

Article title: Complete organelle genomes of Korean fir, *Abies koreana* and phylogenomics of the gymnosperm genus *Abies* using nuclear and cytoplasmic DNA sequence data

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Figure S1. Amino acid sequence and transmembrane helices of ORF69 of *Abies koreana*.
A. Amino acid sequences of ORF69. Gray annotation indicate a partial *ccmC* gene. **B.** Schematic of the transmembrane helices of ORF69 as identified by the TMHMM.

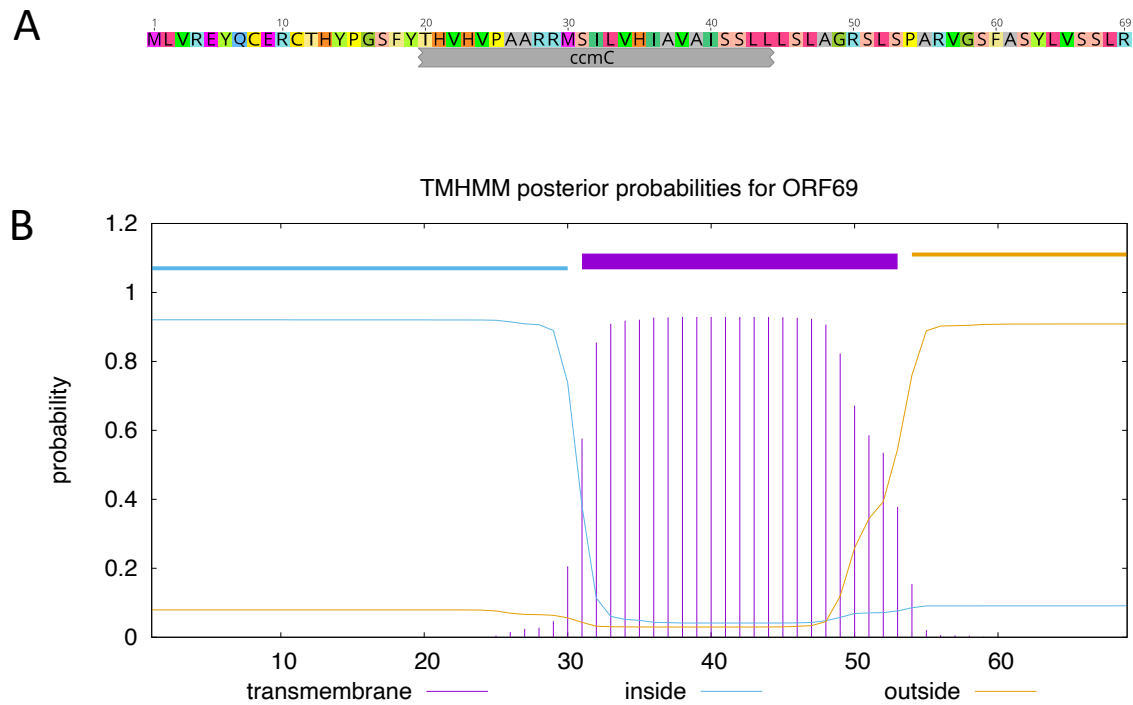


Figure S2. Nucleotide and amino acid sequence alignments of the mitochondrial *cox1* gene. Blue box indicate an internal stop codon created by RNA editing. Red box indicate a new start codon created by RNA editing.

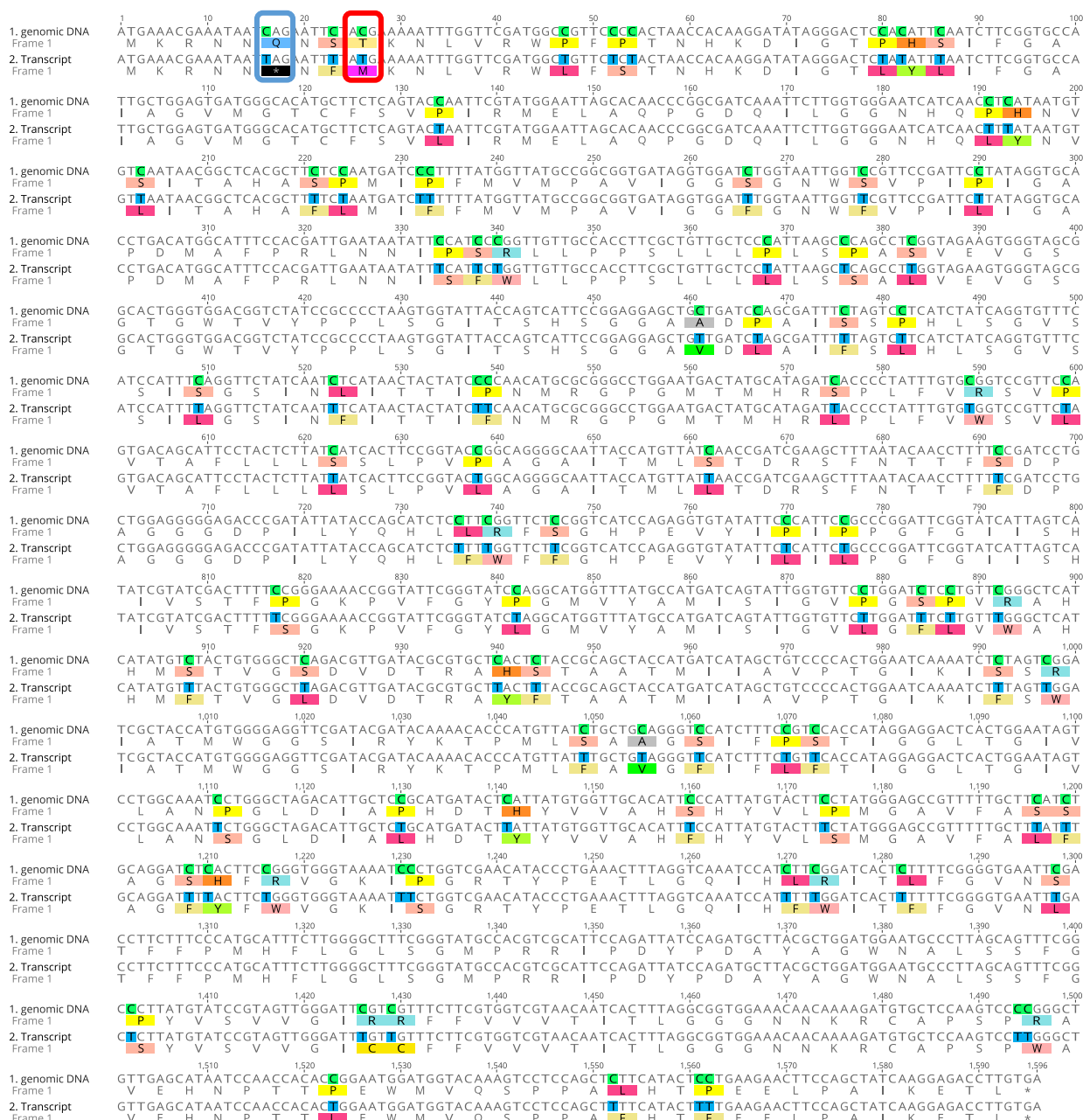


Figure S3. Nucleotide and amino acid sequence alignments of the mitochondrial *rps19* gene. Red box indicate an alternative start codon created by RNA editing.

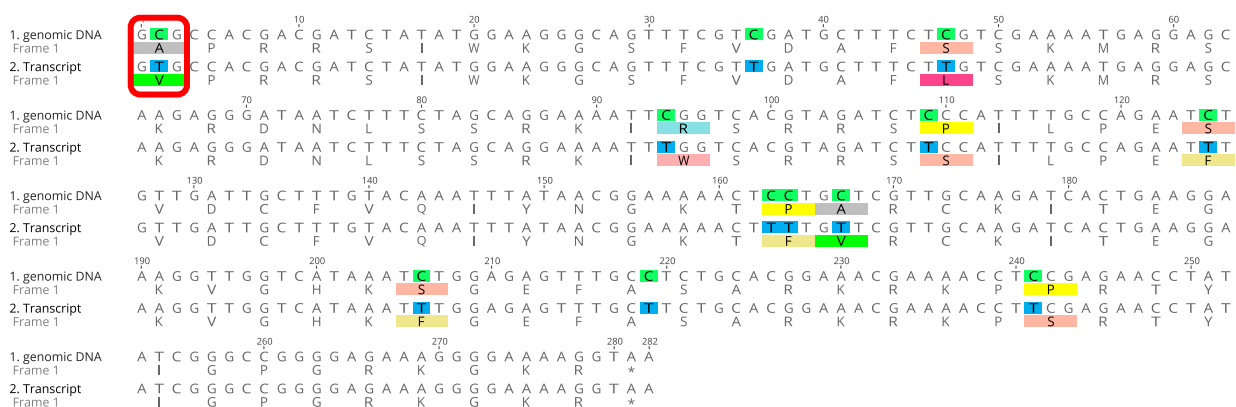
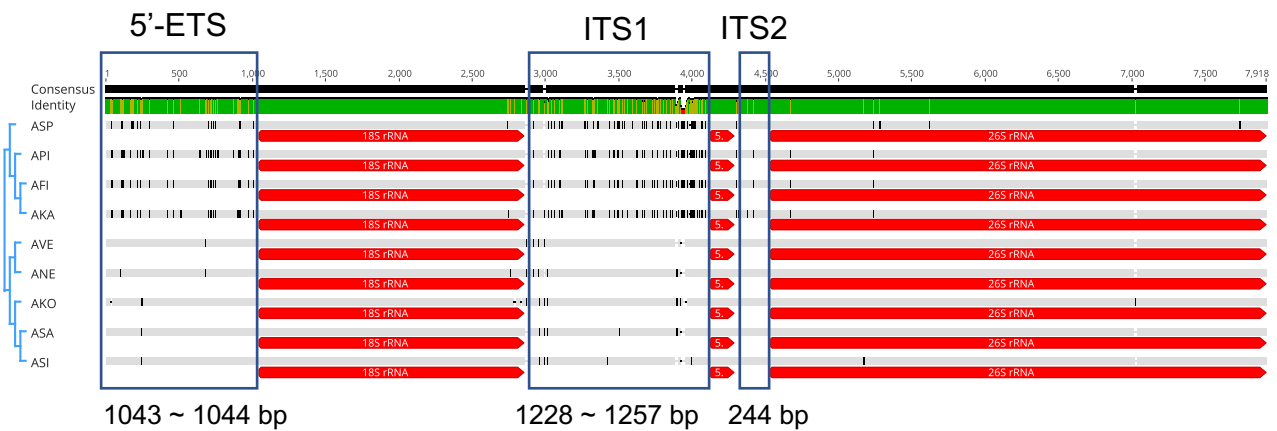


Figure S4. Structural alignments of nuclear ribosomal DNA regions from nine *Abies* species. Neighbor-joining tree was constructed using this dataset. Red boxes indicate a 18S, 5.8S, and 26S rRNA. ASP: *A. spectabilis*, API: *A. pindrow*, AFI: *A. firma*, AKA: *A. kawakamii*, AVE: *A. veitchii*, ANE: *A. nephrolepis*, AKO: *A. koreana*, ASA: *A. sachalinensis*, ASI: *A. sibirica*.



Taxon	Total size (bp)	5'-ETS (bp)	18S rRNA (bp)	ITS1 (bp)	5.8S rRNA (bp)	ITS2 (bp)	26S rRNA
<i>A. kawakamii</i>	7906	1044	1812	1257	162	244	3387
<i>A. nephrolepis</i>	7883	1044	1812	1234	162	244	3387
<i>A. pindrow</i>	7904	1044	1812	1255	162	244	3387
<i>A. sachalinensis</i>	7882	1044	1812	1233	162	244	3387
<i>A. sibirica</i>	7877	1044	1812	1228	162	244	3387
<i>A. spectabilis</i>	7904	1044	1812	1255	162	244	3387
<i>A. veitchii</i>	7878	1044	1812	1229	162	244	3387
<i>A. firma</i>	7905	1044	1812	1256	162	244	3387
<i>A. koreana</i>	7881	1043	1810	1234	162	244	3388

Figure S5. Maximum likelihood tree based on a concatenated alignment from 41 mitochondrial genes and 13 introns of *Abies* species.
The bootstrap value based on 1,000 replicates and > 50% is shown for each node.

