooted with outgroup specimens, which are not shown here. RELL-bootstrap support values >50 are indicated at the nodes. Sampling localities are color-coded on the maps (Figs. 6, A1) and indicated at the tip-labels

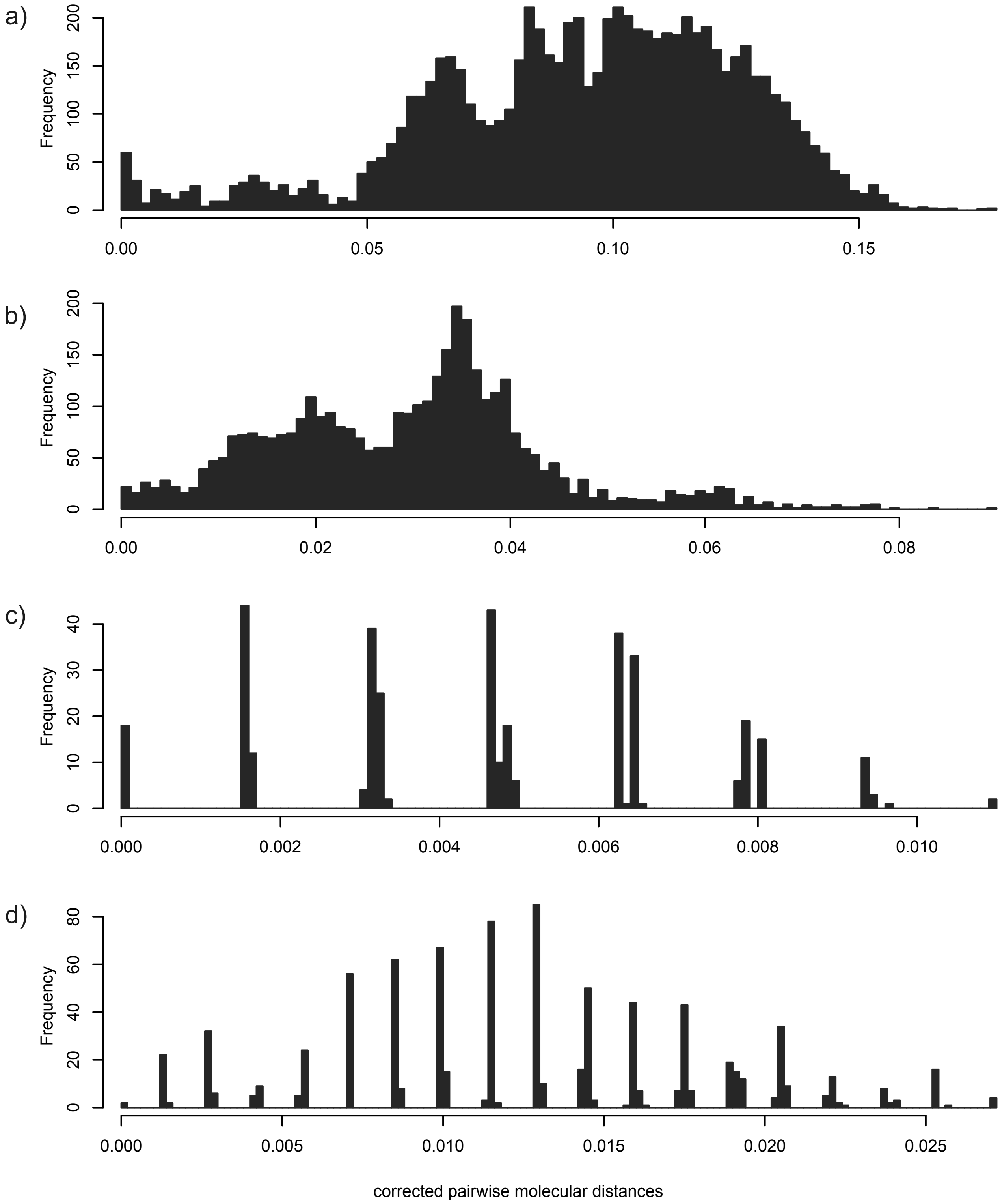

Figure A4: Histograms of corrected pairwise distances that were used as input for the ABGD analysis of individual markers: (a) *cox1*, (b) *rrnL*, (c) 28S, and (d) ArgK. The distances were corrected using the best fitting substitution model inferred with IQ-TREE (Supplement Table A3).

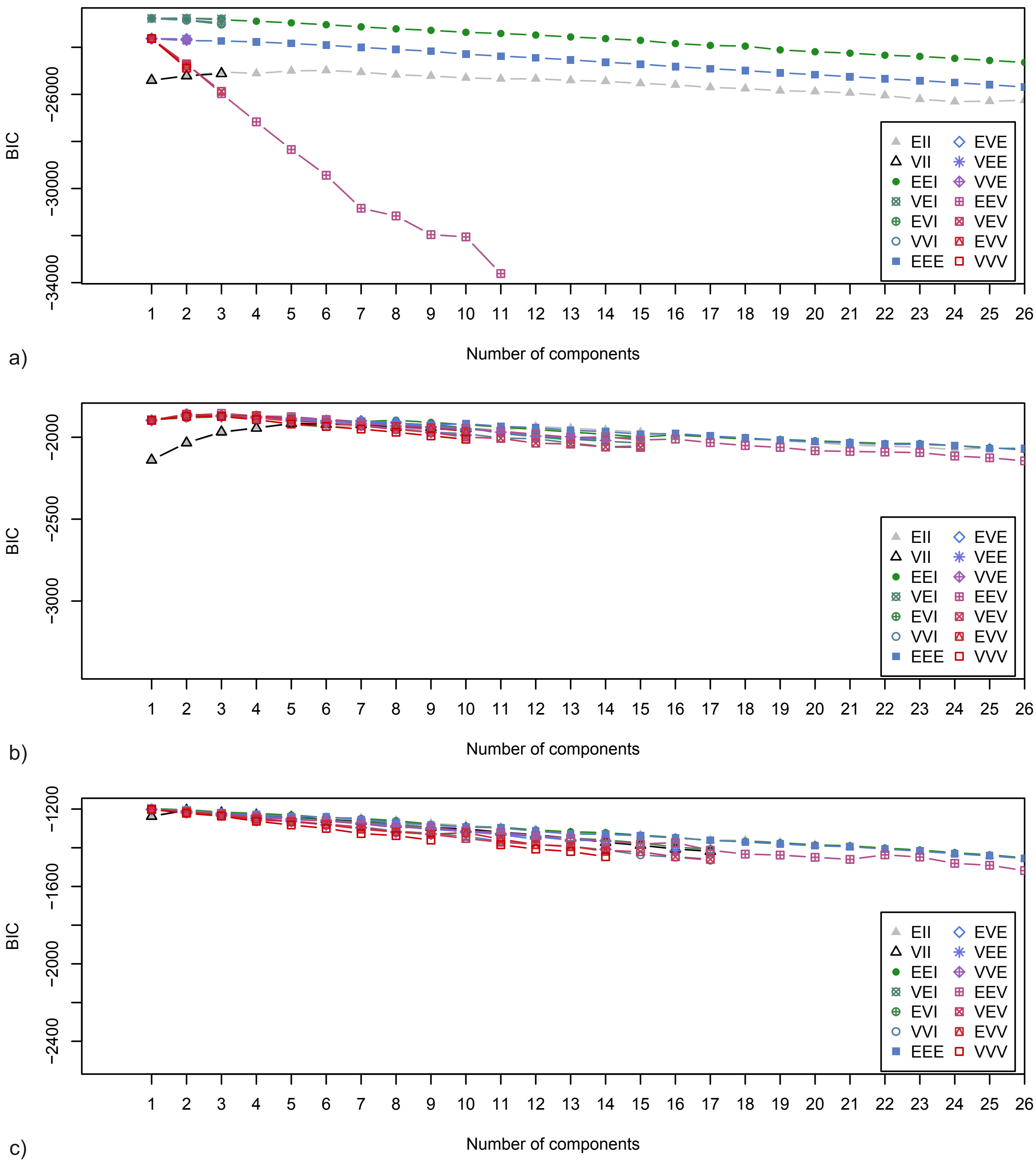

Figure A5: BIC scores of multivariate mixture models evaluated by Gaussian clustering with Mclust for (a) all trait data, (b) all data with prior variable selection, and (c) linear measurements. EII = spherical, equal volume; VII = spherical, unequal volume; EEI = diagonal, equal volume and shape; VEI = diagonal, varying volume, equal shape; EVI = diagonal, equal volume, varying shape; VVI = diagonal, varying volume and shape; EEE = ellipsoidal, equal volume, shape, and orientation; EVE = ellipsoidal, equal volume and orientation; VEE = ellipsoidal, equal shape and orientation; VVE = ellipsoidal, equal orientation; EEV = ellipsoidal, equal volume and equal shape; VEV = ellipsoidal, equal shape; EVV = ellipsoidal, equal volume; VVV = ellipsoidal, varying volume, shape and orientation.

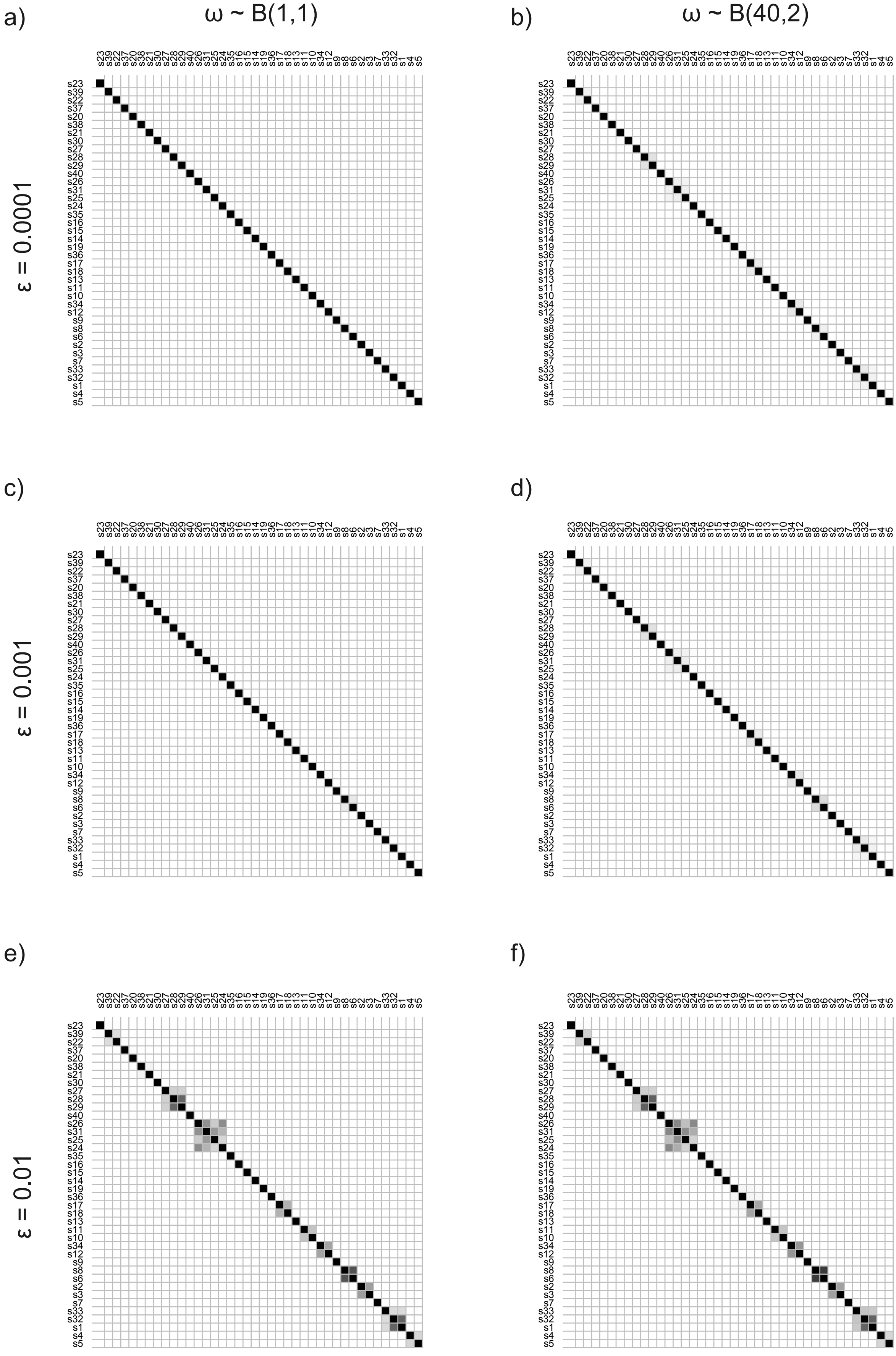

Figure A6: Similarity matrices illustrating the results from the STACEY analyses of MINCs (GMYC clusters) under different collapse weights (a, c, e vs. b, d, f) and increasing collapse heights (a, b vs. c, d vs. e, f). Darker shaded pairs indicate individuals are more similar to each other.

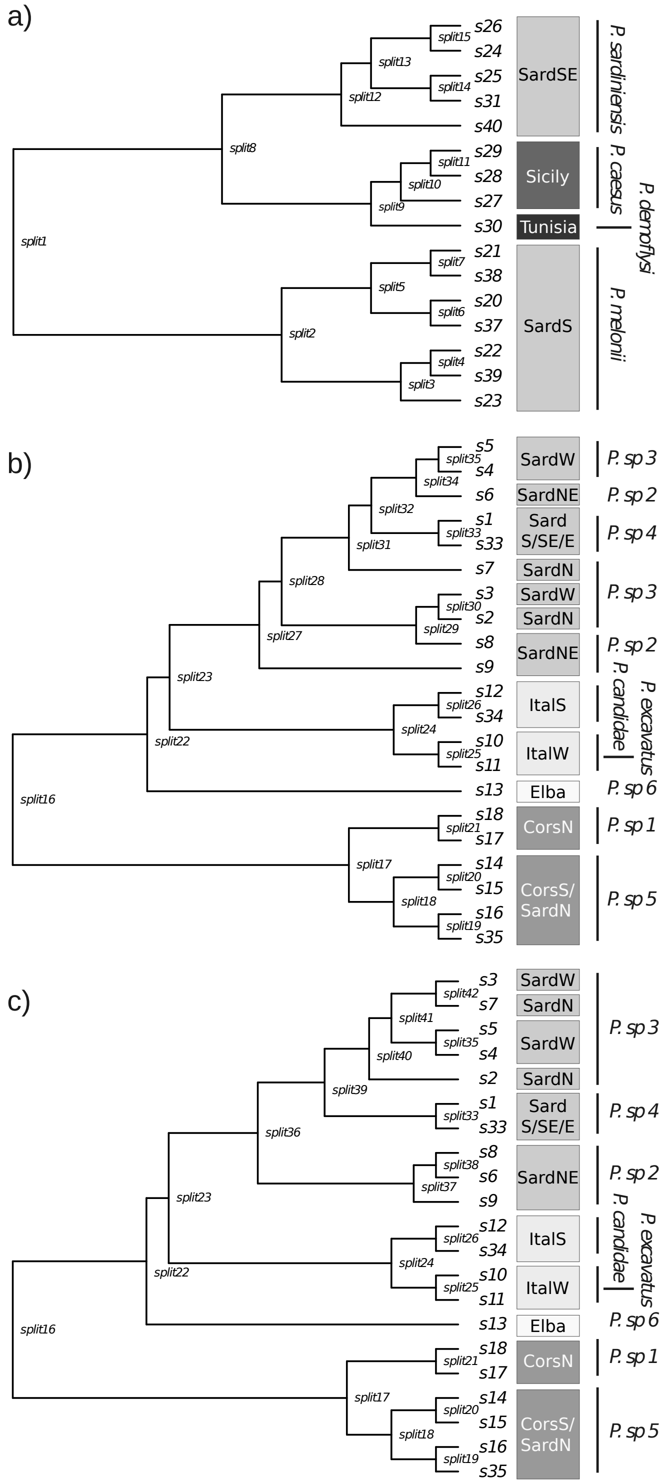

Figure A7: Guide trees used for the iBPP analyses. (a) Guide tree part 1 (Fig. 2, nodes A1+A2). (b) Unmodified guide tree part 2 (Fig. 2, node B). (c) Geography-informed guide tree part 2. Grey boxes indicate geographical origin of MINCs: Cors = Corsica, Ital = Apennine Peninsula, Sard = Sardinia, N/S/E/W/SE/NE = cardinal directions.