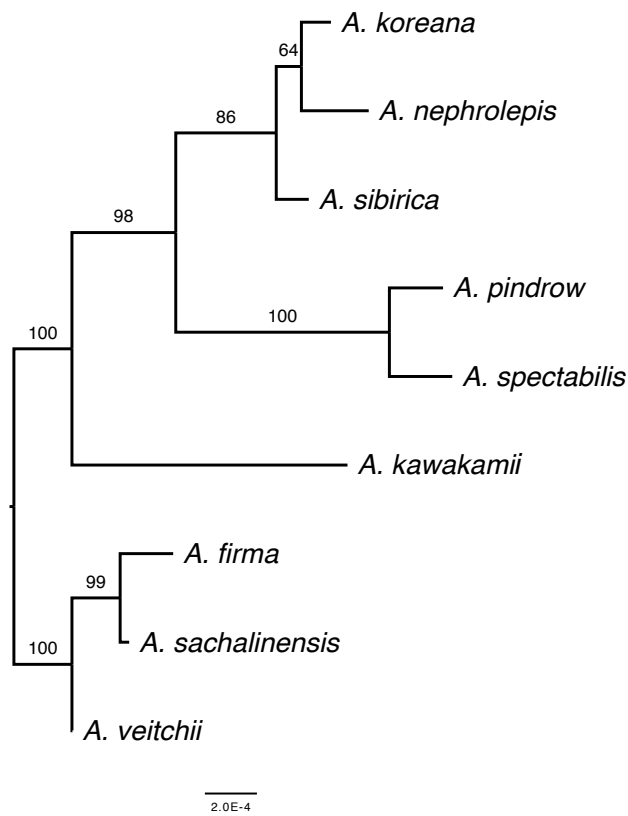
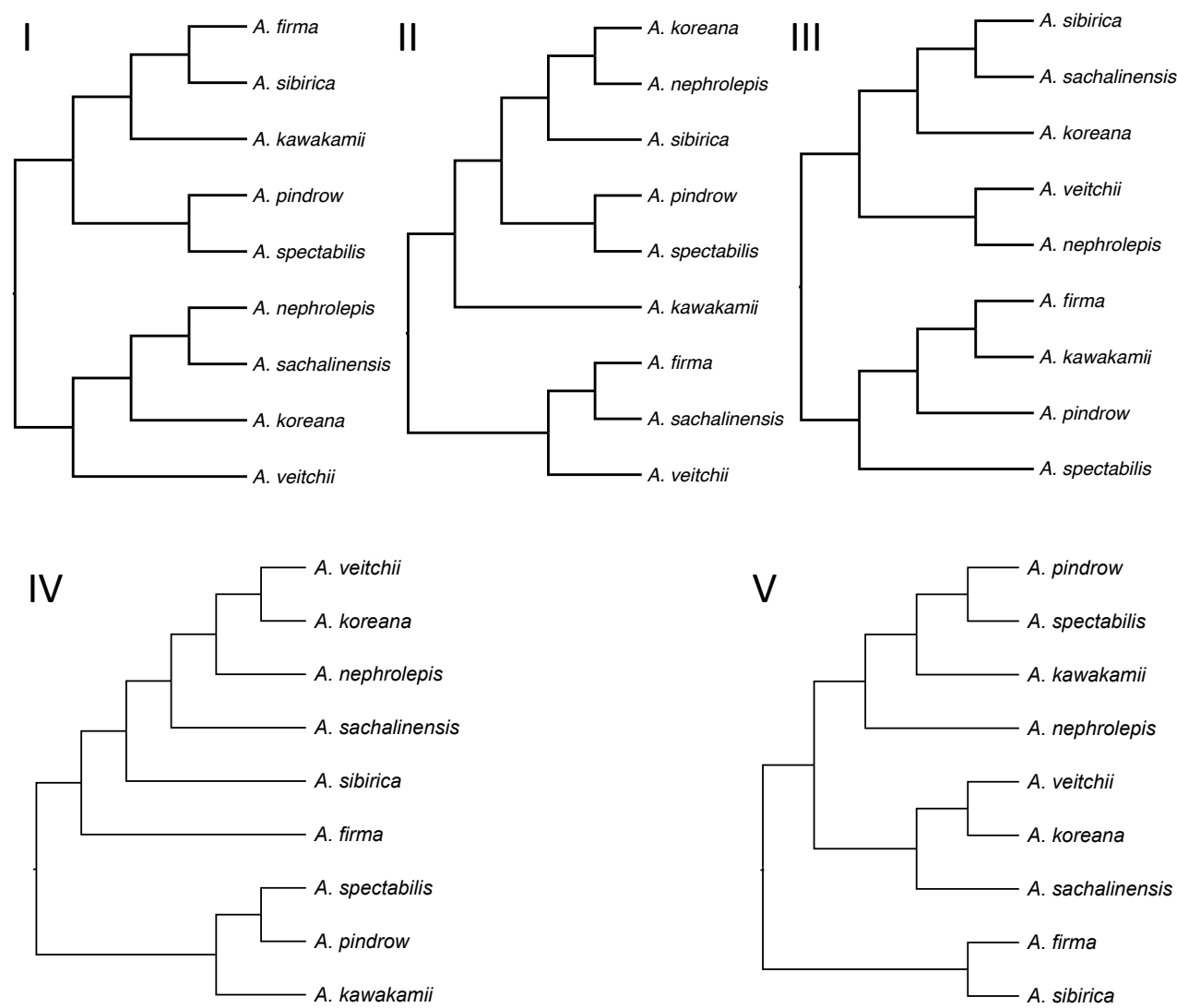


Figure S6. Tests for alternative tree topologies using four different datasets.

AU: *p*-value of approximately unbiased (AU) test, SH: *p*-value of Shimodaira-Hasegawa test, KH: *p*-value of one sided Kishino-Hasegawa test



Dataset	Tree topology (AU/SH/KH)				
	I	II	III	IV	V
Whole plastome sequences	1/1/1	0/0/0	0/0/0	0/0/0	0/0/0
41+13 mitochondrial sequences	0/0/0	1/1/1	0/0/0	0/0/0	0/0/0
Nuclear rDNA sequences	0/0/0	0/0/0	1/1/1	0/0/0	0/0/0
452 nuclear sequences	0/0/0	0/0/0	0/0/0	0/0/0	1/1/0.993

Figure S7. Phylogenetic networks among the analyzed *Abies* species inferred by SplitsTree4.

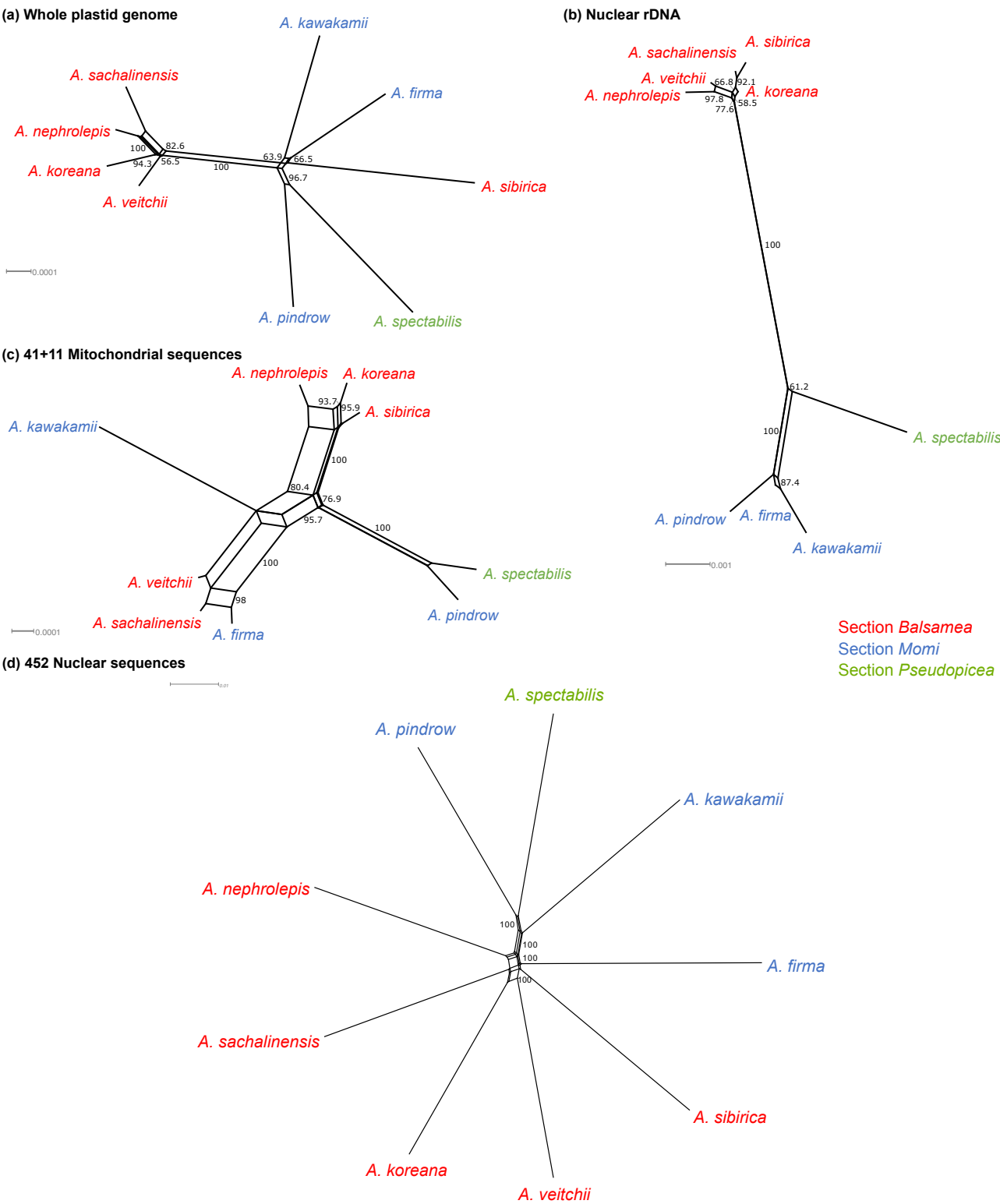


Table S1. Predicted repeat pairs in *Abies koreana* mitochondrial genome.