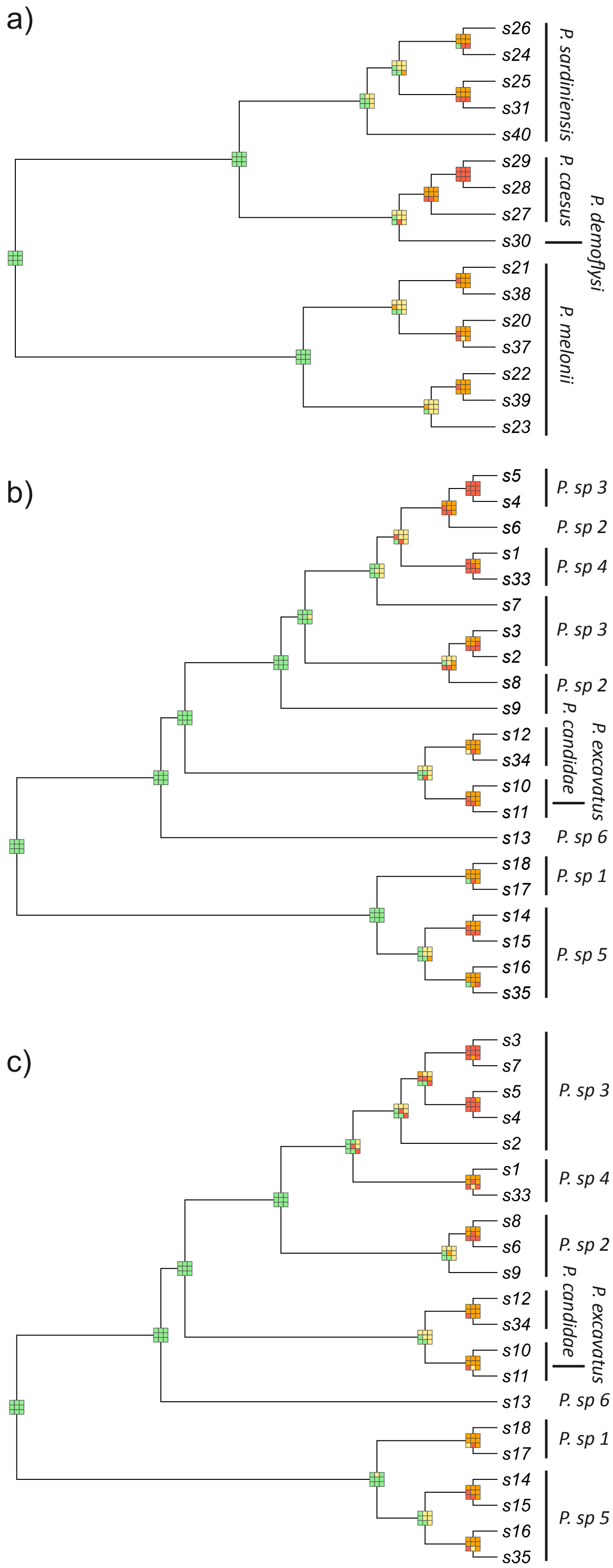

Figure A8: Results of the iBPP analyses without data, i.e., prior sampling for each guide tree. (a) Guide tree part 1, (b) unmodified guide tree part 2, and (c) geography-informed guide tree part 2.

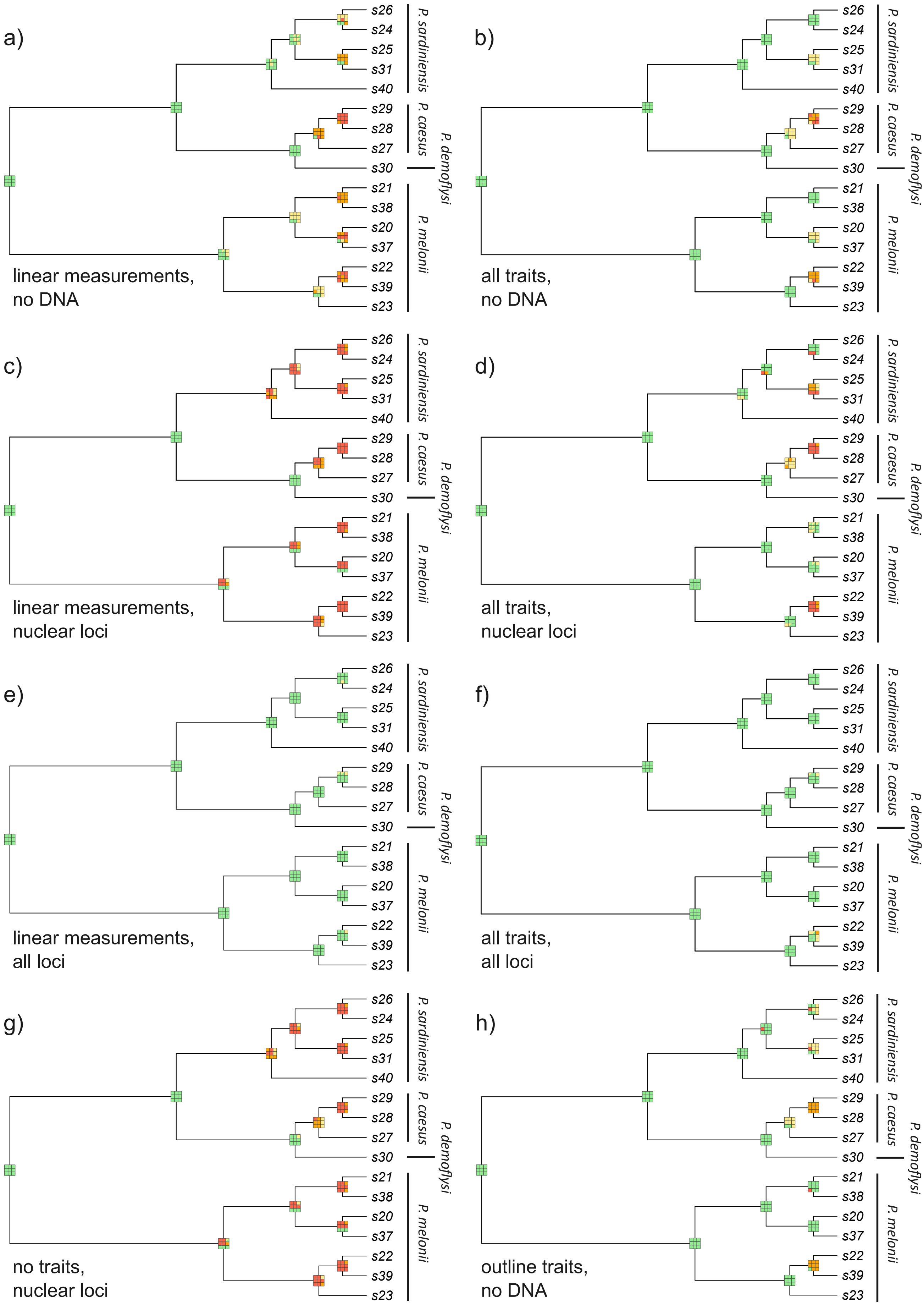

Figure A9: Comprehensive results of the integrative Bayesian species delimitation with iBPP using eight datasets for guide tree part 1. Posterior probabilities for 3×3 combinations of the τ_0 and θ prior distributions are illustrated at each node (see graphical legend in Fig. 4). Minimum clusters from the GMYC analyses (Fig. 2) are indicated at the tips of each tree along with the final species designations.

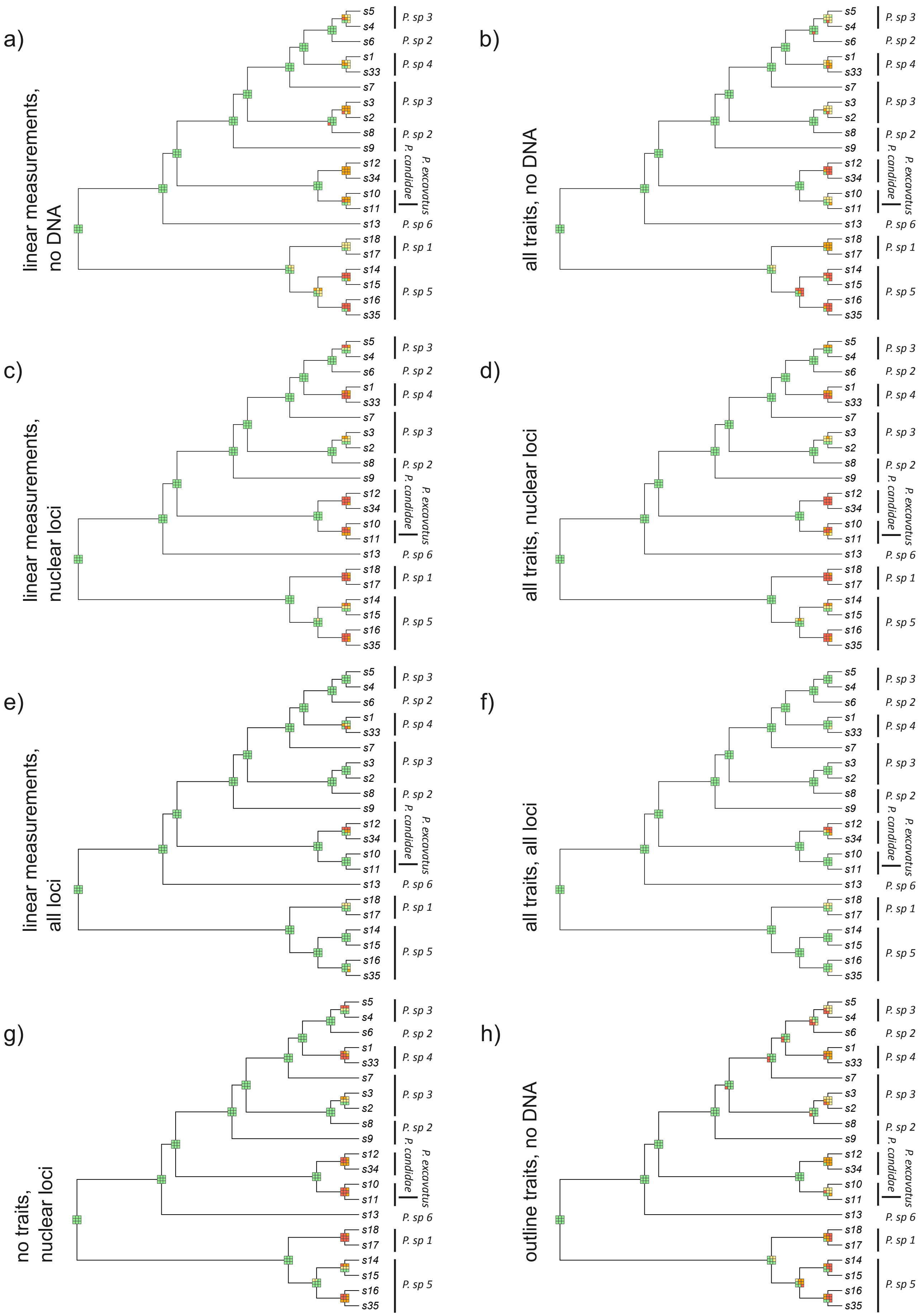

Figure A10: Comprehensive results of the integrative Bayesian species delimitation with iBPP using eight datasets for the unmodified guide tree part 2. Posterior probabilities for 3 × 3 combinations of the τ_0 and θ prior distributions are illustrated at each node (see graphical legend in Fig. 4). Minimum clusters from the GMYC analyses (Fig. 2) are indicated at the tips of each tree along with the final species designations.

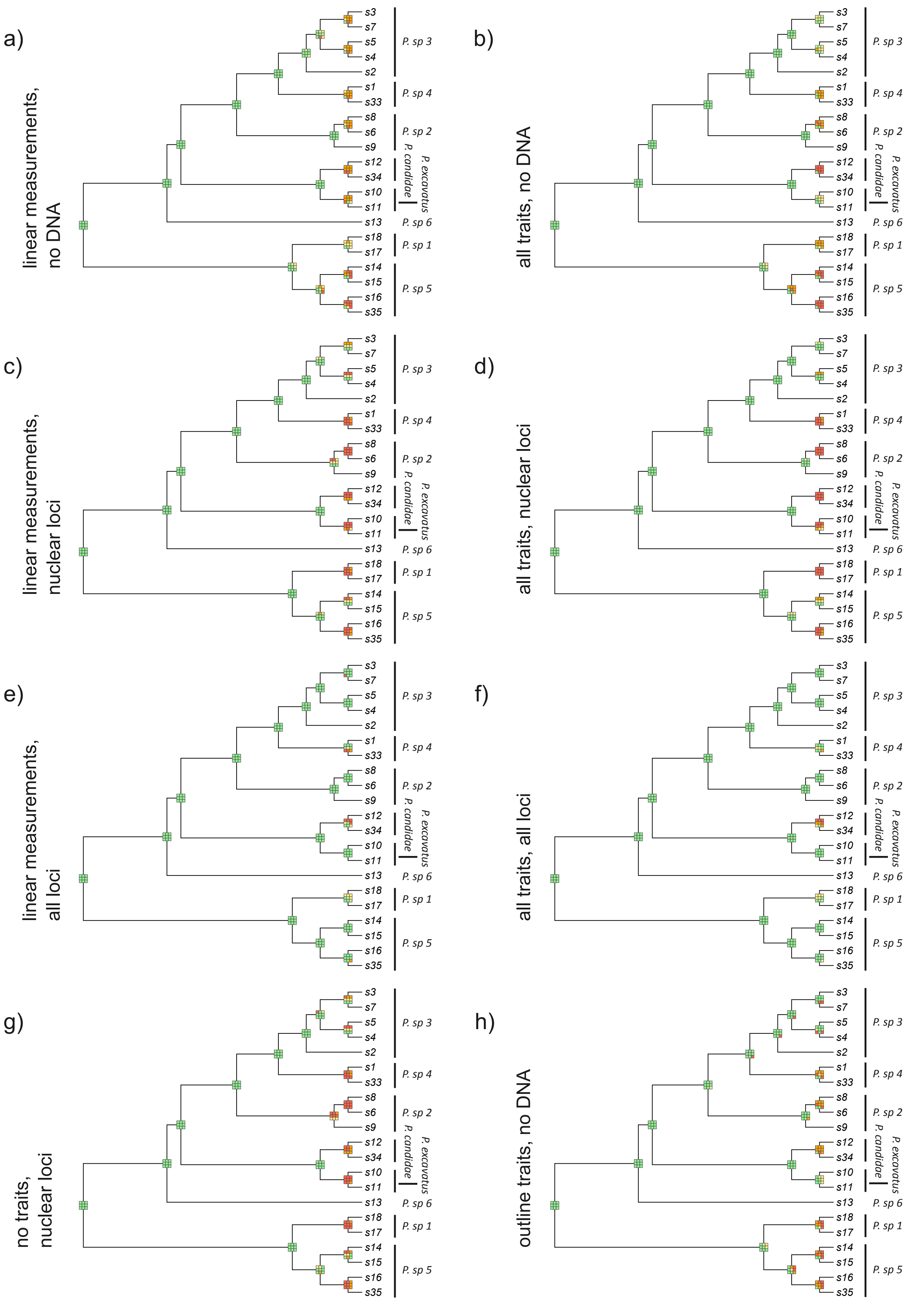

Figure A11: Comprehensive results of the integrative Bayesian species delimitation with iBPP using eight datasets for the geography-informed guide tree part 2. Posterior probabilities for 3×3 combinations of the τ_0 and θ prior distributions are illustrated at each node (see graphical legend in Fig. 4). Minimum clusters from the GMYC analyses (Fig. 2) are indicated at the tips of each tree along with the final species designations.

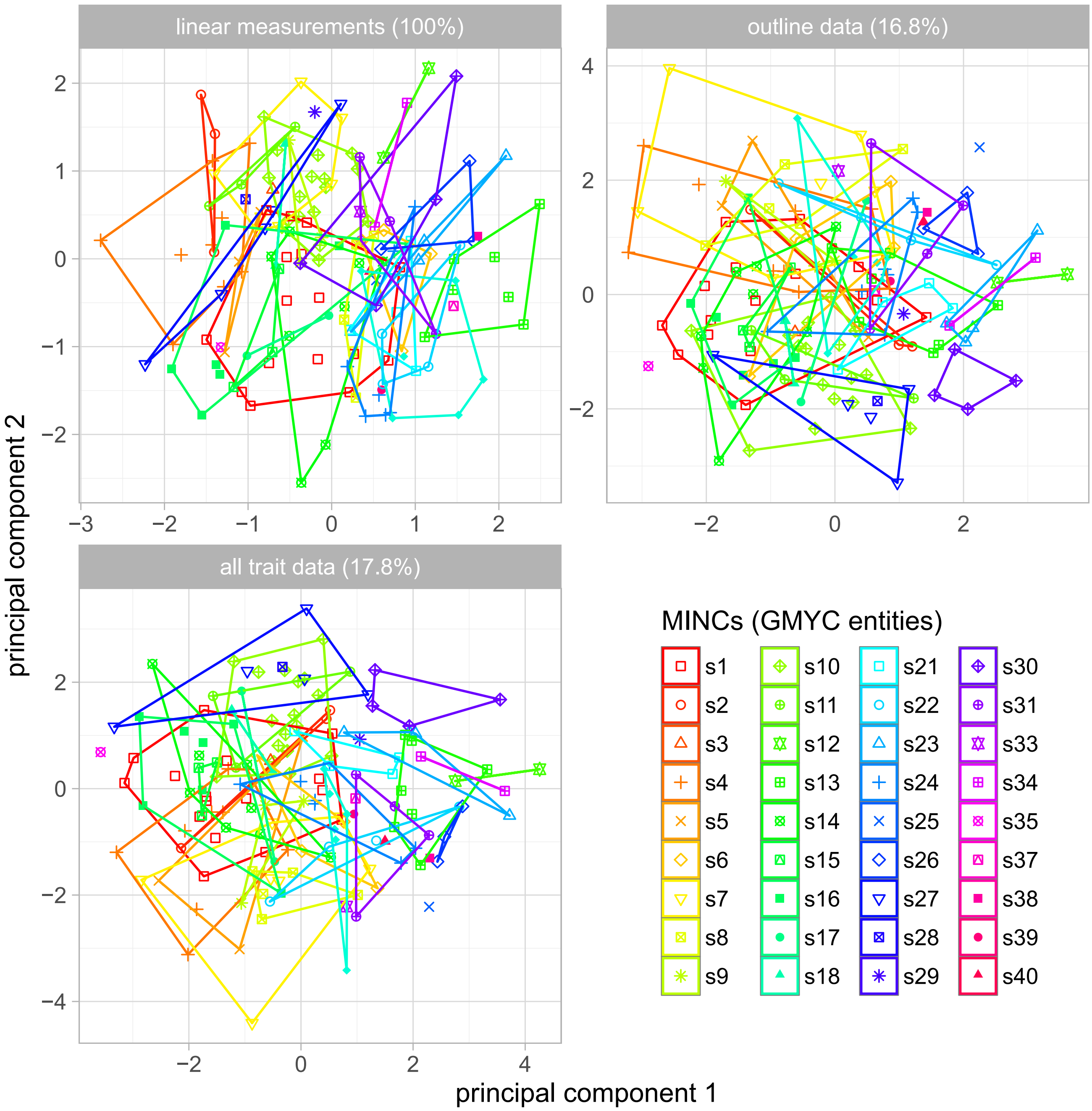

Figure A12: Minimum clusters (MINCs) from the GMYC analysis of the combined molecular data (Fig. 2) used for species delimitation by validation mapped onto the three morphological datasets. Percentages of variation summarized by principal components 1 and 2 are given in the subfigure headings.

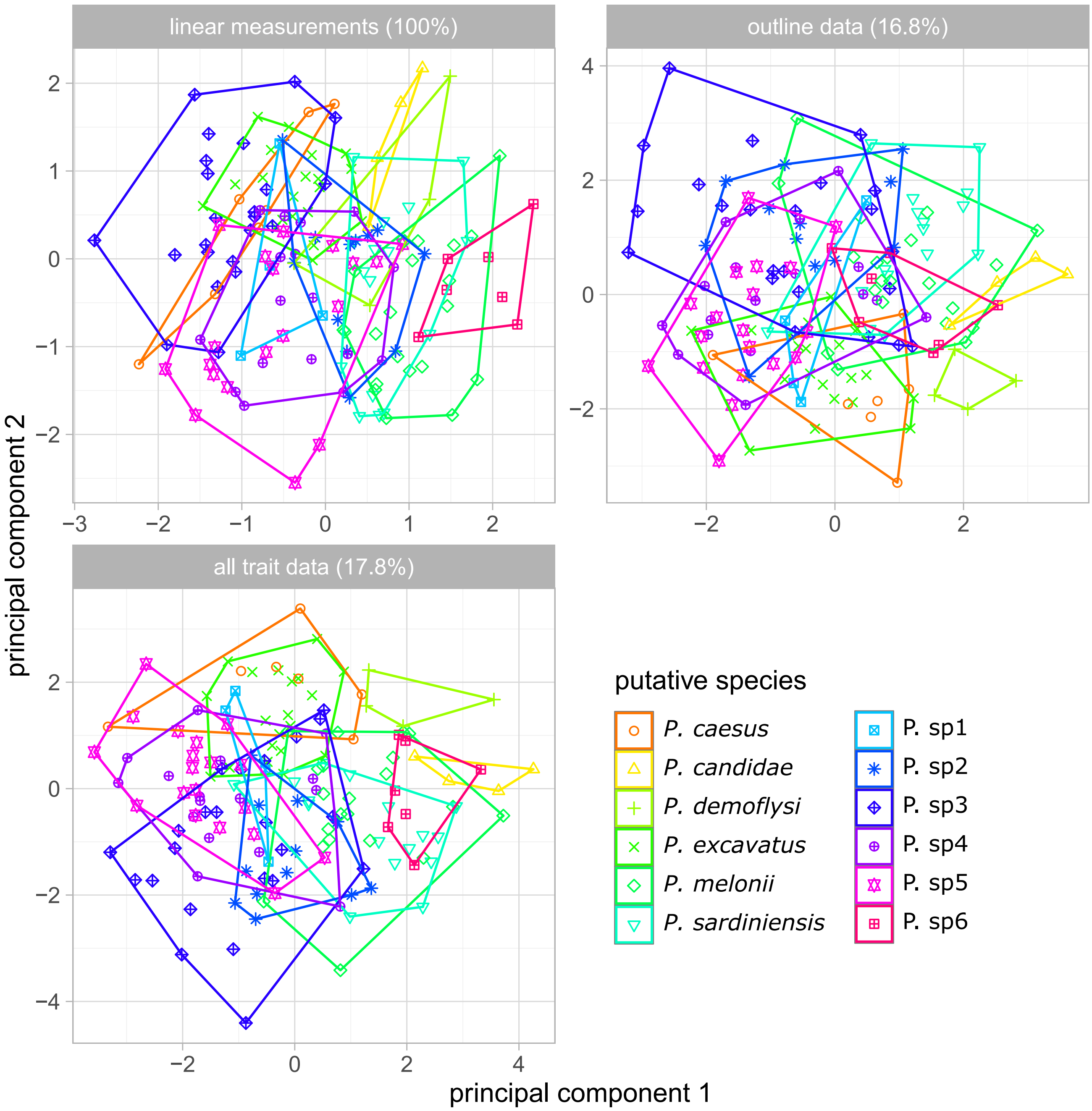

Figure A13: Putative species that were inferred with iBPP mapped onto the three morphological data sets. Percentages of variation summarized by principal components 1 and 2 are given in the subfigure headings.

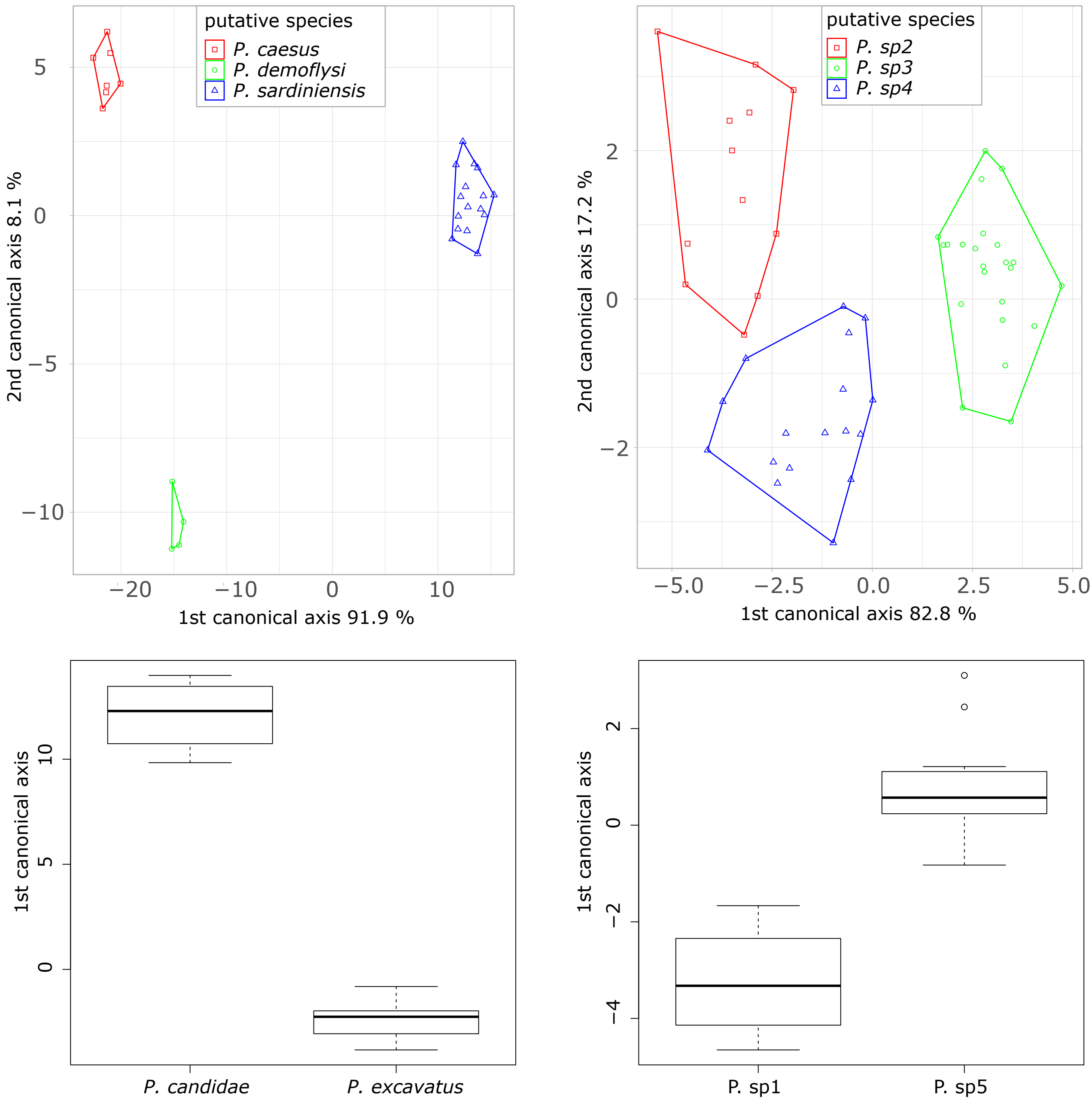

Figure A14: Canonical variate analysis (CVA) of four closely related clades of species that were inferred with iBPP based on all available morphometric data.

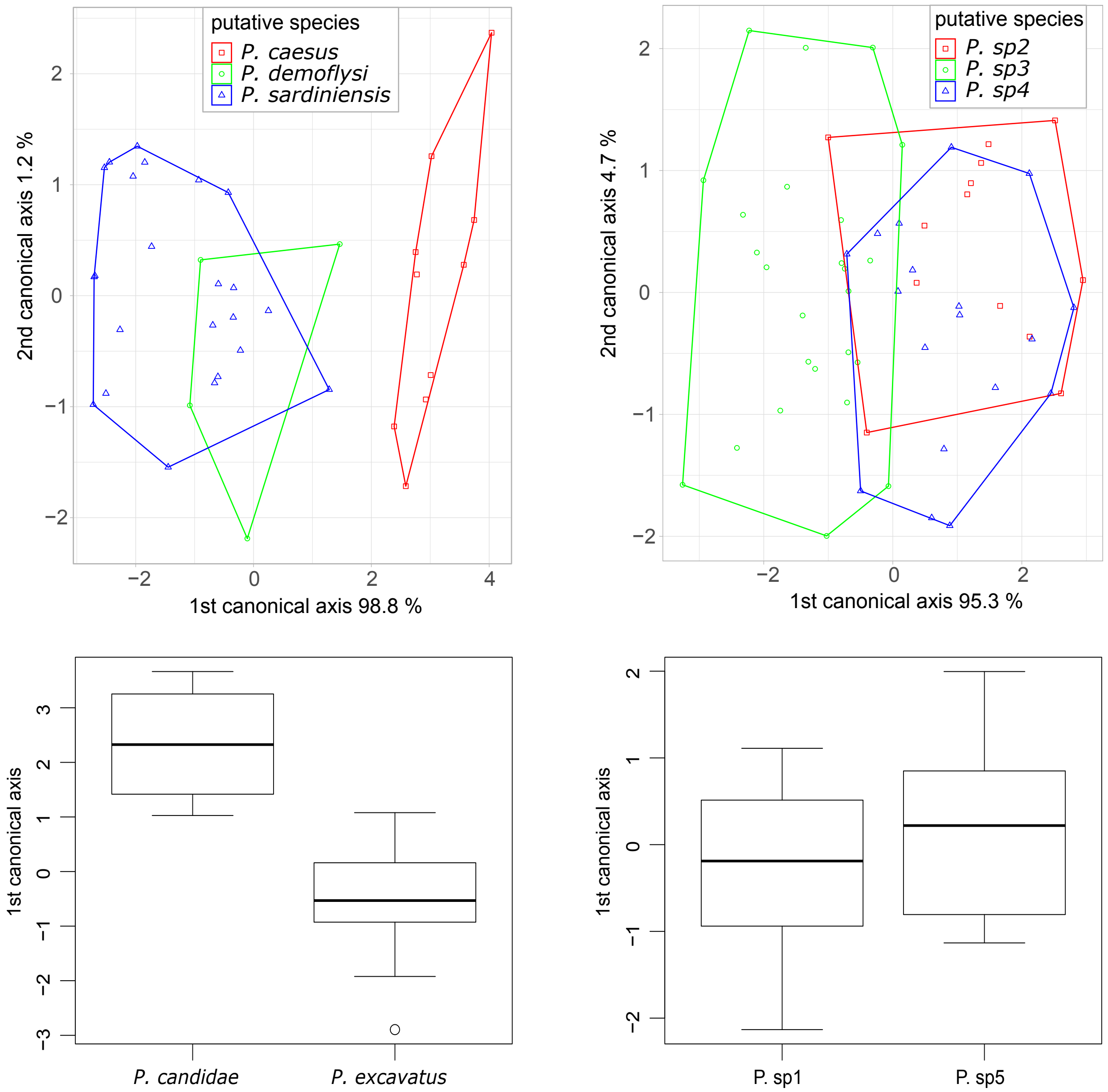

Figure A15: Canonical variate analysis (CVA) of four closely related clades of species that were inferred with iBPP based on linear measurements.

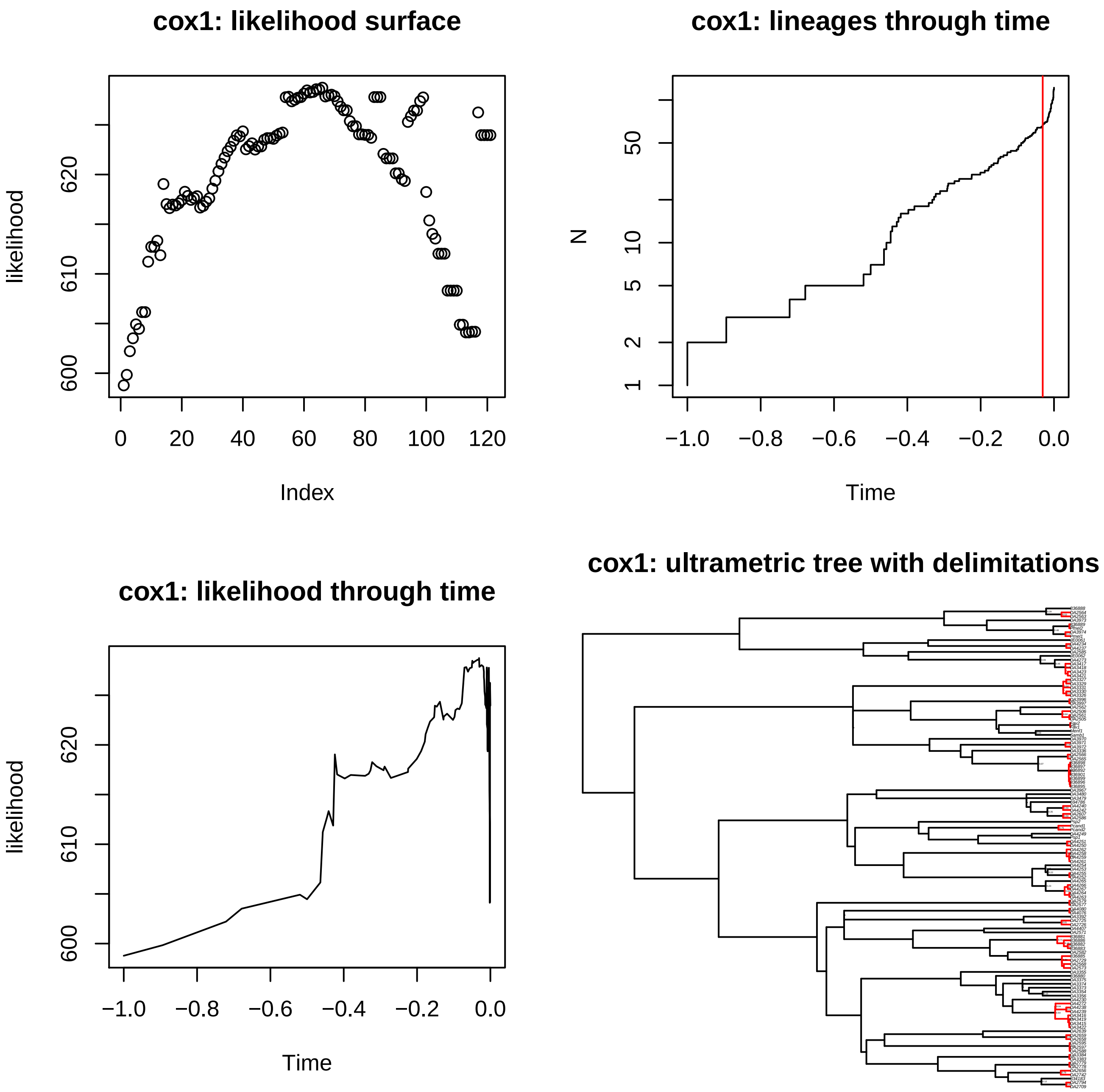

Figure A16: GMYC results for *cox1*.