Repeat	Length	Start	End	Direction	Repeat	Length	Start	End	Direction
Repeat_1	27029	611642	638670	plus	Repeat_306	36	448942	448907	minus
Repeat_1	27029	843862	870890	plus	Repeat_306	36	424477	424512	plus
Repeat_2	23927	594944	618870	plus	Repeat_307	36	371962	371997	plus
Repeat_2	23927	1150877	1174803	plus	Repeat_307	36	909938	909903	minus
Repeat_3	22344	572600	594943	plus	Repeat_308	36	366983	366948	minus
Repeat_3	22344	1128527	1150870	plus	Repeat_308	36	371666	371701	plus
Repeat_4	12115	725642	737756	plus	Repeat_308	36	703276	703241	minus
Repeat_4	12115	1017695	1029809	plus	Repeat_309	36	1046651	1046616	minus
Repeat_5	7414	60048	67461	plus	Repeat_309	36	365500	365535	plus
Repeat_5	7414	251784	244371	minus	Repeat_310	36	353371	353406	plus
Repeat_6	7229	611642	618870	plus	Repeat_310	36	769576	769611	plus
Repeat_6	7229	843862	851090	plus	Repeat_311	36	348814	348849	plus
Repeat_6	7229	1167575	1174803	plus	Repeat_311	36	947739	947704	minus
Repeat_7	5291	737758	743048	plus	Repeat_312	36	641733	641698	minus
Repeat_7	5291	1029811	1035101	plus	Repeat_312	36	346583	346618	plus
Repeat_8	1234	276871	278104	plus	Repeat_313	36	325340	325375	plus
Repeat_8	1234	475135	476368	plus	Repeat_313	36	709092	709127	plus
Repeat_9	1043	278106	279148	plus	Repeat_314	36	325019	325054	plus
Repeat_9	1043	476370	477412	plus	Repeat_314	36	939206	939241	plus
Repeat_10	987	275883	276869	plus	Repeat_315	36	324830	324865	plus
Repeat_10	987	474147	475133	plus	Repeat_315	36	462082	462117	plus
Repeat_11	852	458611	459462	plus	Repeat_315	36	1052083	1052118	plus
Repeat_11	852	1082760	1081909	minus	Repeat_316	36	1016441	1016406	minus
Repeat_12	687	743171	743857	plus	Repeat_316	36	1016478	1016443	minus
Repeat_12	687	1035228	1035914	plus	Repeat_316	36	1042609	1042574	minus
Repeat_13	533	744082	744614	plus	Repeat_316	36	322349	322384	plus
Repeat_13	533	1036162	1036694	plus	Repeat_316	36	324671	324706	plus
Repeat_14	520	666	1185	plus	Repeat_317	36	307038	307073	plus
Repeat_14	520	936042	935523	minus	Repeat_317	36	448300	448335	plus
Repeat_15	516	157214	157729	plus	Repeat_318	36	278695	278730	plus
Repeat_15	516	334666	334151	minus	Repeat_318	36	476959	476994	plus
Repeat_16	341	228965	229305	plus	Repeat_318	36	929518	929483	minus
Repeat_16	341	729283	728943	minus	Repeat_319	36	278500	278535	plus
Repeat_16	341	1021336	1020996	minus	Repeat_319	36	336238	336203	minus
Repeat_17	319	744637	744955	plus	Repeat_319	36	476764	476799	plus
Repeat_17	319	998698	999016	plus	Repeat_320	36	640897	640862	minus
Repeat_18	283	461059	461341	plus	Repeat_320	36	278069	278104	plus
Repeat_18	283	708119	708401	plus	Repeat_320	36	476333	476368	plus
Repeat_19	281	458329	458609	plus	Repeat_321	36	257725	257760	plus
Repeat_19	281	1083042	1082762	minus	Repeat_321	36	371579	371544	minus
Repeat_20	270	24570	24839	plus	Repeat_321	36	619970	620005	plus
Repeat_20	270	922534	922265	minus	Repeat_321	36	743052	743087	plus
Repeat_21	266	829223	829488	plus	Repeat_321	36	773618	773583	minus
Repeat_21	266	979839	979574	minus	Repeat_321	36	852190	852225	plus
Repeat_22	218	334649	334866	plus	Repeat_321	36	1035105	1035140	plus
Repeat_22	218	594935	595152	plus	Repeat_322	36	230815	230850	plus
Repeat_23	209	334658	334866	plus	Repeat_322	36	302271	302306	plus
Repeat_23	209	594944	595152	plus	Repeat_323	36	158155	158190	plus
Repeat_23	209	1150877	1151085	plus	Repeat_323	36	927925	927960	plus
Repeat_24	203	743878	744080	plus	Repeat_324	36	147826	147861	plus
Repeat_24	203	1035958	1036160	plus	Repeat_324	36	311009	310974	minus
Repeat_26	182	461345	461526	plus	Repeat_325	36	1046667	1046632	minus
Repeat_26	182	708411	708592	plus	Repeat_325	36	146233	146268	plus
Repeat_27	180	617463	617642	plus	Repeat_326	36	108082	108117	plus
Repeat_27	180	849683	849862	plus	Repeat_326	36	128237	128202	minus
Repeat_27	180	1016481	1016660	plus	Repeat_326	36	1118046	1118081	plus
Repeat_27	180	1173396	1173575	plus	Repeat_327	36	104901	104936	plus

Repeat_28	161	744616	744776	plus	Repeat_327	36	576133	576168	plus
Repeat_28	161	1036696	1036856	plus	Repeat_327	36	1132060	1132095	plus
Repeat_29	159	676381	676539	plus	Repeat_328	36	58814	58849	plus
Repeat_29	159	810320	810478	plus	Repeat_328	36	961080	961115	plus
Repeat_30	154	969	1122	plus	Repeat_329	36	53858	53893	plus
Repeat_30	154	522161	522008	minus	Repeat_329	36	522645	522680	plus
Repeat_30	154	935739	935586	minus	Repeat_329	36	1101795	1101830	plus
Repeat_31	143	324772	324914	plus	Repeat_330	36	37514	37549	plus
Repeat_31	143	1052025	1052167	plus	Repeat_330	36	257650	257685	plus
Repeat_32	141	1	141	plus	Repeat_330	36	325361	325396	plus
Repeat_32	141	618871	619011	plus	Repeat_330	36	742979	743014	plus
Repeat_32	141	851091	851231	plus	Repeat_330	36	1035032	1035067	plus
Repeat_33	140	744637	744776	plus	Repeat_331	36	427503	427468	minus
Repeat_33	140	998698	998837	plus	Repeat_331	36	490729	490694	minus
Repeat_33	140	1036717	1036856	plus	Repeat_331	36	27336	27371	plus
Repeat_34	137	461728	461864	plus	Repeat_332	36	22921	22956	plus
Repeat_34	137	708819	708955	plus	Repeat_332	36	389854	389819	minus
Repeat_35	127	775348	775222	minus	Repeat_333	35	1078387	1078421	plus
Repeat_35	127	618250	618376	plus	Repeat_333	35	1107221	1107187	minus
Repeat_35	127	850470	850596	plus	Repeat_334	35	946629	946663	plus
Repeat_35	127	1174183	1174309	plus	Repeat_334	35	1105920	1105886	minus
Repeat_36	116	117998	118113	plus	Repeat_335	35	909902	909936	plus
Repeat_36	116	937984	938099	plus	Repeat_335	35	910058	910092	plus
Repeat_37	116	108136	108251	plus	Repeat_336	35	899339	899373	plus
Repeat_37	116	128184	128069	minus	Repeat_336	35	943822	943856	plus
Repeat_38	110	104979	105088	plus	Repeat_337	35	778810	778844	plus
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Repeat_38	110	1132138	1132247	plus	Repeat_338	35	717985	718019	plus
Repeat_39	109	379237	379345	plus	Repeat_338	35	1066088	1066122	plus
Repeat_39	109	594800	594908	plus	Repeat_339	35	775791	775757	minus
Repeat_39	109	1150727	1150835	plus	Repeat_339	35	618199	618233	plus
Repeat_40	106	389160	389265	plus	Repeat_339	35	850419	850453	plus
Repeat_40	106	390987	391092	plus	Repeat_339	35	1174132	1174166	plus
Repeat_42	103	586455	586557	plus	Repeat_340	35	257668	257634	minus
Repeat_42	103	726447	726345	minus	Repeat_340	35	560529	560563	plus
Repeat_42	103	1018500	1018398	minus	Repeat_340	35	773673	773707	plus
Repeat_42	103	1142382	1142484	plus	Repeat_341	35	521559	521593	plus
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Repeat_43	103	851818	851716	minus	Repeat_342	35	518604	518638	plus
Repeat_44	102	829513	829614	plus	Repeat_343	35	478654	478688	plus
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Repeat_50	88	774162	774075	minus	Repeat_347	35	997894	997860	minus
Repeat_51	88	257642	257729	plus	Repeat_347	35	427151	427185	plus
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Repeat_52	87	617779	617865	plus	Repeat_348	35	1109566	1109600	plus
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Repeat_54	86	617912	617997	plus	Repeat_351	35	922064	922098	plus
Repeat_54	86	850132	850217	plus	Repeat_352	35	324880	324914	plus
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Repeat_56	84	308682	308765	plus	Repeat_354	35	308608	308642	plus
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Repeat_65	79	692323	692245	minus	Repeat_361	35	115006	115040	plus
Repeat_66	78	366948	367025	plus	Repeat_361	35	351166	351132	minus
Repeat_66	78	371701	371624	minus	Repeat_362	35	96291	96325	plus
Repeat_67	77	446231	446155	minus	Repeat_362	35	662335	662301	minus
Repeat_67	77	308514	308590	plus	Repeat_363	35	90422	90456	plus
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Repeat_71	75	52100	52174	plus	Repeat_367	35	910271	910305	plus
Repeat_71	75	594564	594490	minus	Repeat_367	35	1101796	1101830	plus
Repeat_71	75	1150491	1150417	minus	Repeat_368	35	462185	462151	minus
Repeat_72	74	529	602	plus	Repeat_368	35	53855	53889	plus
Repeat_72	74	619065	619138	plus	Repeat_368	35	427176	427210	plus
Repeat_72	74	851285	851358	plus	Repeat_368	35	522642	522676	plus
Repeat_73	73	773877	773949	plus	Repeat_368	35	773611	773645	plus
Repeat_73	73	972076	972004	minus	Repeat_369	35	53304	53338	plus
Repeat_74	73	257353	257425	plus	Repeat_369	35	521885	521919	plus
Repeat_74	73	308608	308680	plus	Repeat_370	35	755	789	plus
Repeat_75	72	618386	618457	plus	Repeat_370	35	24282	24316	plus
Repeat_75	72	850606	850677	plus	Repeat_370	35	935953	935919	minus
Repeat_75	72	1174319	1174390	plus	Repeat_371	34	1106948	1106981	plus
Repeat_75	72	775212	775141	minus	Repeat_371	34	1118044	1118011	minus
Repeat_76	72	353277	353348	plus	Repeat_372	34	910148	910181	plus
Repeat_76	72	769483	769554	plus	Repeat_372	34	1037819	1037786	minus
Repeat_77	71	460746	460816	plus	Repeat_373	34	789717	789750	plus
Repeat_77	71	707799	707869	plus	Repeat_373	34	1106555	1106588	plus