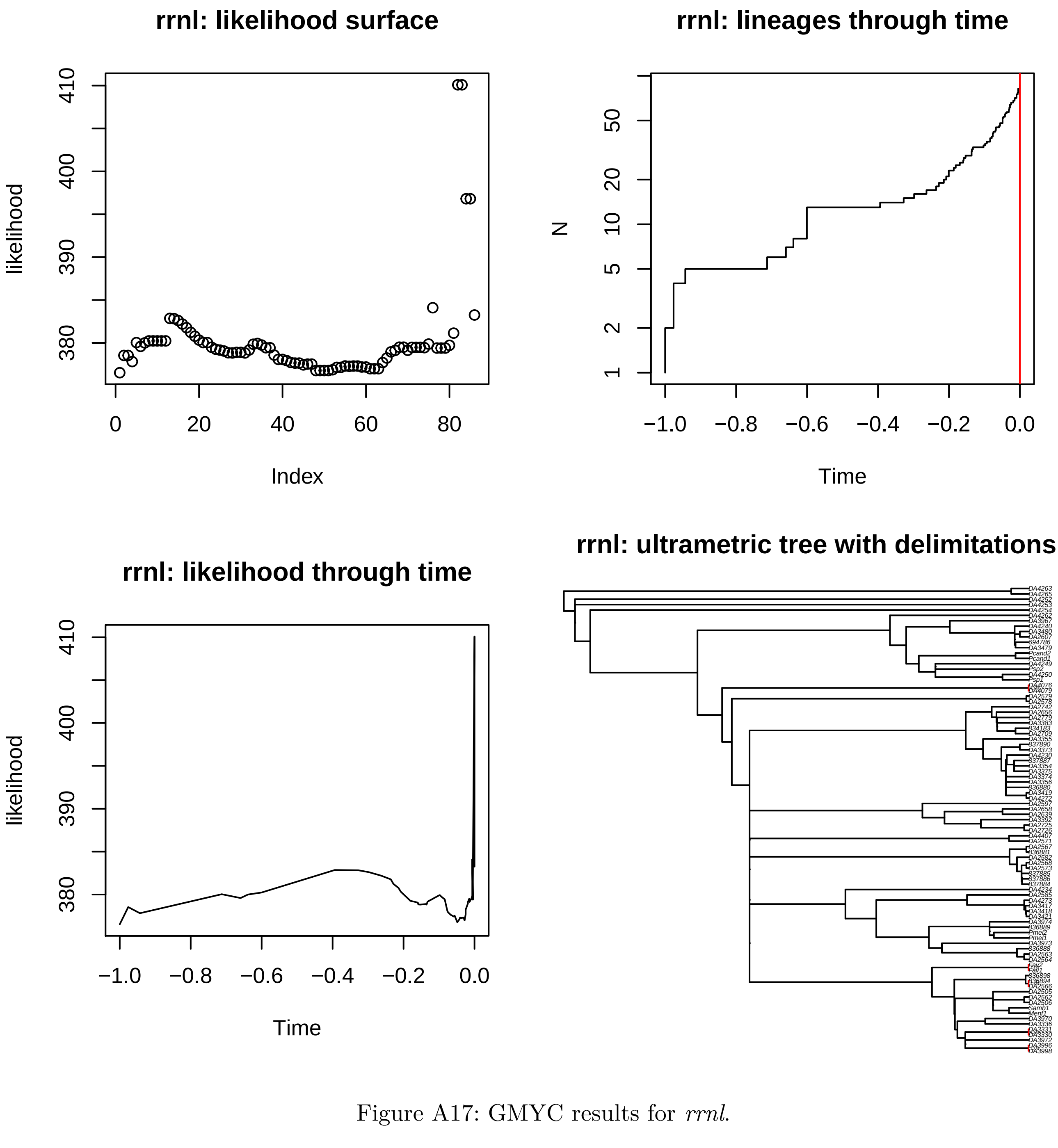

Figure A17: GMYC results for *rrnl*.

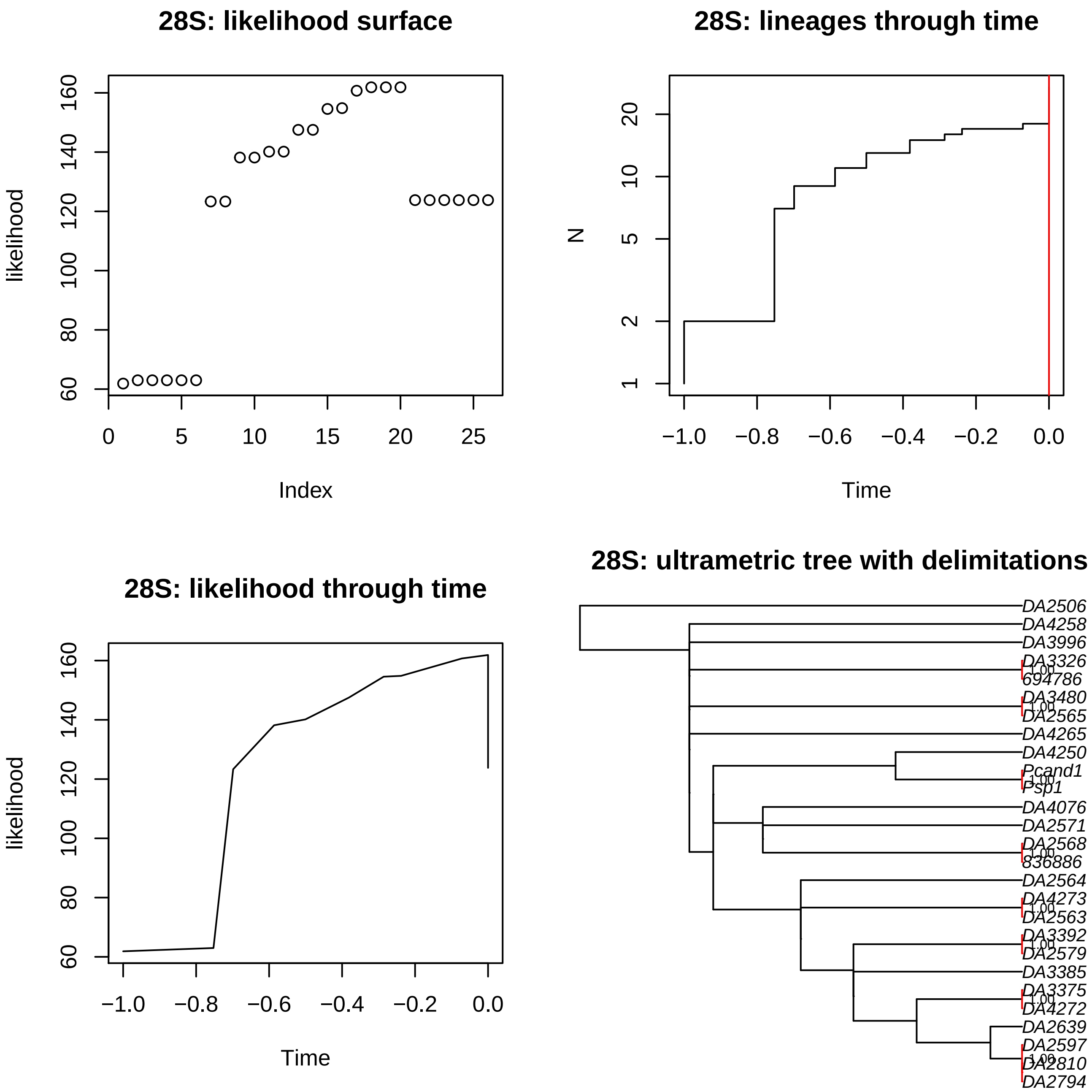

Figure A18: GMYC results for 28S.

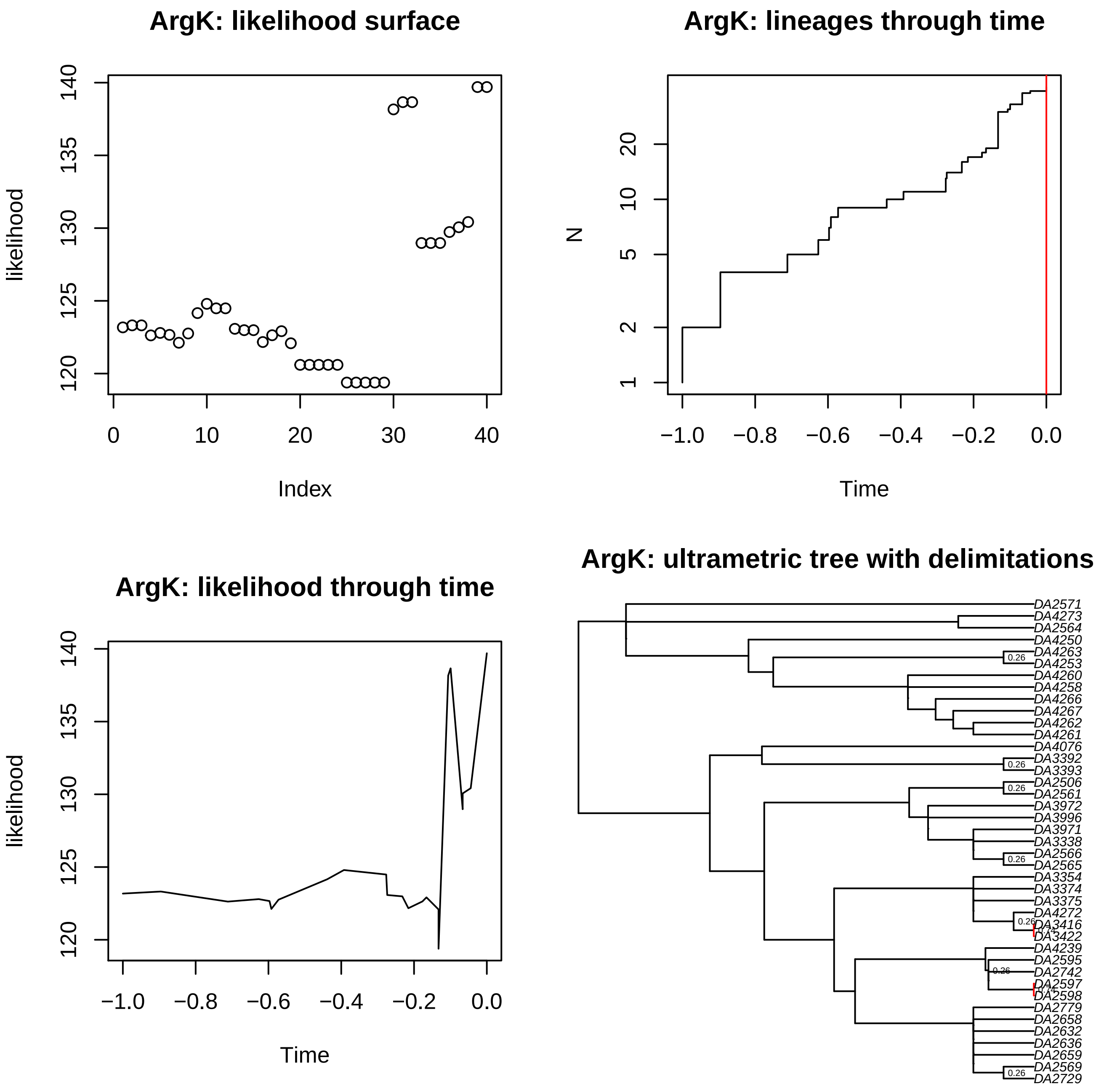

Figure A19: GMYC results for ArgK.

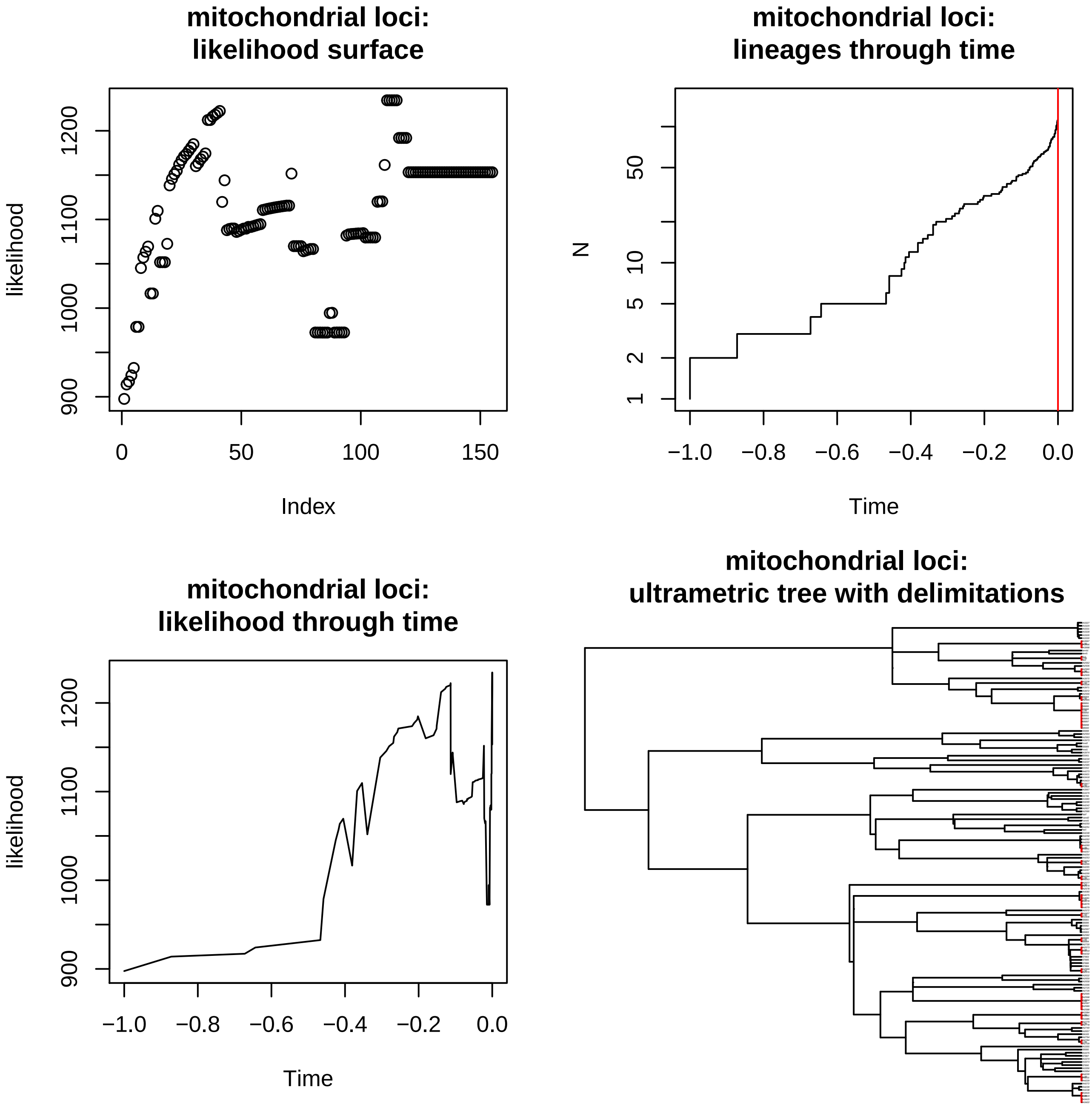

Figure A20: GMYC results for combined mitochondrial loci *(cox1 + rrnl)*.

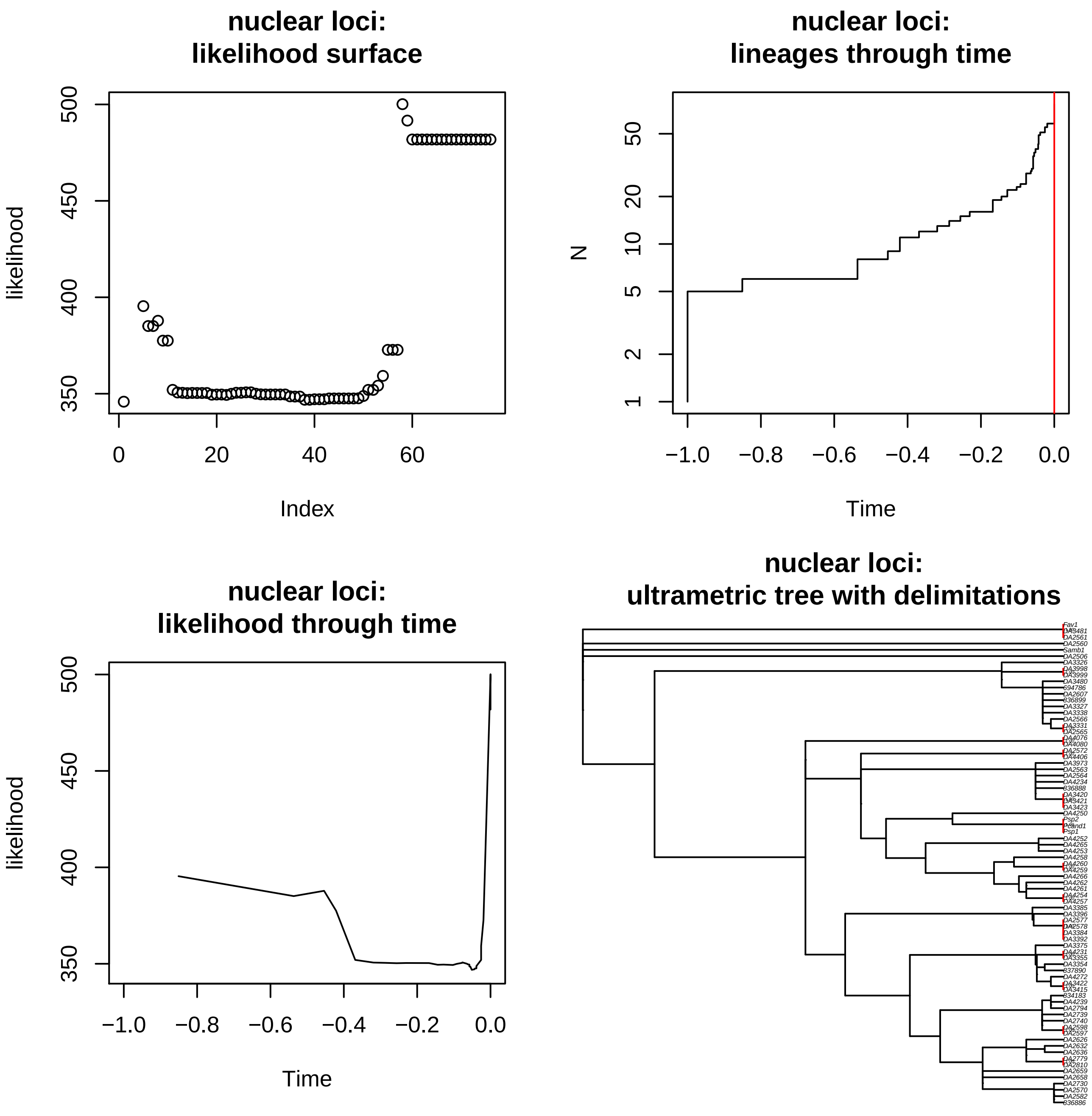

Figure A21: GMYC results for combined nuclear loci (28S + ArgK).

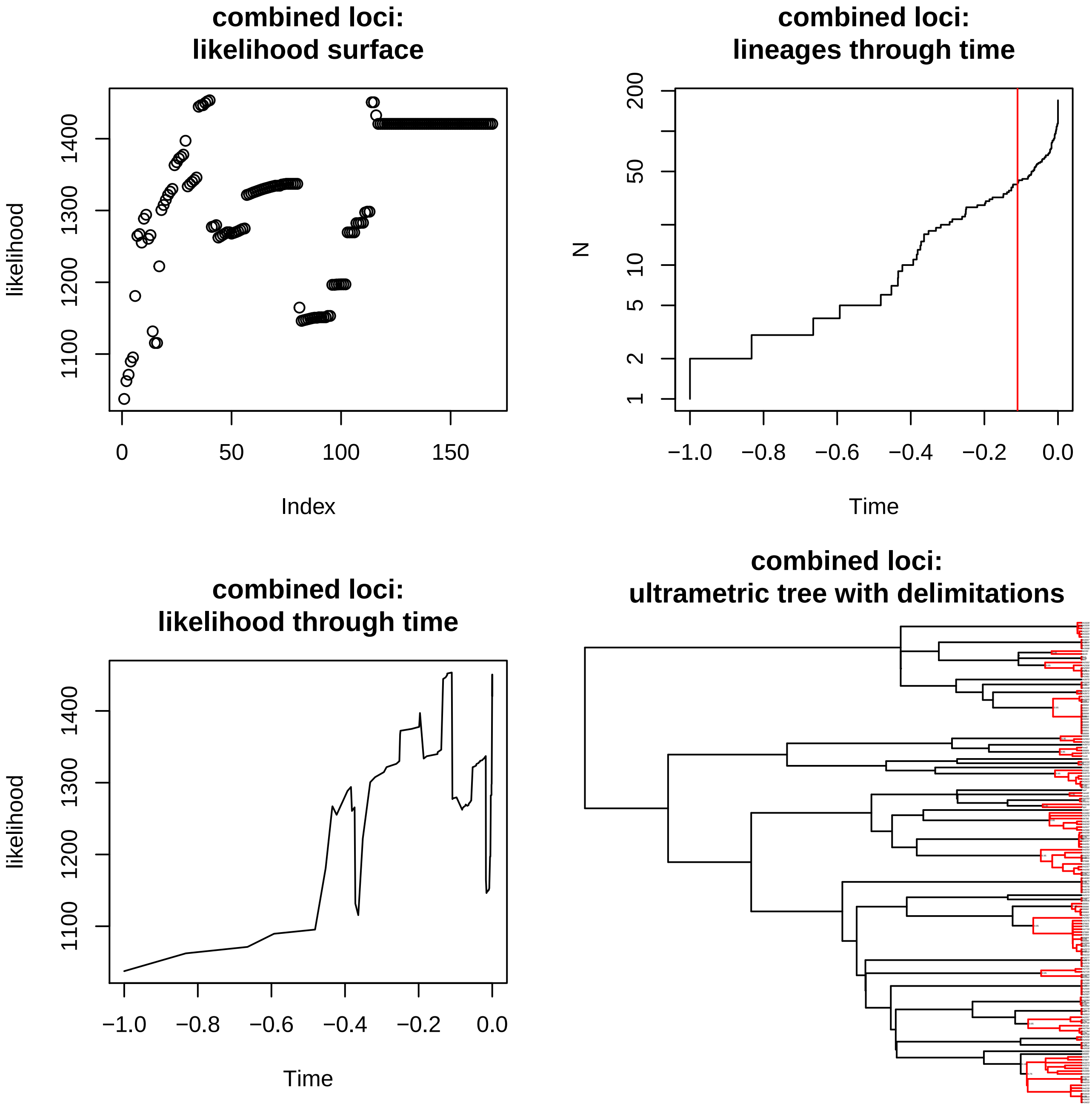

Figure A22: GMYC results for all loci combined.

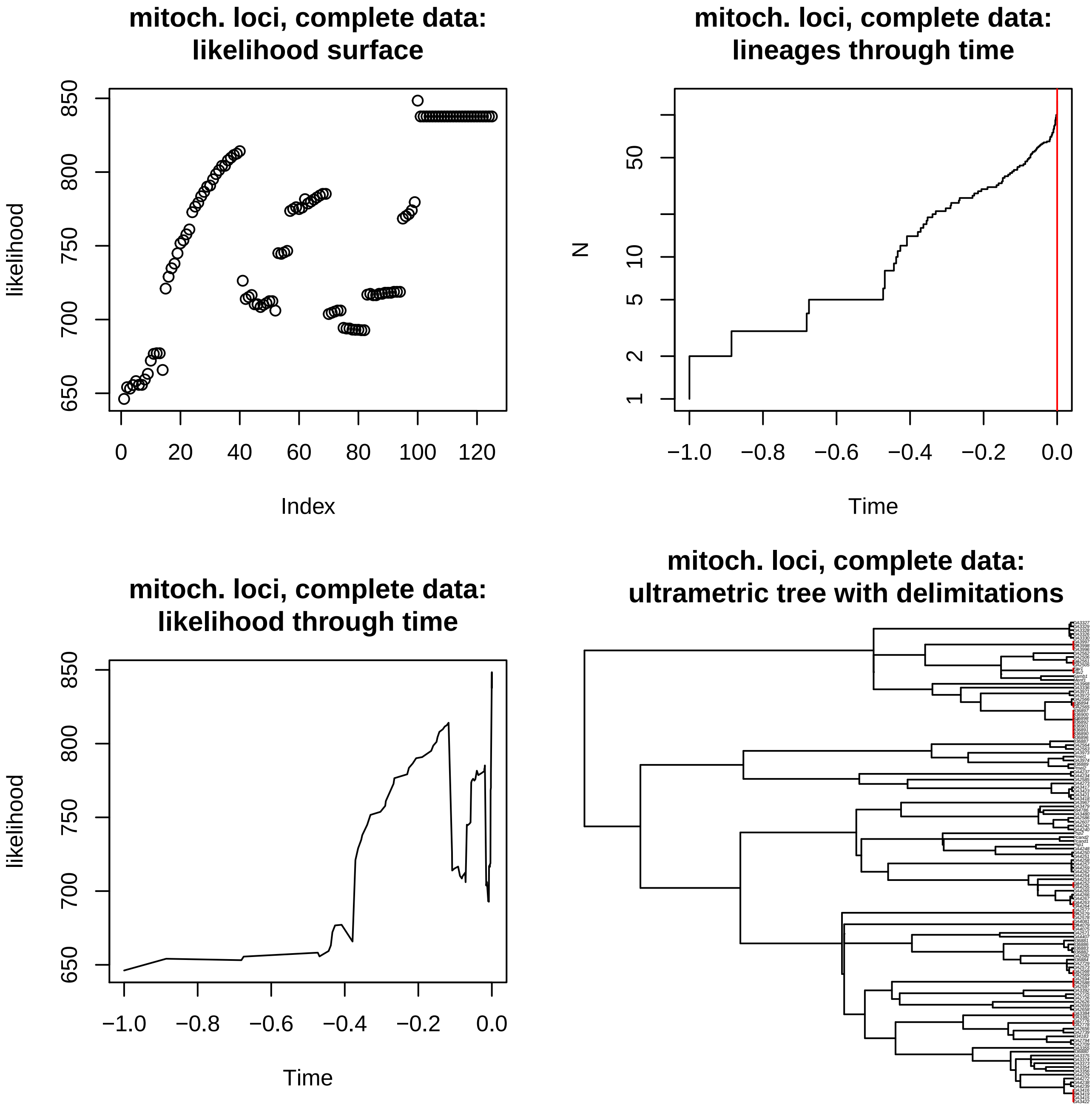

Figure A23: GMYC results for combined mitochondrial loci *(cox1 + rrnl)*, only using specimens for which both loci were available.

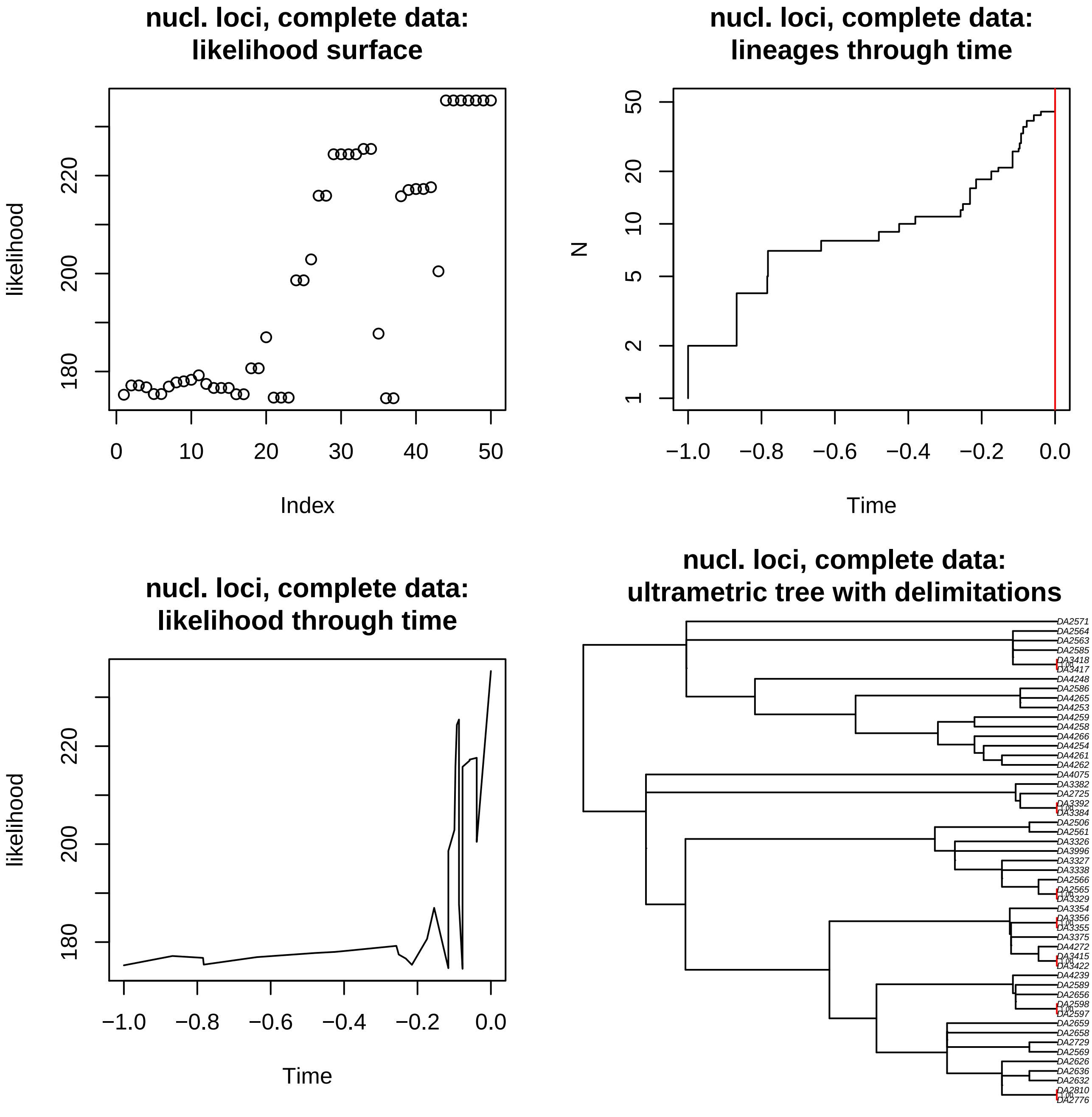

Figure A24: GMYC results for combined nuclear loci (28S + ArgK), only using specimens for which both loci were available.

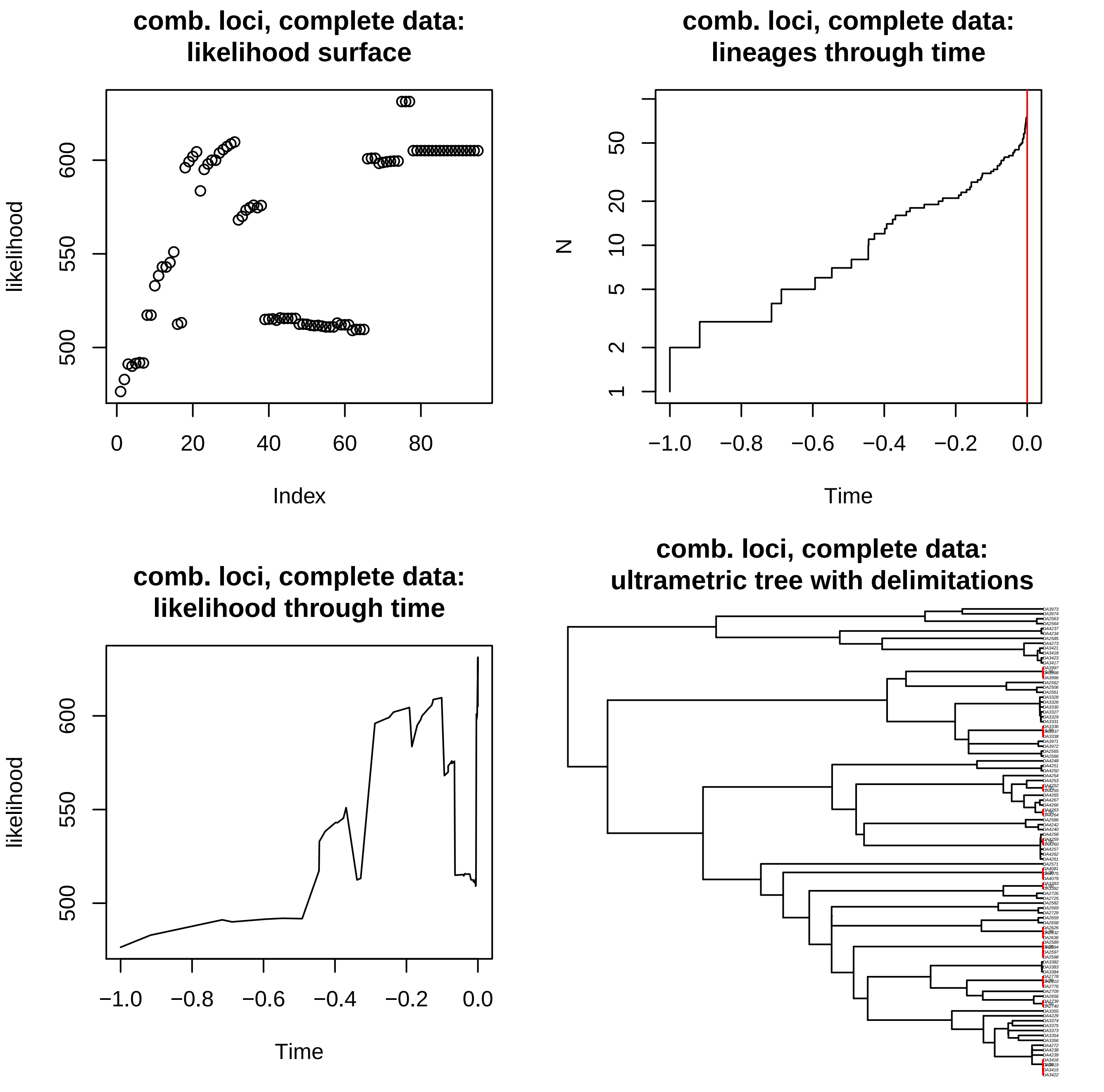

Figure A25: GMYC results for all loci combined, only using specimens for which both loci were available.