Repeat_78	71	257260	257330	plus	Repeat_374	34	773664	773697	plus
Repeat_78	71	308514	308584	plus	Repeat_374	34	932628	932661	plus
Repeat_78	71	446231	446161	minus	Repeat_375	34	53858	53891	plus
Repeat_78	71	774145	774075	minus	Repeat_375	34	522645	522678	plus
Repeat_79	71	128260	128190	minus	Repeat_375	34	773614	773647	plus
Repeat_79	71	108059	108129	plus	Repeat_375	34	1101795	1101828	plus
Repeat_80	70	146433	146502	plus	Repeat_376	34	619859	619892	plus
Repeat_80	70	460145	460214	plus	Repeat_376	34	709098	709131	plus
Repeat_81	69	1106286	1106354	plus	Repeat_376	34	852079	852112	plus
Repeat_81	69	1106510	1106578	plus	Repeat_377	34	532923	532956	plus
Repeat_82	69	1003995	1003927	minus	Repeat_377	34	1109522	1109555	plus
Repeat_82	69	970303	970371	plus	Repeat_378	34	462079	462112	plus
Repeat_83	69	51596	51528	minus	Repeat_378	34	774002	773969	minus
Repeat_83	69	24474	24542	plus	Repeat_379	34	460869	460902	plus
Repeat_84	69	600	668	plus	Repeat_379	34	707918	707951	plus
Repeat_84	69	619138	619206	plus	Repeat_380	34	452420	452453	plus
Repeat_84	69	851358	851426	plus	Repeat_380	34	452440	452473	plus
Repeat_85	68	830282	830349	plus	Repeat_381	34	909936	909903	minus
Repeat_85	68	830350	830417	plus	Repeat_381	34	910092	910059	minus
Repeat_86	68	594506	594573	plus	Repeat_381	34	371964	371997	plus
Repeat_86	68	927193	927126	minus	Repeat_382	34	371962	371995	plus
Repeat_86	68	1150433	1150500	plus	Repeat_382	34	773966	773999	plus
Repeat_87	68	148066	148133	plus	Repeat_382	34	909938	909905	minus
Repeat_87	68	310765	310698	minus	Repeat_383	34	347072	347105	plus
Repeat_88	67	460677	460743	plus	Repeat_383	34	729765	729798	plus
Repeat_88	67	707730	707796	plus	Repeat_383	34	1021818	1021851	plus
Repeat_89	67	403285	403351	plus	Repeat_384	34	325011	325044	plus
Repeat_89	67	534692	534758	plus	Repeat_384	34	513860	513893	plus
Repeat_90	67	308771	308837	plus	Repeat_385	34	324827	324860	plus
Repeat_90	67	445975	445909	minus	Repeat_385	34	909902	909935	plus
Repeat_91	67	55134	55200	plus	Repeat_385	34	910058	910091	plus
Repeat_91	67	432201	432267	plus	Repeat_385	34	1052080	1052113	plus
Repeat_92	66	388050	388115	plus	Repeat_386	34	322588	322621	plus
Repeat_92	66	1114236	1114301	plus	Repeat_386	34	448732	448765	plus
Repeat_93	66	158434	158499	plus	Repeat_387	34	309406	309439	plus
Repeat_93	66	996764	996699	minus	Repeat_387	34	1042939	1042972	plus
Repeat_94	66	104679	104744	plus	Repeat_388	34	289125	289158	plus
Repeat_94	66	575889	575954	plus	Repeat_388	34	533077	533110	plus
Repeat_94	66	1131816	1131881	plus	Repeat_389	34	257631	257664	plus
Repeat_95	66	336280	336215	minus	Repeat_389	34	726076	726109	plus
Repeat_95	66	25099	25164	plus	Repeat_389	34	1018129	1018162	plus
Repeat_96	65	971827	971763	minus	Repeat_389	34	371801	371768	minus
Repeat_96	65	685193	685257	plus	Repeat_389	34	773710	773677	minus
Repeat_97	65	427189	427253	plus	Repeat_390	34	257629	257662	plus
Repeat_97	65	743046	742982	minus	Repeat_390	34	371803	371770	minus
Repeat_97	65	1035099	1035035	minus	Repeat_390	34	702852	702819	minus
Repeat_98	65	351646	351710	plus	Repeat_390	34	773712	773679	minus
Repeat_98	65	619725	619661	minus	Repeat_391	34	257621	257654	plus
Repeat_98	65	851945	851881	minus	Repeat_391	34	910053	910086	plus
Repeat_99	65	117803	117867	plus	Repeat_391	34	371811	371778	minus
Repeat_99	65	929631	929695	plus	Repeat_392	34	255487	255520	plus
Repeat_100	64	162661	162724	plus	Repeat_392	34	307117	307150	plus
Repeat_100	64	805017	804954	minus	Repeat_393	34	335317	335284	minus
Repeat_101	63	388694	388756	plus	Repeat_393	34	175578	175611	plus
Repeat_101	63	390769	390831	plus	Repeat_394	34	153802	153835	plus
Repeat_102	63	348117	348179	plus	Repeat_394	34	325340	325373	plus
Repeat_102	63	1107124	1107062	minus	Repeat_394	34	709092	709125	plus
Repeat_103	63	255396	255458	plus	Repeat_395	34	146146	146179	plus
Repeat_103	63	304310	304372	plus	Repeat_395	34	390945	390978	plus
Repeat_104	62	741817	741878	plus	Repeat_396	34	141026	141059	plus
Repeat_104	62	980531	980592	plus	Repeat_396	34	366535	366568	plus

Repeat_104	62	1033870	1033931	plus	Repeat_397	34	1043799	1043766	minus
Repeat_105	62	427250	427189	minus	Repeat_397	34	137828	137861	plus
Repeat_105	62	462111	462172	plus	Repeat_398	34	128026	128059	plus
Repeat_105	62	742985	743046	plus	Repeat_398	34	1078389	1078422	plus
Repeat_105	62	1035038	1035099	plus	Repeat_399	34	1078778	1078745	minus
Repeat_106	62	162604	162665	plus	Repeat_399	34	127935	127968	plus
Repeat_106	62	805072	805011	minus	Repeat_400	34	111606	111639	plus
Repeat_107	61	967856	967916	plus	Repeat_400	34	1017552	1017519	minus
Repeat_107	61	967910	967970	plus	Repeat_401	34	53856	53889	plus
Repeat_108	61	618025	618085	plus	Repeat_401	34	349047	349080	plus
Repeat_108	61	707870	707930	plus	Repeat_401	34	427177	427210	plus
Repeat_108	61	850245	850305	plus	Repeat_401	34	462184	462151	minus
Repeat_108	61	1173958	1174018	plus	Repeat_401	34	522643	522676	plus
Repeat_109	61	211984	212044	plus	Repeat_401	34	773612	773645	plus
Repeat_109	61	241515	241575	plus	Repeat_402	34	53063	53096	plus
Repeat_110	60	773645	773586	minus	Repeat_402	34	106689	106722	plus
Repeat_110	60	462151	462210	plus	Repeat_403	34	52275	52308	plus
Repeat_111	60	228742	228801	plus	Repeat_403	34	927372	927405	plus
Repeat_111	60	419841	419900	plus	Repeat_404	34	44625	44658	plus
Repeat_112	60	127966	128025	plus	Repeat_404	34	907652	907619	minus
Repeat_112	60	1078742	1078683	minus	Repeat_405	34	37514	37547	plus
Repeat_113	60	51472	51531	plus	Repeat_405	34	257650	257683	plus
Repeat_113	60	477501	477560	plus	Repeat_405	34	325361	325394	plus
Repeat_114	59	943867	943925	plus	Repeat_405	34	513938	513971	plus
Repeat_114	59	963887	963829	minus	Repeat_405	34	742979	743012	plus
Repeat_115	59	366925	366983	plus	Repeat_405	34	1035032	1035065	plus
Repeat_115	59	703218	703276	plus	Repeat_406	33	1005168	1005200	plus
Repeat_116	59	619815	619757	minus	Repeat_406	33	1005219	1005251	plus
Repeat_116	59	852035	851977	minus	Repeat_407	33	935047	935079	plus
Repeat_116	59	351556	351614	plus	Repeat_407	33	935235	935267	plus
Repeat_117	59	52100	52158	plus	Repeat_408	33	827458	827490	plus
Repeat_117	59	927135	927193	plus	Repeat_408	33	827540	827572	plus
Repeat_117	59	594564	594506	minus	Repeat_409	33	53859	53891	plus
Repeat_117	59	1150491	1150433	minus	Repeat_409	33	522646	522678	plus
Repeat_118	58	476343	476400	plus	Repeat_409	33	773615	773647	plus
Repeat_118	58	640887	640830	minus	Repeat_409	33	910271	910303	plus
Repeat_118	58	765930	765873	minus	Repeat_409	33	1101796	1101828	plus
Repeat_119	58	371526	371583	plus	Repeat_410	33	742312	742344	plus
Repeat_119	58	1035158	1035101	minus	Repeat_410	33	980783	980815	plus
Repeat_120	58	353722	353779	plus	Repeat_410	33	1034365	1034397	plus
Repeat_120	58	1079752	1079695	minus	Repeat_411	33	594574	594606	plus
Repeat_121	57	910259	910203	minus	Repeat_411	33	1150501	1150533	plus
Repeat_121	57	462193	462249	plus	Repeat_411	33	927116	927084	minus
Repeat_122	57	365811	365867	plus	Repeat_412	33	513651	513683	plus
Repeat_122	57	927491	927547	plus	Repeat_412	33	591508	591540	plus
Repeat_123	57	153769	153825	plus	Repeat_412	33	1147435	1147467	plus
Repeat_123	57	702944	703000	plus	Repeat_413	33	491932	491964	plus
Repeat_124	57	51567	51623	plus	Repeat_413	33	531891	531859	minus
Repeat_124	57	336086	336030	minus	Repeat_414	33	460783	460815	plus
Repeat_125	56	1016406	1016461	plus	Repeat_414	33	707836	707868	plus
Repeat_125	56	1016443	1016498	plus	Repeat_414	33	882876	882908	plus
Repeat_126	56	743105	743050	minus	Repeat_415	33	450923	450955	plus
Repeat_126	56	1035158	1035103	minus	Repeat_415	33	539393	539361	minus
Repeat_126	56	371526	371581	plus	Repeat_415	33	1013791	1013823	plus
Repeat_127	56	462184	462129	minus	Repeat_416	33	448441	448473	plus
Repeat_127	56	349047	349102	plus	Repeat_416	33	501756	501724	minus
Repeat_127	56	427177	427232	plus	Repeat_417	33	430969	431001	plus
Repeat_128	56	308198	308253	plus	Repeat_417	33	484610	484578	minus
Repeat_128	56	761357	761302	minus	Repeat_418	33	388943	388975	plus
Repeat_129	55	590291	590345	plus	Repeat_418	33	389255	389223	minus
Repeat_129	55	977081	977135	plus	Repeat_418	33	391082	391050	minus

Repeat_129	55	1146218	1146272	plus	Repeat_419	33	388068	388100	plus
Repeat_130	54	162439	162492	plus	Repeat_419	33	797879	797847	minus
Repeat_130	54	805194	805141	minus	Repeat_419	33	1114254	1114286	plus
Repeat_131	54	104624	104677	plus	Repeat_420	33	972180	972148	minus
Repeat_131	54	575834	575887	plus	Repeat_420	33	371750	371782	plus
Repeat_131	54	1131761	1131814	plus	Repeat_421	33	351887	351919	plus
Repeat_132	54	85487	85540	plus	Repeat_421	33	619494	619462	minus
Repeat_132	54	799666	799719	plus	Repeat_421	33	851714	851682	minus
Repeat_133	54	53517	53570	plus	Repeat_422	33	347038	347070	plus
Repeat_133	54	593334	593281	minus	Repeat_422	33	729731	729763	plus
Repeat_133	54	1149261	1149208	minus	Repeat_422	33	1021784	1021816	plus
Repeat_134	53	594595	594647	plus	Repeat_423	33	334864	334896	plus
Repeat_134	53	927089	927037	minus	Repeat_423	33	593495	593527	plus
Repeat_134	53	1150522	1150574	plus	Repeat_423	33	1149422	1149454	plus
Repeat_135	53	427158	427210	plus	Repeat_424	33	330342	330374	plus
Repeat_135	53	773593	773645	plus	Repeat_424	33	1072234	1072202	minus
Repeat_135	53	462203	462151	minus	Repeat_425	33	325416	325448	plus
Repeat_136	53	403405	403457	plus	Repeat_425	33	427201	427169	minus
Repeat_136	53	534809	534861	plus	Repeat_425	33	462160	462192	plus
Repeat_137	53	388046	388098	plus	Repeat_425	33	773636	773604	minus
Repeat_137	53	557493	557545	plus	Repeat_426	33	324828	324860	plus
Repeat_138	53	51802	51854	plus	Repeat_426	33	371997	371965	minus
Repeat_138	53	923184	923132	minus	Repeat_426	33	909903	909935	plus
Repeat_139	53	51616	51668	plus	Repeat_426	33	910059	910091	plus
Repeat_139	53	336033	335981	minus	Repeat_426	33	1052081	1052113	plus
Repeat_140	52	807250	807301	plus	Repeat_427	33	322461	322493	plus
Repeat_140	52	1101772	1101721	minus	Repeat_427	33	666822	666854	plus
Repeat_141	52	776997	776946	minus	Repeat_428	33	308985	309017	plus
Repeat_141	52	591842	591893	plus	Repeat_428	33	427066	427098	plus
Repeat_141	52	1147769	1147820	plus	Repeat_429	33	257725	257757	plus
Repeat_142	52	256712	256763	plus	Repeat_429	33	462178	462210	plus
Repeat_142	52	736535	736484	minus	Repeat_429	33	619970	620002	plus
Repeat_142	52	1028588	1028537	minus	Repeat_429	33	743052	743084	plus
Repeat_143	52	193430	193481	plus	Repeat_429	33	852190	852222	plus
Repeat_143	52	958231	958180	minus	Repeat_429	33	1035105	1035137	plus
Repeat_144	52	175489	175540	plus	Repeat_429	33	371579	371547	minus
Repeat_144	52	335399	335348	minus	Repeat_429	33	773618	773586	minus
Repeat_145	52	778454	778403	minus	Repeat_429	33	987304	987272	minus
Repeat_145	52	54253	54304	plus	Repeat_430	33	255301	255333	plus
Repeat_146	52	53843	53894	plus	Repeat_430	33	304214	304246	plus
Repeat_146	52	522630	522681	plus	Repeat_431	33	210734	210766	plus
Repeat_147	51	807303	807353	plus	Repeat_431	33	235613	235645	plus
Repeat_147	51	1101719	1101669	minus	Repeat_432	33	193549	193581	plus
Repeat_148	51	774322	774372	plus	Repeat_432	33	958087	958055	minus
Repeat_148	51	1117945	1117895	minus	Repeat_433	33	173820	173852	plus
Repeat_149	51	460795	460845	plus	Repeat_433	33	620586	620618	plus
Repeat_149	51	617999	618049	plus	Repeat_433	33	852806	852838	plus
Repeat_149	51	850219	850269	plus	Repeat_434	33	151857	151889	plus
Repeat_149	51	1173932	1173982	plus	Repeat_434	33	1013769	1013737	minus
Repeat_150	51	460625	460675	plus	Repeat_435	33	147293	147325	plus
Repeat_150	51	707678	707728	plus	Repeat_435	33	971514	971546	plus
Repeat_151	51	403565	403615	plus	Repeat_436	33	108514	108546	plus
Repeat_151	51	535010	535060	plus	Repeat_436	33	127565	127533	minus
Repeat_152	51	322366	322416	plus	Repeat_437	33	56352	56384	plus
Repeat_152	51	322398	322448	plus	Repeat_437	33	450557	450525	minus
Repeat_153	51	277716	277766	plus	Repeat_438	33	53034	53066	plus
Repeat_153	51	277757	277807	plus	Repeat_438	33	106659	106691	plus
Repeat_153	51	475980	476030	plus	Repeat_439	33	37517	37549	plus
Repeat_153	51	476021	476071	plus	Repeat_439	33	257653	257685	plus
Repeat_154	51	153785	153835	plus	Repeat_439	33	325364	325396	plus
Repeat_154	51	325323	325373	plus	Repeat_439	33	742982	743014	plus