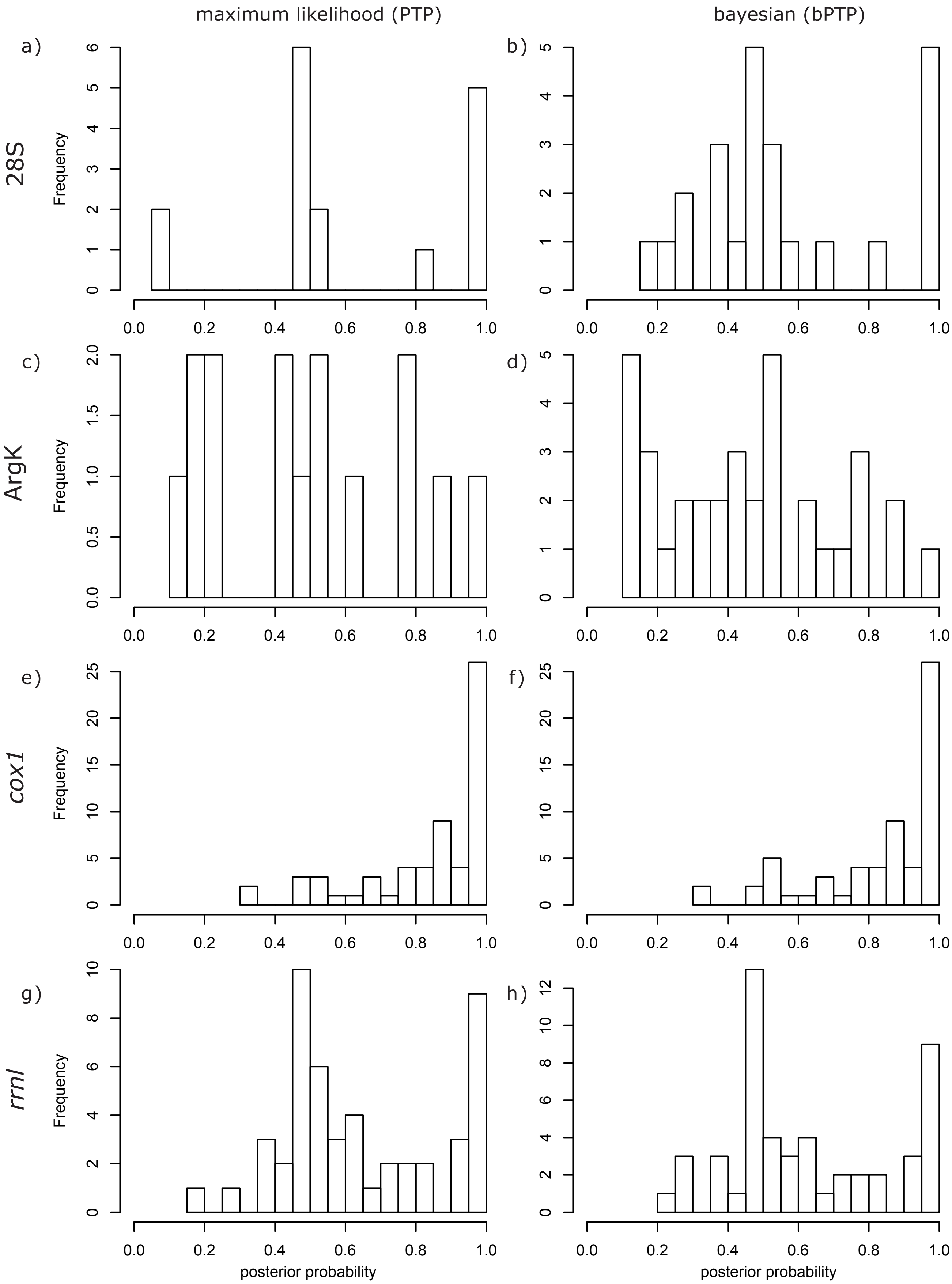

Figure A26: Classified frequency of species' posterior probabilities from the PTP and bPTP analyses of all loci.

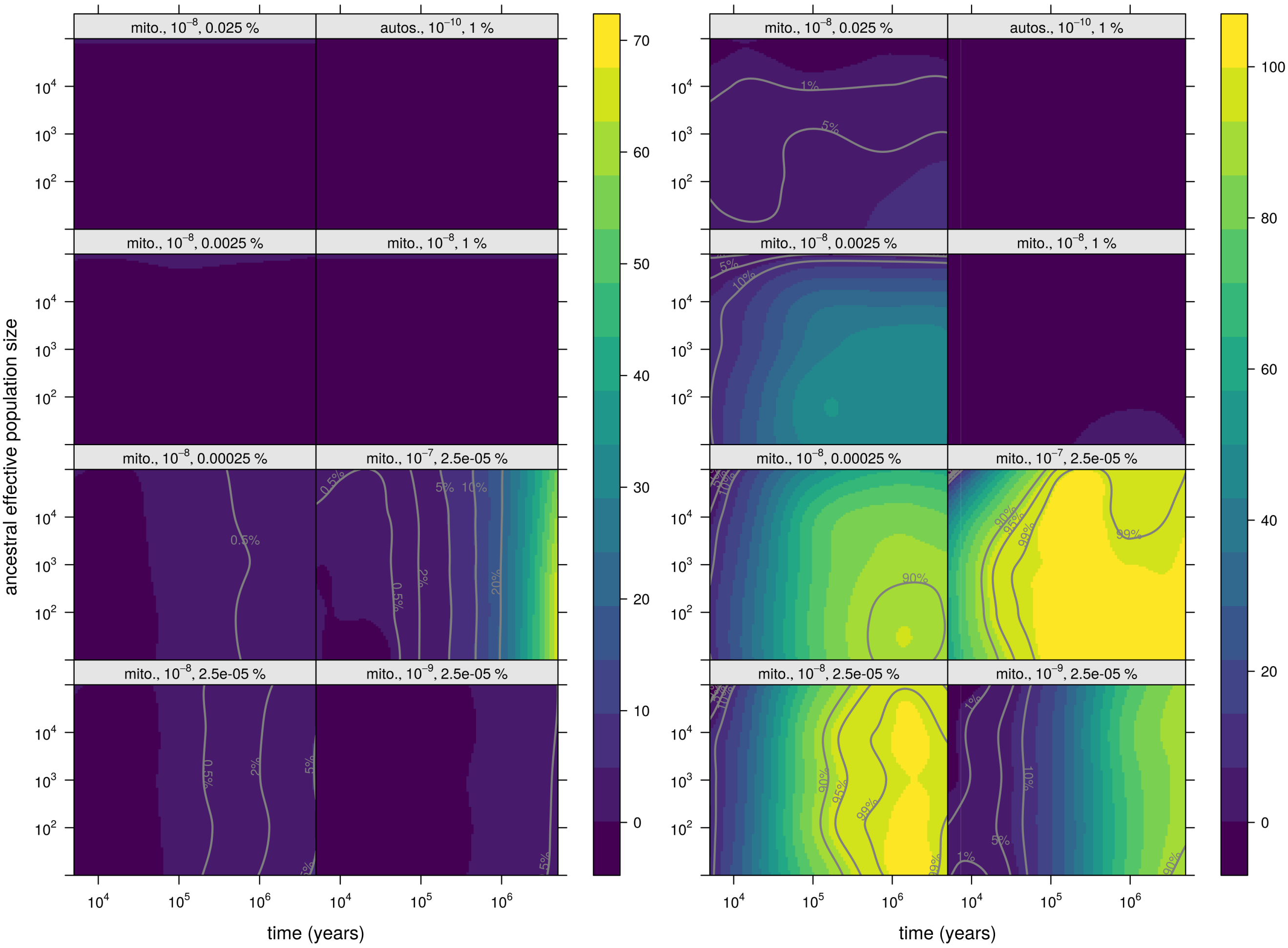

Figure A27: Simulated impact of sex-biased dispersal on nuclear autosomal and mitchondrial loci of two populations in the context of species delimitation. Panel headers indicate origin of locus, mutation rate, and migration rate between populations per generation. The 8 left hand panels illustrate median raw genetic distance; the 8 right hand panels the percentage of reciprocal monophyly of populations in 100 simulation replicates. Generation time was set to one year.

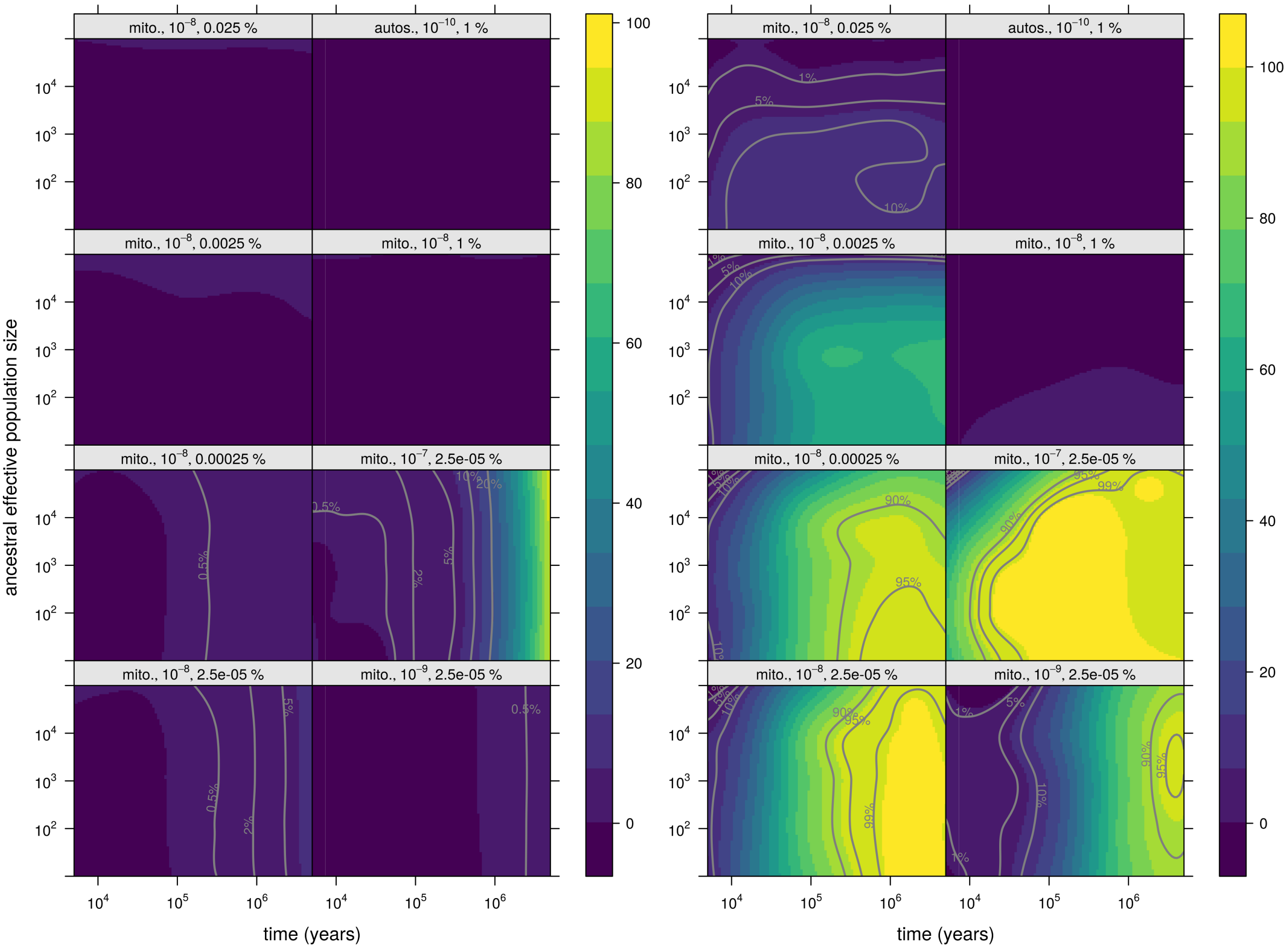

Figure A28: Same as Figure A27 with generation time set to two years.

2 Supplementary Tables

Table A1: Specimen assignment to the putative species that were delimited in this study, sampling locality (refers to table A2), and GenBank accession numbers.

Specimen	Species	Locality	*cox1*	*rrnL*	28S	ArgK
747069	*Buettikeria echinocephala*	na	EF487746	EF487789	EU084171	na
678437	*Cetonia aurata*	na	EF487732	EF487937	JN969244	na
694788	*Chasmatopterus sp.*	na	EF487747	EF487988	EU084173	na
703657	*Oxyomus silvestris*	na	AY132426	EF487820	AY132482	na
703638	*Phyllopertha horticola*	na	AY132398	EF487973	JN969259	na
DA2505	*P. caesus*	L26	KY238671	KY238868	na	na
DA2506	*P. caesus*	L25	KY238672	KY238869	KY238382	KY238539
DA2560	*P. caesus*	L25	KY238680	na	KY238383	na
DA2561	*P. caesus*	L25	KY238681	KY238870	KY238384	KY238540
DA2562	*P. caesus*	L27	KY238820	KY238871	KY238385	KY238541
DA3481	*P. caesus*	L44	na	na	KY238471	na
Fav1	*P. caesus*	L29	KY238692	KY238968	KY238483	na
Fav2	*P. caesus*	L29	KY238742	KY238969	KY238484	na
Menf1	*P. caesus*	L28	KY238683	KY238970	KY238485	na
Samb1	*P. caesus*	L30	KY238777	KY238977	KY238492	na
DA2571	*P. candidae*	L0	KY238702	KY238880	KY238394	KY238547
DA2572	*P. candidae*	L0	KY238779	KY238881	KY238395	KY238548
DA4406	*P. candidae*	L62	na	KY239021	KY238537	na
DA4407	*P. candidae*	L62	KY238832	KY239022	KY238538	na
DA3996	*P. demoflysi*	L48	KY238663	KY238964	KY238479	KY238617
DA3997	*P. demoflysi*	L48	KY238664	KY238965	KY238480	KY238618
DA3998	*P. demoflysi*	L48	KY238665	KY238966	KY238481	KY238619
DA3999	*P. demoflysi*	L48	KY238666	KY238967	KY238482	na
836881	*P. excavatus*	L4	KY238785	KY238841	KY238358	na
836882	*P. excavatus*	L3	KY238784	KY238842	KY238359	na
836883	*P. excavatus*	L3	KY238783	KY238843	KY238360	na
836884	*P. excavatus*	L7	KY238790	KY238844	KY238361	na
836885	*P. excavatus*	L7	KY238789	KY238845	KY238362	na
836886	*P. excavatus*	L5	KY238788	KY238846	KY238363	na
837883	*P. excavatus*	L6	na	KY238862	na	na
837884	*P. excavatus*	L6	na	KY238863	KY238378	na
837885	*P. excavatus*	L6	na	KY238864	na	na
837886	*P. excavatus*	L6	na	KY238865	na	na
DA2567	*P. excavatus*	L2	na	KY238876	KY238390	na
DA2568	*P. excavatus*	L8	KY238673	KY238877	KY238391	na
DA2569	*P. excavatus*	L8	KY238674	KY238878	KY238392	KY238546
DA2570	*P. excavatus*	L8	KY238703	KY238879	KY238393	na
DA2573	*P. excavatus*	L1	KY238704	KY238882	KY238396	na
DA2575	*P. excavatus*	L1	na	na	KY238397	na
DA2582	*P. excavatus*	L9	KY238818	KY238887	KY238403	KY238549
DA2583	*P. excavatus*	L9	KY238819	KY238888	KY238404	KY238550
DA2729	*P. excavatus*	L6	KY238766	KY238911	KY238427	KY238571
DA2730	*P. excavatus*	L6	KY238833	KY238912	KY238428	KY238572
DA4232	*P. excavatus*	L57	na	KY238988	KY238504	na
DA4233	*P. excavatus*	L57	na	KY238989	KY238505	na
836887	*P. melonii*	L24	KY238787	KY238847	KY238364	na
836888	*P. melonii*	L24	KY238781	KY238848	KY238365	na
836889	*P. melonii*	L24	KY238780	KY238849	KY238366	na
DA2563	*P. melonii*	L23	KY238679	KY238872	KY238386	KY238542
DA2564	*P. melonii*	L23	KY238676	KY238873	KY238387	KY238543

Specimen	Species	Locality	*cox1*	*rrnL*	28S	ArgK
DA2585	*P. melonii*	L22	KY238815	KY238889	KY238405	KY238551
DA3417	*P. melonii*	L39	KY238731	KY238948	KY238463	KY238606
DA3418	*P. melonii*	L39	KY238830	KY238949	KY238464	KY238607
DA3420	*P. melonii*	L39	KY238748	KY238951	KY238466	KY238609
DA3421	*P. melonii*	L39	KY238749	KY238952	KY238467	KY238610
DA3423	*P. melonii*	L39	KY238751	KY238954	KY238469	KY238612
DA3973	*P. melonii*	L23	KY238710	KY238962	KY238477	KY238615
DA3974	*P. melonii*	L23	KY238808	KY238963	KY238478	KY238616
DA4234	*P. melonii*	L58	KY238707	KY238990	KY238506	KY238628
DA4235	*P. melonii*	L58	KY238726	KY238991	KY238507	KY238629
DA4236	*P. melonii*	L58	KY238727	KY238992	KY238508	KY238630
DA4237	*P. melonii*	L58	KY238728	KY238993	KY238509	KY238631
DA4273	*P. melonii*	L61	KY238670	KY239020	KY238536	KY238658
JE0061	*P. melonii*	L41	KY238807	na	na	na
JE0062	*P. melonii*	L41	KY238806	na	na	na
Pmel1	*P. melonii*	L23	KY238708	KY238973	KY238488	na
Pmel2	*P. melonii*	L23	KY238805	KY238974	KY238489	na
836890	*P. sardiniensis*	L13	KY238761	KY238850	KY238367	na
836891	*P. sardiniensis*	L13	KY238762	KY238851	KY238368	na
836892	*P. sardiniensis*	L13	KY238763	KY238852	KY238369	na
836893	*P. sardiniensis*	L13	na	KY238853	KY238370	na
836894	*P. sardiniensis*	L13	KY238757	KY238854	KY238371	na
836895	*P. sardiniensis*	L13	KY238758	KY238855	na	na
836896	*P. sardiniensis*	L13	KY238759	KY238856	KY238372	na
836897	*P. sardiniensis*	L13	KY238760	KY238857	KY238373	na
836898	*P. sardiniensis*	L13	KY238755	KY238858	KY238374	na
836899	*P. sardiniensis*	L13	KY238756	KY238859	KY238375	na
836900	*P. sardiniensis*	L13	KY238800	KY238860	KY238376	na
836901	*P. sardiniensis*	L13	KY238801	KY238861	KY238377	na
DA2565	*P. sardiniensis*	L13a	KY238677	KY238874	KY238388	KY238544
DA2566	*P. sardiniensis*	L13a	KY238675	KY238875	KY238389	KY238545
DA3326	*P. sardiniensis*	L33	KY238812	KY238922	KY238437	KY238580
DA3327	*P. sardiniensis*	L33	KY238811	KY238923	KY238438	KY238581
DA3328	*P. sardiniensis*	L33	KY238810	KY238924	KY238439	KY238582
DA3329	*P. sardiniensis*	L33	KY238809	KY238925	KY238440	KY238583
DA3330	*P. sardiniensis*	L33	KY238825	KY238926	KY238441	KY238584
DA3331	*P. sardiniensis*	L33	KY238798	KY238927	KY238442	KY238585
DA3336	*P. sardiniensis*	L34	KY238714	KY238928	KY238443	KY238586
DA3337	*P. sardiniensis*	L34	KY238765	KY238929	KY238444	KY238587
DA3338	*P. sardiniensis*	L34	KY238782	KY238930	KY238445	KY238588
DA3968	*P. sardiniensis*	L46	KY238736	KY238958	KY238473	na
DA3970	*P. sardiniensis*	L46	KY238711	KY238959	KY238474	na
DA3971	*P. sardiniensis*	L47	KY238712	KY238960	KY238475	KY238613
DA3972	*P. sardiniensis*	L47	KY238709	KY238961	KY238476	KY238614
DA4248	*P. sp1*	L52	KY238797	KY238999	KY238515	KY238637
DA4249	*P. sp1*	L52	KY238796	KY239000	KY238516	KY238638
DA4250	*P. sp1*	L53	KY238771	KY239001	KY238517	KY238639
DA4251	*P. sp1*	L53	KY238772	KY239002	KY238518	KY238640
Pcand1*	*P. sp1*	L42	KY238689	KY238971	KY238486	na
Pcand2*	*P. sp1*	L43	KY238690	KY238972	KY238487	na
Psp1	*P. sp1*	L31	KY238740	KY238975	KY238490	na
Psp2*	*P. sp1*	L32	KY238739	KY238976	KY238491	na
DA2577	*P. sp2*	L11	KY238701	KY238883	KY238398	na
DA2578	*P. sp2*	L11	KY238698	KY238884	KY238399	na
DA2579	*P. sp2*	L11	KY238697	KY238885	KY238400	na