Repeat_155	51	65984	66034	plus	Repeat_439	33	1035035	1035067	plus
Repeat_155	51	245848	245798	minus	Repeat_439	33	427253	427221	minus
Repeat_155	51	308893	308943	plus	Repeat_440	33	1185	1217	plus
Repeat_156	50	932860	932909	plus	Repeat_440	33	128026	128058	plus
Repeat_156	50	932957	933006	plus	Repeat_440	33	1078389	1078421	plus
Repeat_157	50	966429	966380	minus	Repeat_440	33	1107219	1107187	minus
Repeat_157	50	793197	793246	plus	Repeat_441	32	963816	963847	plus
Repeat_158	50	650662	650711	plus	Repeat_441	32	1112780	1112811	plus
Repeat_158	50	653212	653261	plus	Repeat_442	32	883494	883525	plus
Repeat_159	50	348691	348740	plus	Repeat_442	32	929283	929314	plus
Repeat_159	50	667929	667880	minus	Repeat_443	32	371964	371995	plus
Repeat_160	50	246079	246030	minus	Repeat_443	32	773968	773999	plus
Repeat_160	50	65753	65802	plus	Repeat_443	32	909936	909905	minus
Repeat_160	50	591595	591644	plus	Repeat_443	32	910092	910061	minus
Repeat_160	50	1147522	1147571	plus	Repeat_444	32	722929	722960	plus
Repeat_161	49	720791	720839	plus	Repeat_444	32	925712	925681	minus
Repeat_161	49	722594	722642	plus	Repeat_445	32	718143	718174	plus
Repeat_162	49	388050	388098	plus	Repeat_445	32	927299	927330	plus
Repeat_162	49	557497	557545	plus	Repeat_446	32	257662	257631	minus
Repeat_162	49	1114236	1114284	plus	Repeat_446	32	371770	371801	plus
Repeat_163	49	460912	460960	plus	Repeat_446	32	702819	702850	plus
Repeat_163	49	707952	708000	plus	Repeat_446	32	726107	726076	minus
Repeat_164	49	815774	815726	minus	Repeat_446	32	773679	773710	plus
Repeat_164	49	448866	448914	plus	Repeat_446	32	1018160	1018129	minus
Repeat_165	49	388758	388806	plus	Repeat_447	32	695023	695054	plus
Repeat_165	49	390833	390881	plus	Repeat_447	32	758435	758404	minus
Repeat_166	49	231721	231769	plus	Repeat_448	32	619791	619822	plus
Repeat_166	49	310320	310368	plus	Repeat_448	32	729366	729335	minus
Repeat_167	48	460746	460793	plus	Repeat_448	32	852011	852042	plus
Repeat_167	48	617950	617997	plus	Repeat_448	32	1021419	1021388	minus
Repeat_167	48	707799	707846	plus	Repeat_449	32	602203	602234	plus
Repeat_167	48	850170	850217	plus	Repeat_449	32	602369	602400	plus
Repeat_167	48	1173883	1173930	plus	Repeat_449	32	1158136	1158167	plus
Repeat_168	48	324880	324927	plus	Repeat_449	32	1158302	1158333	plus
Repeat_168	48	324915	324962	plus	Repeat_450	32	405316	405347	plus
Repeat_169	48	158088	158135	plus	Repeat_450	32	901867	901836	minus
Repeat_169	48	278320	278367	plus	Repeat_451	32	371967	371998	plus
Repeat_169	48	476584	476631	plus	Repeat_451	32	761199	761230	plus
Repeat_170	48	111556	111603	plus	Repeat_452	32	53858	53889	plus
Repeat_170	48	1017603	1017556	minus	Repeat_452	32	349049	349080	plus
Repeat_171	47	967281	967327	plus	Repeat_452	32	427179	427210	plus
Repeat_171	47	1083135	1083181	plus	Repeat_452	32	462182	462151	minus
Repeat_172	47	460273	460227	minus	Repeat_452	32	522645	522676	plus
Repeat_172	47	458089	458135	plus	Repeat_452	32	773614	773645	plus
Repeat_173	47	325275	325321	plus	Repeat_452	32	1101795	1101826	plus
Repeat_173	47	983629	983675	plus	Repeat_453	32	153804	153835	plus
Repeat_174	47	257648	257694	plus	Repeat_453	32	325342	325373	plus
Repeat_174	47	325359	325405	plus	Repeat_453	32	709094	709125	plus
Repeat_174	47	742977	743023	plus	Repeat_453	32	983696	983727	plus
Repeat_174	47	1035030	1035076	plus	Repeat_454	32	324762	324793	plus
Repeat_175	47	147484	147530	plus	Repeat_454	32	909897	909866	minus
Repeat_175	47	971715	971761	plus	Repeat_455	32	288991	289022	plus
Repeat_176	47	146084	146130	plus	Repeat_455	32	786963	786994	plus
Repeat_176	47	1042570	1042524	minus	Repeat_456	32	276353	276384	plus
Repeat_177	46	970207	970252	plus	Repeat_456	32	474617	474648	plus
Repeat_177	46	1004089	1004044	minus	Repeat_456	32	808757	808726	minus
Repeat_178	46	689599	689644	plus	Repeat_457	32	235779	235810	plus
Repeat_178	46	1043064	1043019	minus	Repeat_457	32	333653	333622	minus
Repeat_179	46	591892	591937	plus	Repeat_458	32	229536	229567	plus
Repeat_179	46	776942	776897	minus	Repeat_458	32	230841	230872	plus
Repeat_179	46	1147819	1147864	plus	Repeat_459	32	200787	200818	plus

Repeat_180	46	212045	212090	plus	Repeat_459	32	546724	546755	plus
Repeat_180	46	212121	212166	plus	Repeat_460	32	175539	175570	plus
Repeat_181	46	163146	163191	plus	Repeat_460	32	335353	335322	minus
Repeat_181	46	163216	163261	plus	Repeat_461	32	164123	164154	plus
Repeat_182	46	51810	51855	plus	Repeat_461	32	629980	629949	minus
Repeat_182	46	335846	335801	minus	Repeat_461	32	862200	862169	minus
Repeat_183	46	24540	24585	plus	Repeat_462	32	162645	162676	plus
Repeat_183	46	335540	335495	minus	Repeat_462	32	682562	682593	plus
Repeat_184	45	776794	776838	plus	Repeat_463	32	153751	153782	plus
Repeat_184	45	813887	813931	plus	Repeat_463	32	325289	325320	plus
Repeat_185	45	371544	371588	plus	Repeat_463	32	983643	983674	plus
Repeat_185	45	773583	773627	plus	Repeat_464	32	127464	127495	plus
Repeat_186	45	51854	51810	minus	Repeat_464	32	967211	967180	minus
Repeat_186	45	335802	335846	plus	Repeat_465	32	108083	108114	plus
Repeat_186	45	923132	923176	plus	Repeat_465	32	128236	128205	minus
Repeat_187	45	324666	324710	plus	Repeat_465	32	590987	590956	minus
Repeat_187	45	1016483	1016439	minus	Repeat_465	32	1118047	1118078	plus
Repeat_188	45	324625	324669	plus	Repeat_465	32	1146914	1146883	minus
Repeat_188	45	426975	427019	plus	Repeat_466	32	67262	67293	plus
Repeat_188	45	818095	818139	plus	Repeat_466	32	244570	244539	minus
Repeat_189	45	162288	162332	plus	Repeat_466	32	647765	647734	minus
Repeat_189	45	805340	805296	minus	Repeat_467	32	66036	66067	plus
Repeat_190	45	246119	246075	minus	Repeat_467	32	245796	245765	minus
Repeat_190	45	65713	65757	plus	Repeat_467	32	324827	324858	plus
Repeat_190	45	513673	513717	plus	Repeat_467	32	909902	909933	plus
Repeat_191	45	58768	58812	plus	Repeat_467	32	910058	910089	plus
Repeat_191	45	961034	961078	plus	Repeat_467	32	1052080	1052111	plus
Repeat_192	45	27336	27380	plus	Repeat_468	32	56365	56396	plus
Repeat_192	45	427503	427459	minus	Repeat_468	32	815735	815704	minus
Repeat_193	44	471823	471866	plus	Repeat_469	32	52067	52098	plus
Repeat_193	44	471845	471888	plus	Repeat_469	32	927106	927137	plus
Repeat_194	44	349059	349102	plus	Repeat_470	32	25110	25141	plus
Repeat_194	44	427189	427232	plus	Repeat_470	32	116438	116407	minus
Repeat_194	44	462172	462129	minus	Repeat_470	32	336269	336238	minus
Repeat_194	44	743046	743003	minus	Repeat_471	31	1080350	1080380	plus
Repeat_194	44	1035099	1035056	minus	Repeat_471	31	1117554	1117524	minus
Repeat_195	44	302208	302251	plus	Repeat_472	31	1070889	1070919	plus
Repeat_195	44	721141	721098	minus	Repeat_472	31	1070952	1070982	plus
Repeat_196	44	297460	297503	plus	Repeat_473	31	1014530	1014560	plus
Repeat_196	44	297487	297530	plus	Repeat_473	31	1117735	1117765	plus
Repeat_197	44	278106	278149	plus	Repeat_474	31	981072	981102	plus
Repeat_197	44	476370	476413	plus	Repeat_474	31	1017228	1017258	plus
Repeat_197	44	640860	640817	minus	Repeat_475	31	970254	970284	plus
Repeat_198	44	257621	257664	plus	Repeat_475	31	1004042	1004012	minus
Repeat_198	44	371811	371768	minus	Repeat_476	31	883524	883494	minus
Repeat_199	44	255348	255391	plus	Repeat_476	31	929313	929283	minus
Repeat_199	44	304266	304309	plus	Repeat_476	31	922051	922081	plus
Repeat_200	44	193491	193534	plus	Repeat_477	31	726055	726085	plus
Repeat_200	44	958153	958110	minus	Repeat_477	31	971138	971168	plus
Repeat_201	44	153701	153744	plus	Repeat_477	31	1018108	1018138	plus
Repeat_201	44	983593	983636	plus	Repeat_478	31	703560	703590	plus
Repeat_202	44	147863	147906	plus	Repeat_478	31	703611	703641	plus
Repeat_202	44	310972	310929	minus	Repeat_479	31	619874	619904	plus
Repeat_203	44	108532	108575	plus	Repeat_479	31	852094	852124	plus
Repeat_203	44	967124	967167	plus	Repeat_479	31	972148	972178	plus
Repeat_204	44	51863	51906	plus	Repeat_479	31	371782	371752	minus
Repeat_204	44	923007	922964	minus	Repeat_480	31	577898	577928	plus
Repeat_205	43	943829	943871	plus	Repeat_480	31	577911	577941	plus
Repeat_205	43	953012	953054	plus	Repeat_480	31	1133825	1133855	plus
Repeat_206	43	743127	743169	plus	Repeat_480	31	1133838	1133868	plus
Repeat_206	43	1035184	1035226	plus	Repeat_481	31	573889	573919	plus

Repeat_207	43	497969	498011	plus	Repeat_481	31	577612	577642	plus
Repeat_207	43	981207	981249	plus	Repeat_481	31	1129816	1129846	plus
Repeat_208	43	325352	325394	plus	Repeat_481	31	1133539	1133569	plus
Repeat_208	43	513929	513971	plus	Repeat_482	31	388068	388098	plus
Repeat_209	43	302301	302343	plus	Repeat_482	31	557515	557545	plus
Repeat_209	43	322000	322042	plus	Repeat_482	31	797879	797849	minus
Repeat_210	43	302277	302319	plus	Repeat_482	31	1114254	1114284	plus
Repeat_210	43	721139	721097	minus	Repeat_483	31	518957	518987	plus
Repeat_211	43	257626	257668	plus	Repeat_483	31	518980	519010	plus
Repeat_211	43	773715	773673	minus	Repeat_484	31	445868	445898	plus
Repeat_212	43	186205	186247	plus	Repeat_484	31	462015	461985	minus
Repeat_212	43	1072411	1072453	plus	Repeat_485	31	37547	37517	minus
Repeat_213	43	113199	113241	plus	Repeat_485	31	257683	257653	minus
Repeat_213	43	1042689	1042731	plus	Repeat_485	31	325394	325364	minus
Repeat_214	43	1031	1073	plus	Repeat_485	31	513971	513941	minus
Repeat_214	43	429908	429866	minus	Repeat_485	31	743012	742982	minus
Repeat_214	43	522099	522057	minus	Repeat_485	31	1035065	1035035	minus
Repeat_214	43	935677	935635	minus	Repeat_485	31	427223	427253	plus
Repeat_215	42	970779	970820	plus	Repeat_486	31	419964	419994	plus
Repeat_215	42	1003815	1003774	minus	Repeat_486	31	1017457	1017487	plus
Repeat_216	42	460039	460080	plus	Repeat_487	31	324860	324830	minus
Repeat_216	42	1109623	1109664	plus	Repeat_487	31	371965	371995	plus
Repeat_217	42	371547	371588	plus	Repeat_487	31	462112	462082	minus
Repeat_217	42	462210	462169	minus	Repeat_487	31	773969	773999	plus
Repeat_217	42	773586	773627	plus	Repeat_487	31	909935	909905	minus
Repeat_218	42	929128	929087	minus	Repeat_487	31	910091	910061	minus
Repeat_218	42	334058	334099	plus	Repeat_487	31	1052113	1052083	minus
Repeat_219	42	721139	721098	minus	Repeat_488	31	257664	257634	minus
Repeat_219	42	302210	302251	plus	Repeat_488	31	371768	371798	plus
Repeat_219	42	302277	302318	plus	Repeat_488	31	560533	560563	plus
Repeat_220	42	257653	257694	plus	Repeat_488	31	726109	726079	minus
Repeat_220	42	325364	325405	plus	Repeat_488	31	773677	773707	plus
Repeat_220	42	742982	743023	plus	Repeat_488	31	1018162	1018132	minus
Repeat_220	42	1035035	1035076	plus	Repeat_489	31	352989	353019	plus
Repeat_220	42	427253	427212	minus	Repeat_489	31	608228	608198	minus
Repeat_221	42	257642	257683	plus	Repeat_489	31	1164161	1164131	minus
Repeat_221	42	325353	325394	plus	Repeat_490	31	462181	462151	minus
Repeat_221	42	513930	513971	plus	Repeat_490	31	53859	53889	plus
Repeat_222	42	230821	230862	plus	Repeat_490	31	349050	349080	plus
Repeat_222	42	1118163	1118122	minus	Repeat_490	31	427180	427210	plus
Repeat_223	42	141096	141137	plus	Repeat_490	31	522646	522676	plus
Repeat_223	42	366605	366646	plus	Repeat_490	31	773615	773645	plus
Repeat_224	42	106453	106494	plus	Repeat_490	31	910271	910301	plus
Repeat_224	42	513590	513549	minus	Repeat_490	31	1101796	1101826	plus
Repeat_225	42	85544	85585	plus	Repeat_491	31	348894	348924	plus
Repeat_225	42	799723	799764	plus	Repeat_491	31	668033	668003	minus
Repeat_226	42	24624	24665	plus	Repeat_492	31	324880	324910	plus
Repeat_226	42	922480	922439	minus	Repeat_492	31	324915	324945	plus
Repeat_226	42	927343	927384	plus	Repeat_492	31	774729	774759	plus
Repeat_227	42	22776	22817	plus	Repeat_492	31	1052133	1052163	plus
Repeat_227	42	835243	835284	plus	Repeat_493	31	324835	324865	plus
Repeat_228	41	814000	814040	plus	Repeat_493	31	349144	349114	minus
Repeat_228	41	906345	906385	plus	Repeat_493	31	462087	462117	plus
Repeat_229	41	388778	388818	plus	Repeat_493	31	1052088	1052118	plus
Repeat_229	41	424569	424609	plus	Repeat_494	31	324830	324860	plus
Repeat_230	41	153785	153825	plus	Repeat_494	31	371995	371965	minus
Repeat_230	41	325323	325363	plus	Repeat_494	31	462082	462112	plus
Repeat_230	41	702960	703000	plus	Repeat_494	31	773999	773969	minus
Repeat_231	41	324666	324706	plus	Repeat_494	31	909905	909935	plus
Repeat_231	41	1016446	1016406	minus	Repeat_494	31	910061	910091	plus
Repeat_231	41	1016483	1016443	minus	Repeat_494	31	1052083	1052113	plus

Repeat_232	41	322344	322384	plus	Repeat_495	31	322423	322453	plus
Repeat_232	41	1042614	1042574	minus	Repeat_495	31	427063	427093	plus
Repeat_233	41	257725	257765	plus	Repeat_496	31	245848	245818	minus
Repeat_233	41	773618	773578	minus	Repeat_496	31	65984	66014	plus
Repeat_234	41	1185	1225	plus	Repeat_496	31	308893	308923	plus
Repeat_234	41	1107219	1107179	minus	Repeat_496	31	462000	462030	plus
Repeat_235	40	1099393	1099432	plus	Repeat_497	31	307318	307348	plus
Repeat_235	40	1099534	1099573	plus	Repeat_497	31	435637	435607	minus
Repeat_236	40	371544	371583	plus	Repeat_498	31	302209	302239	plus
Repeat_236	40	773583	773622	plus	Repeat_498	31	721140	721110	minus
Repeat_236	40	1035140	1035101	minus	Repeat_498	31	1118164	1118134	minus
Repeat_237	40	619968	620007	plus	Repeat_499	31	279273	279303	plus
Repeat_237	40	773620	773581	minus	Repeat_499	31	926650	926680	plus
Repeat_237	40	852188	852227	plus	Repeat_500	31	278106	278136	plus
Repeat_238	40	777099	777060	minus	Repeat_500	31	476370	476400	plus
Repeat_238	40	591745	591784	plus	Repeat_500	31	640860	640830	minus
Repeat_238	40	1147672	1147711	plus	Repeat_500	31	765903	765873	minus
Repeat_239	40	462174	462213	plus	Repeat_501	31	254545	254575	plus
Repeat_239	40	987308	987269	minus	Repeat_501	31	818178	818148	minus
Repeat_240	40	427117	427156	plus	Repeat_502	31	230775	230805	plus
Repeat_240	40	743118	743079	minus	Repeat_502	31	302306	302336	plus
Repeat_240	40	1035171	1035132	minus	Repeat_502	31	322005	322035	plus
Repeat_241	40	351515	351554	plus	Repeat_503	31	335261	335231	minus
Repeat_241	40	619856	619817	minus	Repeat_503	31	175638	175668	plus
Repeat_241	40	852076	852037	minus	Repeat_504	31	805295	805265	minus
Repeat_242	40	346349	346388	plus	Repeat_504	31	162332	162362	plus
Repeat_242	40	1051319	1051358	plus	Repeat_505	31	151856	151886	plus
Repeat_243	40	324821	324860	plus	Repeat_505	31	231572	231542	minus
Repeat_243	40	909896	909935	plus	Repeat_506	31	116029	116059	plus
Repeat_243	40	1052074	1052113	plus	Repeat_506	31	116166	116196	plus
Repeat_244	40	104938	104977	plus	Repeat_507	31	108648	108678	plus
Repeat_244	40	576170	576209	plus	Repeat_507	31	967254	967284	plus
Repeat_244	40	1132097	1132136	plus	Repeat_507	31	1083102	1083132	plus
Repeat_245	40	65975	66014	plus	Repeat_508	31	108578	108608	plus
Repeat_245	40	245857	245818	minus	Repeat_508	31	967170	967200	plus
Repeat_245	40	461991	462030	plus	Repeat_509	31	90132	90162	plus
Repeat_246	40	51931	51970	plus	Repeat_509	31	90179	90209	plus
Repeat_246	40	922930	922891	minus	Repeat_510	31	80258	80288	plus
Repeat_247	39	883486	883524	plus	Repeat_510	31	750190	750160	minus
Repeat_247	39	922089	922051	minus	Repeat_511	31	78148	78178	plus
Repeat_248	39	773961	773999	plus	Repeat_511	31	78163	78193	plus
Repeat_248	39	909943	909905	minus	Repeat_512	31	244687	244657	minus
Repeat_249	39	593365	593403	plus	Repeat_512	31	67145	67175	plus
Repeat_249	39	593810	593848	plus	Repeat_512	31	971640	971670	plus
Repeat_249	39	1149292	1149330	plus	Repeat_513	31	66037	66067	plus
Repeat_249	39	1149737	1149775	plus	Repeat_513	31	245795	245765	minus
Repeat_250	39	591802	591840	plus	Repeat_513	31	324828	324858	plus
Repeat_250	39	777037	776999	minus	Repeat_513	31	371997	371967	minus
Repeat_250	39	1147729	1147767	plus	Repeat_513	31	761229	761199	minus
Repeat_251	39	590440	590478	plus	Repeat_513	31	909903	909933	plus
Repeat_251	39	932379	932417	plus	Repeat_513	31	910059	910089	plus
Repeat_251	39	1146367	1146405	plus	Repeat_513	31	1052081	1052111	plus
Repeat_252	39	388057	388095	plus	Repeat_514	31	11362	11392	plus
Repeat_252	39	557504	557542	plus	Repeat_514	31	1085630	1085600	minus
Repeat_252	39	1043307	1043345	plus	Repeat_515	30	1099395	1099424	plus
Repeat_252	39	1114243	1114281	plus	Repeat_515	30	1099467	1099496	plus
Repeat_253	39	257664	257626	minus	Repeat_515	30	1099536	1099565	plus
Repeat_253	39	371768	371806	plus	Repeat_516	30	935027	934998	minus
Repeat_253	39	773677	773715	plus	Repeat_516	30	932344	932373	plus
Repeat_254	39	371763	371801	plus	Repeat_517	30	823499	823528	plus
Repeat_254	39	726114	726076	minus	Repeat_517	30	824723	824752	plus