Specimen	Species	Locality	*cox1*	*rrnL*	28S	ArgK
DA2580	*P. sp2*	L11	KY238817	KY238886	KY238401	na
DA2581	*P. sp2*	L11	na	na	KY238402	na
DA2725	*P. sp2*	L14	KY238824	KY238909	KY238425	KY238569
DA2726	*P. sp2*	L14	KY238775	KY238910	KY238426	KY238570
DA3382	*P. sp2*	L37	KY238732	KY238937	KY238452	KY238595
DA3383	*P. sp2*	L37	KY238720	KY238938	KY238453	KY238596
DA3384	*P. sp2*	L37	KY238734	KY238939	KY238454	KY238597
DA3385	*P. sp2*	L37	KY238733	KY238940	KY238455	KY238598
DA3392	*P. sp2*	L38	KY238699	KY238941	KY238456	KY238599
DA3393	*P. sp2*	L38	KY238700	KY238942	KY238457	KY238600
DA3394	*P. sp2*	L38	KY238778	KY238943	KY238458	KY238601
DA3395	*P. sp2*	L38	KY238705	KY238944	KY238459	KY238602
DA3396	*P. sp2*	L38	KY238770	KY238945	KY238460	KY238603
834183	*P. sp3*	L20	KY238753	KY238839	KY238356	na
DA2588	*P. sp3*	L15	KY238822	KY238891	KY238407	na
DA2589	*P. sp3*	L15	KY238823	KY238892	KY238408	KY238553
DA2594	*P. sp3*	L15	KY238661	KY238893	KY238409	KY238554
DA2595	*P. sp3*	L15	KY238660	KY238894	KY238410	KY238555
DA2597	*P. sp3*	L15	KY238659	KY238895	KY238411	KY238556
DA2598	*P. sp3*	L15	KY238662	KY238896	KY238412	KY238557
DA2606	*P. sp3*	L15	KY238717	KY238897	KY238413	KY238558
DA2626	*P. sp3*	L16	KY238821	KY238899	KY238415	KY238559
DA2632	*P. sp3*	L16	KY238802	KY238900	KY238416	KY238560
DA2636	*P. sp3*	L16	KY238764	KY238901	KY238417	KY238561
DA2639	*P. sp3*	L16	KY238713	KY238902	KY238418	KY238562
DA2656	*P. sp3*	L21	KY238793	KY238903	KY238419	KY238563
DA2657	*P. sp3*	L21	KY238794	KY238904	KY238420	KY238564
DA2658	*P. sp3*	L17	KY238791	KY238905	KY238421	KY238565
DA2659	*P. sp3*	L17	KY238792	KY238906	KY238422	KY238566
DA2709	*P. sp3*	L19	KY238715	KY238907	KY238423	KY238567
DA2719	*P. sp3*	L19	KY238746	KY238908	KY238424	KY238568
DA2739	*P. sp3*	L20	KY238837	KY238913	KY238429	KY238573
DA2740	*P. sp3*	L20	KY238668	KY238914	KY238430	KY238574
DA2742	*P. sp3*	L20	KY238667	KY238915	KY238431	KY238575
DA2776	*P. sp3*	L18	KY238745	KY238916	KY238432	KY238576
DA2778	*P. sp3*	L18	KY238744	KY238917	KY238433	KY238577
DA2779	*P. sp3*	L18	KY238743	KY238918	KY238434	KY238578
DA2784	*P. sp3*	L19	KY238735	KY238919	na	na
DA2794	*P. sp3*	L19	KY238752	KY238920	KY238435	na
DA2810	*P. sp3*	L18	KY238754	KY238921	KY238436	KY238579
837887	*P. sp4*	L10	na	KY238866	KY238379	na
837890	*P. sp4*	L10	na	KY238867	KY238381	na
836880*	*P. sp4*	L12	na	na	na	na
DA3354	*P. sp4*	L35	KY238835	KY238931	KY238446	KY238589
DA3355	*P. sp4*	L35	KY238836	KY238932	KY238447	KY238590
DA3356	*P. sp4*	L35	KY238834	KY238933	KY238448	KY238591
DA3373	*P. sp4*	L36	KY238831	KY238934	KY238449	KY238592
DA3374	*P. sp4*	L36	KY238695	KY238935	KY238450	KY238593
DA3375	*P. sp4*	L36	KY238696	KY238936	KY238451	KY238594
DA3415	*P. sp4*	L39	KY238729	KY238946	KY238461	KY238604
DA3416	*P. sp4*	L39	KY238724	KY238947	KY238462	KY238605
DA3419	*P. sp4*	L39	KY238725	KY238950	KY238465	KY238608
DA3422	*P. sp4*	L39	KY238750	KY238953	KY238468	KY238611
DA4229	*P. sp4*	L56	KY238747	KY238985	KY238502	KY238626
DA4230	*P. sp4*	L56	KY238722	KY238986	na	na

Specimen	Species	Locality	*cox1*	*rrnL*	28S	ArgK
DA4231	*P. sp4*	L56	KY238723	KY238987	KY238503	KY238627
DA4238	*P. sp4*	L59	KY238738	KY238994	KY238510	KY238632
DA4239	*P. sp4*	L59	KY238730	KY238995	KY238511	KY238633
DA4272	*P. sp4*	L61	KY238669	KY239019	KY238535	KY238657
694786	*P. sp5*	L40	KY238741	KY238838	KY238355	na
837888*	*P. sp5*	L10	na	na	na	na
DA2586	*P. sp5*	L15	KY238816	KY238890	KY238406	KY238552
DA2607	*P. sp5*	L15	KY238716	KY238898	KY238414	na
DA3479	*P. sp5*	L40	KY238718	KY238955	na	na
DA3480	*P. sp5*	L40	KY238706	KY238956	KY238470	na
DA3967	*P. sp5*	L45	KY238737	KY238957	KY238472	na
DA4240	*P. sp5*	L60	KY238799	KY238996	KY238512	KY238634
DA4241	*P. sp5*	L60	KY238803	KY238997	KY238513	KY238635
DA4242	*P. sp5*	L60	KY238829	KY238998	KY238514	KY238636
DA4252	*P. sp5*	L50	KY238769	KY239003	KY238519	KY238641
DA4253	*P. sp5*	L50	KY238813	KY239004	KY238520	KY238642
DA4254	*P. sp5*	L50	KY238826	KY239005	KY238521	KY238643
DA4255	*P. sp5*	L50	KY238776	KY239006	KY238522	KY238644
DA4256	*P. sp5*	L50	KY238773	KY239007	KY238523	KY238645
DA4257	*P. sp5*	L51	KY238774	KY239008	KY238524	KY238646
DA4258	*P. sp5*	L51	KY238767	KY239009	KY238525	KY238647
DA4259	*P. sp5*	L51	KY238768	KY239010	KY238526	KY238648
DA4260	*P. sp5*	L51	KY238687	KY239011	KY238527	KY238649
DA4261	*P. sp5*	L51	KY238686	KY239012	KY238528	KY238650
DA4262	*P. sp5*	L51	KY238685	KY239013	KY238529	KY238651
DA4263	*P. sp5*	L49	KY238684	KY239014	KY238530	KY238652
DA4264	*P. sp5*	L49	KY238814	KY239015	KY238531	KY238653
DA4265	*P. sp5*	L49	KY238682	KY239016	KY238532	KY238654
DA4266	*P. sp5*	L49	KY238795	KY239017	KY238533	KY238655
DA4267	*P. sp5*	L49	KY238719	KY239018	KY238534	KY238656
DA4075	*P. sp6*	L55	KY238691	KY238978	KY238493	KY238620
DA4076	*P. sp6*	L55	KY238688	KY238980	KY238497	KY238621
DA4077	*P. sp6*	L55	KY238721	KY238981	KY238498	KY238622
DA4078	*P. sp6*	L55	KY238693	KY238982	KY238499	KY238623
DA4079	*P. sp6*	L55	KY238694	KY238983	KY238500	KY238624
DA4080	*P. sp6*	L55	KY238828	na	KY238494	na
DA4081	*P. sp6*	L55	KY238827	KY238984	KY238501	KY238625

* Excluded from species validation approaches due to large amounts of missing data.

Table A2: IDs of sampling localities that were used in trees (Fig. 2, Supplementary Figs. A2, A3) and the locality map (Supplementary Fig. A1). Coordinates are given in decimal format (WGS84).

No.	Sampling Locality	Latitude	Longitude
L0	Italy: Puglia (TA), Castellaneta, Fiume Lato	40.495833	16.990833
L1	Italy: Lazio (LT), Priverno, Bosco Polverino, 40 m	41.436111	13.187222
L2	Italy: Lazio (LT), Parco Nazionale del Circeo, Promontorio del Circeo, Quarto Freddo, Peretto (Conecofor site), 120 m	41.240932	13.069646
L3	Italy: Lazio (LT), Sabaudia, Fonte di Lucullo	41.257222	13.061389
L4	Italy: Lazio (LT), Selva del Circeo, 5 km N of Sabaudia	41.330556	13.062778
L5	Italy: Lazio (LT), W of Lago di Sabaudia	41.284722	13.061667
L6	Italy: Lazio (RM), Castel di Guido	41.889167	12.263889
L7	Italy: Lazio (RM), Nettuno, Pineta di Torre Astura	41.413611	12.758333
L8	Italy: Lazio (LT), Monti Ausoni, Sugherete di San Vito e Valle Marina, San Vito 70 m	41.366667	13.333333
L9	Italy: Lazio (LT), Parco di Gianola e Monte di Scauri	41.246837	13.680725
L10	Italy: Sardinia (NU), 2 km S Santa Maria Navarese	39.98	9.686667
L11	Italy: Sardinia (OT), San Teodoro, Cala d'Ambra, 2 m	40.775	9.677222
L12	Italy: Sardinia (NU), 5 km S of Marina di Tertenia	39.611389	9.653056
L13	Italy: Sardinia (CA), Foce del Flumendosa (Muravera)	39.395	9.443889
L13a	Italy: Sardinia (CA), Muravera	39.428333	9.625
L14	Italy: Sardinia (NU), Cala Pineta, near Santa Lucia 12 m	40.568611	9.788056
L15	Italy: Sardinia (OT), Vignola Mare	41.126944	9.073056
L16	Italy: Sardinia (SS), Valledoria	40.937	8.812998
L17	Italy: Sardinia (OR), Bosa Marina, 16 m	40.275278	8.484722
L18	Italy: Sardinia (OR), Is Arenas, 15 m	40.071667	8.486111
L19	Italy: Sardinia (CI), dunes between Torre dei Corsari and Pistis, 40 m	39.688889	8.456944
L20	Italy: Sardinia (CI), Arbus, Camping Sciopadroxiu, 2 km W of Irgutosu, 62 m	39.525278	8.472222
L21	Italy: Sardinia (CI), Portixeddu, 0-42 m	39.440556	8.423333
L22	Italy: Sardinia (CI) 3 km S of Porto Pino	38.943333	8.640556
L23	Italy: Sardinia (CA), Assemini	39.285556	8.983333
L24	Italy: Sardinia (CA), between Uta and Assemini Fiume Mannu	39.275	8.990556
L25	Italy: Sicily (CT), Giardino Bellini	37.512222	15.083056
L26	Italy: Sicily(CT) Piazza S. Maria di Gesu	37.512222	15.083056
L27	Italy: Sicily (PA), Cefalù	38.034444	14.014167
L28	Italy: Sicily (AG), Menfi, Porto Palo	37.578333	12.908611
L29	Italy: Sicily (PA), Palermo, Parco della Favorita	38.16	13.343889
L30	Italy: Sicily (AG), Sambuca di Sicilia, Lago Arancio	37.646111	13.104722
L31	France: Corsica, Desert des Agriates, Baie de l'Acciolu	42.691568	9.068386
L32	France: Corsica, Desert des Agriates, Magtazzini Rues	42.72542	9.203274
L33	Italy: Sardinia (CA), Villasimius	39.123056	9.511111
L34	Italy: Sardinia (CA), Piscina Rei	39.274722	9.585556
L35	Italy: Sardinia (NU) Torre di Barì	39.835556	9.680278
L36	Italy: Sardinia (NU), Lotzorai, Lido delle Rose	39.969167	9.685556
L37	Italy: Sardinia (NU), Orosei,Caletta di Osalla	40.33	9.675278
L38	Italy: Sardinia (NU), Orosei, Cala Liberotto, Cala Ginepro	40.441389	9.795
L39	Italy: Sardinia (CI), Domus de Maria, Torre di Chia	38.899167	8.886111
L40	France: Corsica, 2 km S Porto-Vecchio	41.573719	9.281359
L41	Italy: Sardinia (CA), Pula	39.005779	9.021993
L42	France: Corsica, Belgodere	42.587782	9.018395
L43	France: Corsica, Tour Saleccia	42.639768	8.975615
L44	Italy: Sicily (CL),Manfria	37.103863	14.116609
L45	France: Corsica, Arggiavara	41.837339	9.262047
L46	Italy: Sardinia (CA), Marcalagonis, Villa dei Gigli	39.278211	9.332063

No	Sampling Locality	Latitude	Longitude
L47	Italy: Sardinia (CA), Maracalagonis, Torre delle Stelle	39.148966	9.397931
L48	Tunisia: Gov. Beja, Cap Serrat, 50 km E of Tabarka	37.218847	9.221964
L49	France: Corsica, Camping Villata (10 km N Porto Vecchio)	41.658333	9.372833
L50	France: Corsica, Casteddu d'Araghju (parking of the castle), 5 km NW Porto Vecchio	41.641667	9.266167
L51	France: Corsica, Estuary of river Liamone, 4 km S Sagone	42.085	8.735962
L52	France: Corsica, L'Ostriconi	42.653333	9.068667
L53	France: Corsica, Farinole, Camping "U Sole Marinu", Albine river	42.713333	9.3335
L55	Italy: Toscana (LI), Elba, Portoferraio, loc. Norsi	42.766328	10.342791
L56	Italy: Sardinia (CA), Sinnai, San Gregorio	39.300266	9.364815
L57	Italy: Lazio (RM), Sughereta di Pomezia	41.659255	12.511969
L58	Italy: Sardinia (CI), San Giovanni Suergiu, Matzaccara	39.132291	8.449044
L59	Italy: Sardinia (CA), Assemini, Gutturu Mannu	39.181125	8.904419
L60	Italy: Sardinia (SS), Palau, Porto Pollo	41.185695	9.32795
L61	Italy: Sardinia (CA), Santa Margherita di Pula	38.925129	8.910341
L62	Italy: Basilicata (MT), Policoro	40.190807	16.715527

Table A3: Best fitting substitution models that were inferred with IQ-TREE (used with ABGD) and simplified models for use with STACEY (see main text). Furthermore, the minimum and maximum intraspecific divergence used in ABGD (P_{min}, P_{max}) is given per locus.

locus	for ABGD	Pmin	Pmax	for STACEY
cox1	TIM+I+G4	0.0018	0.1777	GTR+I+G4
rrnl	HKY+I+G4	0.0009	0.0895	HKY+I+G4
28S	JC+I	0.0001	0.0110	JC+I
ArgK	K2P+G4	0.0003	0.0271	K2P+G4

+I: prop. of invariable sites, +Gx: discrete Gamma model with x rate categories

Table A4: Linear measurements of body parts in millimeters. AL = length of antennal club, EWhc = elytron width at humeral callus, EL = elytron length, PWmax = maximum pronotum width, PWb = width of pronotum at base, PL = medial pronotum length, MTL = length of metatibia, MTW = maximum width of metatibia, 'na' = not available.