Repeat_254	39	1018167	1018129	minus	Repeat_518	30	726516	726545	plus
Repeat_255	39	371752	371790	plus	Repeat_518	30	1018569	1018598	plus
Repeat_255	39	619904	619866	minus	Repeat_518	30	1106924	1106895	minus
Repeat_255	39	852124	852086	minus	Repeat_519	30	642343	642372	plus
Repeat_256	39	348315	348353	plus	Repeat_519	30	1049832	1049861	plus
Repeat_256	39	1100244	1100282	plus	Repeat_520	30	619966	619995	plus
Repeat_257	39	345529	345567	plus	Repeat_520	30	852186	852215	plus
Repeat_257	39	570454	570492	plus	Repeat_520	30	997858	997887	plus
Repeat_258	39	308606	308644	plus	Repeat_521	30	614314	614343	plus
Repeat_258	39	446141	446103	minus	Repeat_521	30	614336	614365	plus
Repeat_259	39	276214	276252	plus	Repeat_521	30	846534	846563	plus
Repeat_259	39	474478	474516	plus	Repeat_521	30	846556	846585	plus
Repeat_259	39	689673	689711	plus	Repeat_521	30	1170247	1170276	plus
Repeat_260	39	257656	257694	plus	Repeat_521	30	1170269	1170298	plus
Repeat_260	39	325367	325405	plus	Repeat_522	30	593825	593854	plus
Repeat_260	39	427250	427212	minus	Repeat_522	30	594146	594175	plus
Repeat_260	39	462111	462149	plus	Repeat_522	30	1149752	1149781	plus
Repeat_260	39	742985	743023	plus	Repeat_522	30	1150073	1150102	plus
Repeat_260	39	1035038	1035076	plus	Repeat_523	30	560535	560564	plus
Repeat_261	39	228831	228869	plus	Repeat_523	30	943830	943859	plus
Repeat_261	39	419930	419968	plus	Repeat_523	30	953013	953042	plus
Repeat_262	39	147942	147980	plus	Repeat_524	30	471418	471447	plus
Repeat_262	39	310890	310852	minus	Repeat_524	30	471444	471473	plus
Repeat_263	39	104746	104784	plus	Repeat_525	30	458170	458199	plus
Repeat_263	39	575956	575994	plus	Repeat_525	30	592891	592862	minus
Repeat_263	39	1131883	1131921	plus	Repeat_525	30	1148818	1148789	minus
Repeat_264	39	53476	53514	plus	Repeat_526	30	450606	450635	plus
Repeat_264	39	593375	593337	minus	Repeat_526	30	963556	963585	plus
Repeat_264	39	1149302	1149264	minus	Repeat_527	30	371554	371583	plus
Repeat_265	38	750049	750086	plus	Repeat_527	30	427158	427187	plus
Repeat_265	38	786920	786957	plus	Repeat_527	30	462203	462174	minus
Repeat_266	38	420017	420054	plus	Repeat_527	30	773593	773622	plus
Repeat_266	38	1017589	1017626	plus	Repeat_527	30	987279	987308	plus
Repeat_267	38	371544	371581	plus	Repeat_527	30	1035130	1035101	minus
Repeat_267	38	620005	619968	minus	Repeat_528	30	424562	424591	plus
Repeat_267	38	743087	743050	minus	Repeat_528	30	448846	448817	minus
Repeat_267	38	773583	773620	plus	Repeat_529	30	391138	391167	plus
Repeat_267	38	852225	852188	minus	Repeat_529	30	981011	981040	plus
Repeat_267	38	1035140	1035103	minus	Repeat_530	30	388112	388141	plus
Repeat_268	38	619666	619629	minus	Repeat_530	30	797833	797804	minus
Repeat_268	38	851886	851849	minus	Repeat_531	30	371892	371921	plus
Repeat_268	38	351710	351747	plus	Repeat_531	30	462085	462056	minus
Repeat_269	38	324845	324882	plus	Repeat_532	30	619895	619866	minus
Repeat_269	38	513763	513800	plus	Repeat_532	30	852115	852086	minus
Repeat_269	38	1052098	1052135	plus	Repeat_532	30	371761	371790	plus
Repeat_270	38	773618	773581	minus	Repeat_532	30	950623	950652	plus
Repeat_270	38	257725	257762	plus	Repeat_533	30	371753	371782	plus
Repeat_270	38	619970	620007	plus	Repeat_533	30	619903	619874	minus
Repeat_270	38	852190	852227	plus	Repeat_533	30	666535	666506	minus
Repeat_271	38	257350	257387	plus	Repeat_533	30	852123	852094	minus
Repeat_271	38	1117958	1117995	plus	Repeat_533	30	972177	972148	minus
Repeat_272	38	231590	231627	plus	Repeat_534	30	365433	365462	plus
Repeat_272	38	348229	348192	minus	Repeat_534	30	943944	943973	plus
Repeat_273	38	593053	593016	minus	Repeat_535	30	532957	532928	minus
Repeat_273	38	1148980	1148943	minus	Repeat_535	30	357632	357661	plus
Repeat_273	38	54398	54435	plus	Repeat_536	30	1100482	1100453	minus
Repeat_274	38	53350	53387	plus	Repeat_536	30	351138	351167	plus
Repeat_274	38	279071	279108	plus	Repeat_537	30	347125	347154	plus
Repeat_274	38	477335	477372	plus	Repeat_537	30	729817	729846	plus
Repeat_274	38	521926	521963	plus	Repeat_537	30	1021870	1021899	plus
Repeat_275	38	24433	24470	plus	Repeat_538	30	335715	335744	plus

Repeat_275	38	336020	336057	plus	Repeat_538	30	980347	980376	plus
Repeat_276	38	429908	429871	minus	Repeat_539	30	325346	325375	plus
Repeat_276	38	522099	522062	minus	Repeat_539	30	619859	619888	plus
Repeat_276	38	935677	935640	minus	Repeat_539	30	709098	709127	plus
Repeat_276	38	969967	969930	minus	Repeat_539	30	852079	852108	plus
Repeat_276	38	1031	1068	plus	Repeat_540	30	322190	322219	plus
Repeat_277	37	906422	906458	plus	Repeat_540	30	1042354	1042383	plus
Repeat_277	37	909856	909892	plus	Repeat_541	30	309891	309920	plus
Repeat_278	37	771863	771899	plus	Repeat_541	30	1035123	1035094	minus
Repeat_278	37	1042983	1042947	minus	Repeat_542	30	309408	309437	plus
Repeat_279	37	725988	726024	plus	Repeat_542	30	450601	450630	plus
Repeat_279	37	971090	971126	plus	Repeat_542	30	1042941	1042970	plus
Repeat_279	37	1018041	1018077	plus	Repeat_543	30	309034	309063	plus
Repeat_280	37	624057	624093	plus	Repeat_543	30	365391	365420	plus
Repeat_280	37	713467	713503	plus	Repeat_544	30	308967	308996	plus
Repeat_280	37	856277	856313	plus	Repeat_544	30	322307	322336	plus
Repeat_281	37	593932	593968	plus	Repeat_545	30	721003	720974	minus
Repeat_281	37	740007	740043	plus	Repeat_545	30	302345	302374	plus
Repeat_281	37	1032060	1032096	plus	Repeat_546	30	721139	721110	minus
Repeat_281	37	1149859	1149895	plus	Repeat_546	30	1118163	1118134	minus
Repeat_282	37	776895	776859	minus	Repeat_546	30	230821	230850	plus
Repeat_282	37	591939	591975	plus	Repeat_546	30	302210	302239	plus
Repeat_282	37	1147866	1147902	plus	Repeat_546	30	302277	302306	plus
Repeat_283	37	541213	541249	plus	Repeat_547	30	640788	640759	minus
Repeat_283	37	686473	686509	plus	Repeat_547	30	278165	278194	plus
Repeat_284	37	462174	462210	plus	Repeat_547	30	476429	476458	plus
Repeat_284	37	1035101	1035137	plus	Repeat_548	30	1043522	1043493	minus
Repeat_284	37	371583	371547	minus	Repeat_548	30	255539	255568	plus
Repeat_284	37	773622	773586	minus	Repeat_549	30	254577	254606	plus
Repeat_284	37	987308	987272	minus	Repeat_549	30	322423	322452	plus
Repeat_285	37	403499	403535	plus	Repeat_549	30	427063	427092	plus
Repeat_285	37	534943	534979	plus	Repeat_550	30	151886	151857	minus
Repeat_286	37	462210	462174	minus	Repeat_550	30	231542	231571	plus
Repeat_286	37	1035137	1035101	minus	Repeat_550	30	1013740	1013769	plus
Repeat_286	37	371547	371583	plus	Repeat_551	30	720999	720970	minus
Repeat_286	37	773586	773622	plus	Repeat_551	30	230839	230868	plus
Repeat_286	37	987272	987308	plus	Repeat_552	30	721139	721110	minus
Repeat_287	37	349108	349144	plus	Repeat_552	30	1118163	1118134	minus
Repeat_287	37	462123	462087	minus	Repeat_552	30	230821	230850	plus
Repeat_288	37	349084	349120	plus	Repeat_552	30	302210	302239	plus
Repeat_288	37	773649	773685	plus	Repeat_552	30	302277	302306	plus
Repeat_289	37	324959	324995	plus	Repeat_553	30	609072	609043	minus
Repeat_289	37	513808	513844	plus	Repeat_553	30	1165005	1164976	minus
Repeat_290	37	324874	324910	plus	Repeat_553	30	230776	230805	plus
Repeat_290	37	774723	774759	plus	Repeat_553	30	302307	302336	plus
Repeat_290	37	1052127	1052163	plus	Repeat_553	30	322006	322035	plus
Repeat_291	37	257634	257670	plus	Repeat_554	30	168767	168796	plus
Repeat_291	37	560563	560527	minus	Repeat_554	30	578145	578174	plus
Repeat_292	37	257353	257389	plus	Repeat_554	30	1134072	1134101	plus
Repeat_292	37	308608	308644	plus	Repeat_555	30	160013	160042	plus
Repeat_292	37	446139	446103	minus	Repeat_555	30	1070293	1070264	minus
Repeat_293	37	163716	163752	plus	Repeat_556	30	158398	158427	plus
Repeat_293	37	492725	492689	minus	Repeat_556	30	996801	996772	minus
Repeat_294	37	158016	158052	plus	Repeat_557	30	147327	147356	plus
Repeat_294	37	278265	278301	plus	Repeat_557	30	971548	971577	plus
Repeat_294	37	476529	476565	plus	Repeat_558	30	142932	142961	plus
Repeat_295	37	146993	147029	plus	Repeat_558	30	143019	143048	plus
Repeat_295	37	1042625	1042589	minus	Repeat_559	30	113298	113327	plus
Repeat_296	37	66028	66064	plus	Repeat_559	30	963270	963299	plus
Repeat_296	37	245804	245768	minus	Repeat_560	30	113067	113096	plus
Repeat_296	37	773723	773687	minus	Repeat_560	30	997669	997640	minus

Repeat_297	37	53855	53891	plus	Repeat_561	30	106550	106579	plus
Repeat_297	37	522642	522678	plus	Repeat_561	30	1126238	1126267	plus
Repeat_297	37	773611	773647	plus	Repeat_562	30	68937	68966	plus
Repeat_298	37	156924	156888	minus	Repeat_562	30	923188	923217	plus
Repeat_298	37	922500	922464	minus	Repeat_563	30	52828	52857	plus
Repeat_298	37	24604	24640	plus	Repeat_563	30	53958	53987	plus
Repeat_299	36	1014572	1014607	plus	Repeat_563	30	413834	413863	plus
Repeat_299	36	1117777	1117812	plus	Repeat_564	30	335979	335950	minus
Repeat_300	36	460708	460743	plus	Repeat_564	30	51670	51699	plus
Repeat_300	36	617912	617947	plus	Repeat_565	30	427250	427221	minus
Repeat_300	36	707761	707796	plus	Repeat_565	30	37520	37549	plus
Repeat_300	36	850132	850167	plus	Repeat_565	30	257656	257685	plus
Repeat_300	36	1173845	1173880	plus	Repeat_565	30	325367	325396	plus
Repeat_301	36	617393	617428	plus	Repeat_565	30	462111	462140	plus
Repeat_301	36	849613	849648	plus	Repeat_565	30	742985	743014	plus
Repeat_301	36	1015639	1015674	plus	Repeat_565	30	1035038	1035067	plus
Repeat_301	36	1173326	1173361	plus	Repeat_566	30	36190	36219	plus
Repeat_302	36	567326	567361	plus	Repeat_566	30	254758	254787	plus
Repeat_302	36	741448	741413	minus	Repeat_567	30	24582	24611	plus
Repeat_302	36	1033501	1033466	minus	Repeat_567	30	24688	24717	plus
Repeat_303	36	257648	257683	plus	Repeat_567	30	922416	922387	minus
Repeat_303	36	325359	325394	plus	Repeat_567	30	922522	922493	minus
Repeat_303	36	513936	513971	plus	Repeat_568	30	51596	51567	minus
Repeat_303	36	742977	743012	plus	Repeat_568	30	24474	24503	plus
Repeat_303	36	1035030	1035065	plus	Repeat_568	30	336057	336086	plus
Repeat_304	36	815722	815687	minus	Repeat_569	30	21749	21778	plus
Repeat_304	36	448918	448953	plus	Repeat_569	30	1004456	1004485	plus
Repeat_305	36	427488	427523	plus	Repeat_570	30	14953	14982	plus
Repeat_305	36	947678	947643	minus	Repeat_570	30	1001269	1001298	plus

Table S2. plastid-derived DNA segments in *Abies koreana* mitochondrial genome.