Specimen	AL	EL	EWhc	MTL	MTW	PL	PWb	PWmax
694786	na	na	na	na	na	na	na	na
834183	0.875	6	6.375	2	1.625	4.625	5.563	6
836880*	na	6.375	7.125	2.25	1.625	5.375	6.125	6.625
836881	1	6.125	6.25	1.875	1.625	4.875	5.5	5.75
836882	na	na	na	na	na	na	na	na
836883	1	6	6.375	1.875	1.75	4.625	5.5	5.875
836884	1	5.625	6.125	2.125	1.75	4.75	5.25	5.75
836885	1	5.625	6.25	2.25	1.688	4.75	5.375	5.875
836886	na	na	na	na	na	na	na	na
836887	1.5	4.5	6.5	2.25	1.375	4.375	5.375	6
836888	1.375	5.375	5.875	2	1.25	4	4.75	5.375
836889	1.375	4.5	5.625	2	1.25	4	4.875	5.063
836890	1.625	5.625	6.125	2.375	1.625	4.5	5.25	5.5
836891	1.625	6.25	6.75	2.375	1.625	4.75	5.75	6
836892	1.438	5	5.375	2	1.375	3.75	4.625	4.875
836893	1.5	5.625	6.125	2.5	1.625	4.375	5.375	5.688
836894	1.5	5.375	6.125	2.25	1.5	4.375	5.25	5.563
836895	1.563	5.375	6.125	2.375	1.625	4.375	5.125	5.375
836896	1.563	5.75	6.5	2.5	1.625	5.125	5.75	6
836897	na	5.75	6.375	2.5	1.688	4.375	5.5	5.875
836898	na	na	na	na	na	na	na	na
836899	1.5	5.25	6.25	2.375	1.5	4.063	5.063	5.5
836900	na	6.375	7.5	2.75	1.938	5.75	6.5	6.875
836901	na	6	6.25	2.5	1.563	4.75	5.375	5.75
837883	1.125	5.688	6.375	2.375	1.75	4.75	5.625	5.875
837884	1.125	6	6.75	2.438	1.875	5.188	6.063	6.5
837885	1.125	5.75	6.875	2.5	1.75	5	5.75	6
837886	1.125	6.25	7.375	2.375	2	5.25	6.375	6.75
837887	1.375	5.625	5.875	2	1.625	4.375	5	5.375
837888*	na	6.813	8.063	3.25	2	5.75	7	7.5
837890	1.625	6.75	8.125	3.25	2.25	6.125	7	7.625
DA2505	1.25	7	7.75	2.5	2	5.875	6.75	7.75
DA2506	1.375	7.5	8	2.5	2.25	6.25	6.875	7.25
DA2560	1.313	7.125	8.125	2.625	2.125	5.875	6.875	7.375
DA2561	1.25	7	7.5	2.5	2.125	5.25	6.375	6.875
DA2562	1.25	7.125	7.375	2.25	1.875	4.563	6	6.5
DA2563	1.375	5.25	5.688	2	1.125	4.125	4.875	5.375
DA2564	1.375	5.125	5.75	2	1.25	4.25	5	5.438
DA2565	2	7.5	8.5	2.813	2.125	6.438	7.375	7.875
DA2566	2.188	7.875	9.875	3.25	2.5	7.25	8.5	9
DA2567	1.188	6.25	7.25	2.125	1.75	5.25	6.375	6.625
DA2568	1.125	6.25	7	2.375	1.875	5.375	5.813	6.375
DA2569	1.188	6.25	6.625	2.125	1.75	5.25	5.875	6.375
DA2570	1.125	6.375	6.875	2.125	1.75	5.125	6.125	6.625
DA2571	1.75	7.75	9.5	3.125	2.5	7.625	8.5	9
DA2572	1.563	6.688	7.5	2.5	1.938	6	6.25	7
DA2573	1	5.375	5.875	1.875	1.563	4.75	5.188	5.5
DA2575	1.125	5.875	6.5	2.125	1.813	5	5.688	6.125
DA2577	1.313	6.75	6.75	2.125	1.75	4.625	6	6.25
DA2578	1.375	6	6.438	2.063	1.688	4.625	5.875	6.25

Specimen	AL	EL	EWhc	MTL	MTW	PL	PWb	PWmax
DA2579	1.375	5.625	6.438	na	na	4.563	5.875	6.063
DA2580	1.5	6.5	7.5	2.313	1.875	5.125	6.438	6.625
DA2581	1.375	6.25	6.875	1.75	1.625	4.875	6.125	6.438
DA2582	1.125	6.375	7.375	2.125	2	5.5	6.375	6.875
DA2583	1.125	6.125	6.875	2.5	1.75	5.438	6.125	6.625
DA2585	1.375	4.875	5.625	2.25	1.25	4.125	4.938	5.125
DA2586	0.875	5.5	5.75	2	1.5	3.875	4.5	5
DA2588	1.25	6.375	7	2	1.75	5.125	5.625	6.375
DA2589	1.25	6.625	7.625	2.5	1.875	5.875	6.75	7.25
DA2594	1.063	6.125	7.375	2.125	1.75	4.688	6	6.625
DA2595	1.313	7	8.5	2.375	1.938	6.125	7.25	7.625
DA2597	1.063	6.125	6.625	2.25	1.563	4.875	5.5	6.063
DA2598	1.25	6.625	7.5	2.625	1.813	5.625	6.5	7
DA2606	1.188	6.375	7.125	2.25	1.625	4.75	5.938	6.5
DA2607	0.938	4.875	5.25	1.875	1.438	3.375	4.125	4.688
DA2626	na	6.625	6.063	2.063	1.625	4.25	5.125	5.375
DA2632	1.125	6.75	7.625	2	2	5.625	6.375	6.75
DA2636	1.125	7.125	8.25	2.125	2.125	5.875	7	7.375
DA2639	1.188	6.125	6.625	1.875	1.875	4.625	5.688	6
DA2656	1	6	6.375	1.875	1.813	4.5	5.5	5.625
DA2657	0.938	6.25	6.875	1.75	1.75	4.375	5.5	5.75
DA2658	1	5.563	6.25	1.938	1.563	4.625	5.313	5.563
DA2659	na	5.875	7.125	2	1.875	5.25	6.375	6.813
DA2709	1.125	6.5	7	2.125	1.813	4.875	6	6.5
DA2719	1	6.313	6.75	2.25	1.75	4.688	5.875	6.125
DA2725	na	6.563	7.313	2.375	1.75	5	6.375	6.75
DA2726	na	6.563	7.25	2.25	1.875	4.75	6.25	6.563
DA2729	1.125	5.75	6.75	2.375	1.875	5	5.75	6.313
DA2730	1.313	6.25	7.25	2.5	2	5.625	6.438	7
DA2739	1.125	5.75	6.25	1.875	1.75	4.375	5.25	5.563
DA2740	1.125	6.563	6.625	2.125	2	4.688	5.563	6
DA2742	1.063	6.875	7.313	2.125	2.125	5	6.125	6.625
DA2776	1.25	6.5	7	2.063	1.813	5.125	5.938	6.5
DA2778	0.938	5.25	5.375	1.875	1.375	3.75	4.5	4.75
DA2779	1.188	6.688	6.875	2.25	1.875	5	6	6.5
DA2784	0.938	5.5	6	1.75	1.5	4.375	5.25	5.625
DA2794	0.875	5.75	5.375	2	1.5	4.25	4.938	5.25
DA2810	1.125	6.5	7.625	2	2	5.875	6.75	7
DA3326	1.938	7.625	8.75	2.875	2.125	6.563	7.625	8.125
DA3327	1.75	7	8.063	2.875	2	6.125	6.75	8.125
DA3328	1.875	7.625	9	3	2.313	6.5	7.688	8.313
DA3329	1.75	6.75	7.875	3.375	1.875	6.25	7	7.625
DA3330	1.875	8.25	10.063	3.25	2.563	7.25	9	9.375
DA3331	1.625	6.25	7.25	3.125	1.875	5.625	6.063	6.688
DA3336	2.25	7.75	9.625	3.25	2.375	7.5	8.375	9.25
DA3337	2.063	8.75	10.375	3.75	2.563	7.688	8.875	9.313
DA3338	2	7.375	8.75	3.625	2.188	6.75	7.875	8.5
DA3354	1.625	7.938	9.125	2.813	2.375	6.625	7.625	8.25
DA3355	1.688	7.625	8.25	2.75	2.188	6.625	7.25	7.875
DA3356	1.688	6.5	7.375	2.875	1.875	5.5	6	6.625
DA3373	1.5	6.625	7.375	2.375	1.875	5.063	4.875	6.688
DA3374	1.625	7	7.75	2.625	2.125	5.625	6.625	7.125
DA3375	1.25	5.625	6	2.625	1.5	4.25	5.25	5.5
DA3382	1.25	5.375	6.25	2.125	1.438	4.5	5.125	5.75
DA3383	1.25	5.125	6	2.5	1.5	4.5	5.375	5.75

Specimen	AL	EL	EWhc	MTL	MTW	PL	PWb	PWmax
DA3384	1.125	4.938	5.625	2.625	1.5	4.25	4.875	5.188
DA3385	1.313	5.875	6.563	2.375	1.625	5.125	5.875	6
DA3392	1.625	6.5	7.25	3	2	5.125	6.25	6.625
DA3393	1.5	5.75	6.625	2.438	1.875	4.75	5.625	6
DA3394	1.625	6.625	7.5	2.5	2	5.5	6.625	7.125
DA3395	1.625	6.25	7.25	2.5	2	5.125	6.125	6.625
DA3396	1.375	5.625	6.5	2.25	1.625	4.688	5.75	6.125
DA3415	1.375	7.625	8.125	3	2	5.75	7.125	7.75
DA3416	1.125	6.25	6.375	2.375	1.75	5	5.625	6.25
DA3417	1.5	5.125	5.5	2.5	1.25	4.063	4.75	5.125
DA3418	1.375	4.875	5.5	2.25	1.25	3.688	4.625	4.875
DA3419	0.875	4.25	4.75	2.125	1.125	3.375	3.75	4.5
DA3420	1.313	4.125	4.813	2.125	1.125	3.5	4.125	4.438
DA3421	1.563	5.625	6.438	2.563	1.625	5	5.875	6
DA3422	1.313	6.75	7.5	3	2	5.5	6.375	7
DA3423	1.563	5.75	6.625	2.75	1.625	5.125	5.875	6.375
DA3479	1.313	5.688	5.188	2.125	1.875	4.75	5.563	6
DA3480	1.125	4.875	5.5	1.75	1.375	4.125	4.625	4.938
DA3481	1.375	7.125	8.625	2.75	2.125	6.5	7.375	8.125
DA3967	0.875	5.625	5.875	2.25	1.375	4.063	4.688	5.125
DA3968	1.75	7.125	7.625	2.625	1.75	5.375	6.375	6.813
DA3970	2	7.875	8.875	3	2.125	6.375	7.75	8.125
DA3971	1.938	6.75	7.625	3	2	5.875	6.625	7.063
DA3972	1.75	7.5	8.25	3.125	2.063	6.125	7.375	7.75
DA3973	1.375	5	5.5	2.125	1.25	3.75	4.625	5
DA3974	1.375	5	5.5	2.25	1.125	3.875	4.625	5
DA3996	1.5	5.75	7.75	2.875	2	5.75	6.375	7
DA3997	1.375	7.25	7.5	2.625	1.875	5.688	6.5	7
DA3998	1.5	5.625	8	2.625	1.875	5.75	6.875	7.375
DA3999	1.375	5.813	6.5	2.5	1.75	5	5.5	6.063
DA4075	1.875	6.44	7.44	3.4	1.8	5.78	6.78	7.22
DA4076	1.78	6.25	7.7	3.34	1.87	5.8	6.84	7.36
DA4077	1.68	6.05	7.2	3.2	1.67	5.9	6.6	7.08
DA4078	1.6	6.67	7.25	3.26	1.62	5.34	6.35	6.85
DA4079	1.57	5.2	6.06	2.87	1.45	4.75	5.28	5.87
DA4080	1.5	6	6.625	2.75	1.5	5.125	6	6.375
DA4081	1.625	6.5	7.25	3.125	1.75	5.75	6.375	6.875
DA4229	1.125	6.375	6.5	2.25	1.75	4.375	5.625	6
DA4230	1.125	6.125	6.125	2.5	1.688	4.375	5.375	5.938
DA4231	1.125	6.125	6.25	2.375	1.625	4.375	5.125	5.625
DA4232	1.125	6	6.5	2.625	1.75	5.375	5.75	6.25
DA4233	1.125	6.125	7	2.5	1.875	5.375	6.125	6.625
DA4234	1.375	6	6.625	2.625	1.5	4.938	6	6.375
DA4235	1.25	5.563	6	2.313	1.375	4.25	5.125	5.5
DA4236	1.375	5.625	6.25	2.5	1.438	4.5	5.375	5.875
DA4237	1.438	5	5.625	2.25	1.188	3.75	4.875	5.125
DA4238	1.125	5.75	6.25	2.25	1.5	4.313	5.375	5.625
DA4239	1.125	6.5	7.25	2.5	1.875	5.125	6.25	6.875
DA4240	0.875	5	5.375	2.125	1.375	3.375	4.625	4.875
DA4241	1	5.625	6.375	2	1.688	4.25	5.625	5.75
DA4242	1	5.875	6	2.25	1.5	4	5	5.5
DA4248	1.25	6.25	6.75	2.375	1.875	4.625	5.75	6
DA4249	1.063	5.75	6.125	2.5	1.563	4.875	4.875	5.625
DA4250	1.125	6.125	6.875	2.5	1.75	4.75	5.75	6.438
DA4251	1.125	6.875	7.5	2.5	1.875	5.688	6.625	7.188

Specimen	AL	EL	EWhc	MTL	MTW	PL	PWb	PWmax
DA4252	1.188	5.625	5.5	2.375	1.375	4	4.375	5
DA4253	1.125	6.125	6.75	2.375	1.813	4.813	5.875	6.25
DA4254	na	5.625	6.125	2.5	1.5	4.375	5.438	5.563
DA4255	na	5.25	5.875	2.5	1.375	4.125	4.875	5.125
DA4256	1.125	5.25	5.5	2.375	1.375	4	4.875	4.5
DA4257	na	6.625	7.875	2.375	1.875	5.125	6.375	7
DA4258	1	5.625	6.25	2.375	1.625	4.375	5.5	5.75
DA4259	1.125	5.375	6	2.125	1.625	4	4.875	5.125
DA4260	0.875	5.125	5.5	2.188	1.25	3.563	4.5	4.688
DA4261	1.125	6.813	7.375	2.813	1.75	5.25	6.438	6.625
DA4262	1	5.313	6.25	2.375	1.5	4.25	4.875	5.125
DA4263	1.313	5.875	7	2.75	1.625	5	6.063	6.25
DA4264	1.25	6.5	7.125	2.375	1.688	5	6.125	6.625
DA4265	1.125	5.75	5.75	2.25	1.5	4	6	5.125
DA4266	1.25	5.563	6.25	2.375	1.625	4.5	5.5	5.688
DA4267	1.125	6	6.5	2.75	1.438	4.75	5.875	6
DA4272	1.25	6.625	7.5	2.625	1.75	5.313	6.375	6.875
DA4273	1.438	6.25	7	2.5	1.5	4.875	6	6.375
DA4406	1.5	7.5	8.375	3.125	2.125	6.625	7.625	8.313
DA4407	1.563	7.5	8.875	3.125	2.125	7.25	8	8.875
Fav1	1.2	8.8	8.8	3	1.9	7	7	8
Fav2	1.1	8.4	8.5	3.1	2.1	6.7	7	7.7
JE0061	1.5	5.375	6.375	2.5	1.375	4.75	5.625	6
JE0062	1.625	5.875	6.25	2.375	1.5	4.625	5.375	5.875
Menf1	1.2	7.3	8.3	2.9	2.2	6.5	7.5	8
Pcand1*	1	5.9	6.5	2.5	1.8	4.8	6	6.2
Pcand2*	1.1	6.8	6.8	2.6	2	5.5	6	6.3
Pmel1	1.2	5	5	2	1.1	3.8	4.3	4.5
Pmel2	1.5	6	5.8	2	1.2	4.5	5	5.3
Psp1	0.9	5.2	5.5	2.1	1.5	4	4.5	4.9
Psp2*	0.9	3.8	4	1.9	1.3	3	3.6	4
Samb1	1.5	9.1	9.9	3.2	2.6	9.1	9	9.3

* Excluded from species validation analyses due to large amounts of missing data

Table A5: Summary of principal component analysis on the covariance matrix of linear measurements.

component	variance	cum. variance
PC1	46.94%	46.94%
PC2	15.65%	62.59%
PC3	10.32%	72.90%
PC4	9.07%	81.98%
PC5	7.43%	89.41%
PC6	6.30%	95.71%
PC7	4.29%	100.00%
PC8	0.00%	100.00%

Table A6: Details of recursive partitions inferred with ABGD. Partition ranges, the respective resulting number of entities, and the respective prior intraspecific divergences are given.

locus	partitions	no. entities	P-range
cox1	p1 – p7	69	0.0018 – 0.0023
	p8 – p16	48	0.0025 – 0.0036
	p17 – p35	47	0.0037 – 0.0086
	p36 – p39	33	0.0091 – 0.0104
	p40 – p41	32	0.0109 – 0.0114
	p42	30	0.0120
	p43 – p44	29	0.0125 – 0.0131
	p45	28	0.0138
	p46	26	0.0144
	p47	24	0.0151
	p48 – p55	23	0.0158 – 0.0219
	p56	1	0.0230
rrnl	p1 – p15	32	0.0009 – 0.0017
	p16 – p23	30	0.0018 – 0.0025
	p24 – p29	27	0.0026 – 0.0033
	p30	23	0.0035
	p31 – p35	12	0.0036 – 0.0044
	p36 – p42	6	0.0046 – 0.0060
	p43	1	0.0063
28S	p1 – p100	15	< 0.0000
ArgK	p1 – p100	39	< 0.0000

Supplementary tables A7 – A10 are provided as separate files.