Identity	Aligned length	number of mismatches	number of gap openings	Query start	Query end	Hit start	Hit end	E value	Bit-score	Annotation
89.623	106	11	0	85121	85226	1003774	1003879	1.72E-30	135	<i>petA*</i>
85.437	103	3	4	75680	75778	1075838	1075932	8.13E-19	97.1	<i>psbK*</i>
93.75	80	5	0	47623	47702	435116	435195	4.82E-26	121	<i>trnW-CCA</i>
88.462	78	9	0	48270	48347	350493	350416	2.92E-18	95.3	<i>ycfI*</i>
94.203	69	4	0	75179	75247	1075344	1075412	1.35E-21	106	<i>psaA*</i>
92.647	68	1	1	75902	75969	1075994	1076057	2.92E-18	95.3	<i>psaA*</i>

Table S3. Summary of putative transposable elements (TEs) in *Abies koreana* mitochondrial genome.

Repeat Class	Fragments	Length
Integrated Virus	5	304
Caulimoviridae	5	304
Interspersed Repeat	2	264
Transposable Element	559	48,022
DNA transposon	184	12,380
EnSpm/CACTA	41	2,745
Harbinger	14	1,319
Helitron	27	1,575
Mariner/Tc1	1	79
MuDR	66	4,602
hAT	29	1,601
LTR Retrotransposon	322	29,809
Copia	124	10,764
Gypsy	192	18,188
Non-LTR Retrotransposon	52	5,750
L1	45	5,351
Penelope	6	350
Naiad/Chlamys	6	350
Multicopy gene	6	355
tRNA	6	355
Simple Repeat	4	328
Satellite	3	249
Total	514	44,991

Table S4. Mitochondrial gene clusters among gymnosperms.

No.	gene clusters	<i>Abies</i>	<i>Cycas</i>	<i>Ginkgo</i>	<i>Welwitschia</i>	<i>Pinus</i>	<i>Taxus</i>
1	<i>atp8-cox3-sdh4</i>	X	X	X	X	X	O
2	<i>nad5 e3-nad1 e5</i>	X	X	X	X	X	X
3	<i>nad3-rps12</i>	O	O	O	O	O	O
4	<i>nad4L-atp4</i>	X	X	X	X	X	X
5	<i>rpl16-rps3-rps19-rpl2</i>	O	O	O	O	O	X
6	<i>cob-rps14-rpl5</i>	X	O	O	X	X	X
7	<i>rps10-cox1</i>	X	O	O	X	X	X
8	<i>rps13-nad1 e2-e3</i>	X	X	X	X	X	X
9	<i>rrn26- trnfM(CAU)</i>	X	X	X	X	X	X
10	<i>rrn18-rrn5</i>	X	O	O	X	X	O
11	<i>trnP(TGG)-sdh3</i>	O	O	O	O	O	O
12	<i>trnP(TGG)cp- trnW(CCA)cp</i>	X	X	X	X	X	X
13	<i>trnS(GCT)- trnF(GAA)- trnP(UGG)</i>	X	X	X	X	X	X
14	<i>trnY(GTA)-nad2 e5- e4-e3</i>	X	X	X	X	X	X
	Total	3	6	6	3	3	5

Table S5. Putative chimeric ORFs.

ORFs	ORF start	ORF end	ORF length	Identity	ORF hit start	ORF hit end	Chimera length	Gene hit start	Gene hit end	E-value	Gene	No of transmembrane helices/probabilities
<i>orf226</i>	708727	708047	681	95.5	56	681	626	185	788	0	<i>atp1</i>	0/0.028
<i>orf57</i>	707981	707808	174	92	1	174	187	850	1036	2.34E-76	<i>atp1</i>	0/07456
<i>orf97</i>	593057	592764	294	96.5	1	56	57	8	64	2.77E-21	<i>rps11</i>	0/0.09219
	1148984	1148691										
<i>orf70</i>	619024	618812	213	100	14	100	87	296	382	1.62E-41	<i>cox2</i>	0/0.03084
	851224	851032										
<i>orf69</i>	555940	555731	210	91.4	57	137	81	159	236	5.95E-28	<i>ccmC</i>	1/0.92061
<i>orf66</i>	255404	255204	201	90.8	1	104	109	1022	1126	2.26E-39	<i>nad4</i>	0/0.11072

Table S6. Summary of editing sites detected in the 41 protein-coding genes of the *Abies koreana* mitogenome

Gene	Size (bp)	Codon changes by C-to-U editing														PREP-Mt	RNA-seq		Generation of		
		A>V	H>Y	L>F	P>F	P>L	P>S	Q>L	Q>*	R>C	R>W	R>*	S>F	S>L	T>I	T>M	total	Silent	Start	Stop	
<i>atp1</i>	1524	1	1	0	0	2	0	0	0	0	0	0	0	2	0	0	6	6	0	No	No
<i>atp4</i>	543	0	0	0	1	7	1	0	1	3	0	0	3	6	0	1	21	24	1	No	Yes
<i>atp6</i>	777	0	3	1	2	14	4	0	1	2	2	0	14	13	1	1	54	61	3	Yes	Yes
<i>atp8</i>	480	0	2	1	0	5	1	0	0	1	1	0	3	1	0	0	21	20	5	No	No
<i>atp9</i>	249	2	1	1	0	0	1	0	0	0	0	1	3	3	0	0	12	13	1	No	Yes
<i>ccmB</i>	624	0	1	0	0	13	3	0	0	4	1	0	6	9	0	0	37	40	3	No	No
<i>ccmC</i>	720	0	4	1	0	9	8	0	0	3	6	0	6	5	1	0	49	51	8	No	No
<i>ccmFc</i>	1395	1	1	2	2	9	3	0	1	6	2	0	5	3	2	0	38	39	2	No	Yes
<i>ccmFn</i>	1728	0	2	3	4	12	5	0	0	7	7	0	5	9	0	0	58	57	3	No	No
<i>cob</i>	1194	0	6	0	6	13	2	0	0	2	8	0	7	6	0	0	51	57	7	No	No
<i>cox1</i>	1596	2	5	5	8	19	7	0	1	2	8	0	18	10	0	1	84	88	2	Yes	Yes
<i>cox2</i>	807	1	1	1	0	3	1	0	0	1	4	0	3	6	0	2	21	23	0	No	No
<i>cox3</i>	798	0	2	2	6	7	3	0	0	1	5	0	4	6	0	0	37	39	3	No	No
<i>matR</i>	2190	0	3	1	0	11	0	0	0	0	2	0	2	1	0	0	30	20	0	No	No
<i>mttB</i>	750	0	2	1	2	10	2	0	0	4	2	0	8	10	1	1	47	47	4	Yes	No
<i>nad1</i>	981	1	2	2	2	11	3	0	0	2	4	0	8	6	0	1	42	47	5	Yes	No
<i>nad2</i>	1473	1	4	1	2	11	7	0	0	5	1	0	11	11	1	2	56	66	9	No	No
<i>nad3</i>	357	0	2	0	0	6	2	0	0	1	1	0	3	4	0	0	25	20	1	No	No
<i>nad4</i>	1578	5	2	4	8	25	10	0	0	3	2	1	16	9	1	2	84	97	9	No	Yes
<i>nad4L</i>	567	0	0	0	0	3	3	0	0	1	1	1	2	8	1	0	19	20	0	No	Yes
<i>nad5</i>	2004	1	6	1	6	19	11	0	0	6	5	0	20	18	1	4	97	108	10	No	No
<i>nad6</i>	615	1	4	2	6	7	2	1	0	1	2	0	6	10	1	1	41	47	3	Yes	No
<i>nad7</i>	1185	2	5	0	0	5	3	0	0	3	0	0	6	14	0	0	38	44	6	No	No
<i>nad9</i>	591	1	0	0	2	4	4	0	0	1	1	0	5	4	0	1	21	26	3	Yes	No
<i>rpl2</i>	1416 ^A	0	0	0	0	3	6	0	1	0	1	0	1	5	2	2	25	21	0	Yes	Yes
<i>rpl5</i>	576	0	2	0	0	5	2	0	0	1	0	0	2	3	0	0	17	17	2	No	No
<i>rpl10</i>	483	0	0	0	0	6	0	0	0	0	0	0	1	3	0	0	13	10	0	No	No
<i>rpl16</i>	414	1	0	0	0	3	0	0	1	0	1	0	0	1	3	0	9	11	1	No	Yes
<i>rps1</i>	690	1	0	0	2	7	3	0	0	1	0	0	5	2	3	1	24	27	2	No	No
<i>rps2</i>	720	2	0	0	0	7	1	0	0	2	0	0	5	2	0	0	20	20	1	No	No
<i>rps3</i>	1668	0	4	1	0	4	4	0	0	0	2	0	5	4	0	2	29	33	7	Yes	No
<i>rps4</i>	1053	2	5	0	0	12	4	0	0	1	1	0	5	9	0	1	36	43	3	Yes	No
<i>rps7</i>	588	0	1	0	0	4	1	0	0	0	0	0	0	2	1	1	16	10	0	No	No
<i>rps10</i>	342	0	1	0	2	0	0	0	0	0	1	0	1	3	1	1	11	10	0	Yes	No
<i>rps11</i>	582	1	0	1	0	4	1	0	0	0	0	0	3	1	0	0	3	13	2	No	No
<i>rps12</i>	378	1	0	0	0	3	3	0	0	2	0	0	0	5	1	0	15	15	0	No	No
<i>rps13</i>	489	0	1	0	0	1	0	0	0	1	0	0	0	2	0	0	7	5	0	No	No
<i>rps14</i>	303	0	2	0	0	2	3	0	0	0	1	0	1	2	0	0	11	11	0	No	No
<i>rps19</i>	282	2	0	0	2	0	2	0	0	0	1	0	2	1	0	0	10	12	2	No	No
<i>sdh3</i>	564	0	1	2	2	5	3	0	0	1	0	1	0	3	0	0	24	21	3	No	Yes
<i>sdh4</i>	396	1	1	1	3	4	0	0	0	0	1	0	0	1	0	0	9	17	5	No	No
Total		30	77	34	68	295	119	1	6	68	74	4	195	223	21	25	1268	1356	116	10	10

Table S7. RNA editing in 41 protein-coding genes for *Abies koreana* mitochondrial genome.

gene	Nt Pos	Effect	PREP-Mt Score	RNA-seq	gene	Nt Pos	Effect	PREP-Mt Score	RNA-seq
<i>atp1</i>	398	GCG (A) => GTG (V)	1.00	X	<i>nad3</i>	22	CGT (R) => TGT (C)	0.73	O
1524	557	TCG (S) => TTG (L)	1.00	O	357	44	TCG (S) => TTG (L)	1.00	O
	701	GCC (A) => GTC (V)	X	O		62	CCA (P) => CTA (L)	0.95	O
	923	CCA (P) => CTA (L)	1.00	O		80	CCA (P) => CTA (L)	1.00	O
	1345	CAT (H) => TAT (Y)	0.90	O		88	CCC (P) => TCC (S)	0.95	O
	1490	CCG (P) => CTG (L)	0.90	O		124	CAC (H) => TAC (Y)	1.00	O
	1502	TCA (S) => TTA (L)	0.70	O		137	TCC (S) => TTC (F)	1.00	O
<i>atp4</i>	5	CCA (P) => CTA (L)	1.00	O		146	TCC (S) => TTC (F)	1.00	O
543	20	CCA (P) => CTA (L)	0.86	O		185	CCG (P) => CTG (L)	0.95	O
	28	CGT (R) => TGT (C)	1.00	O		190	CCT (P) => TCT (S)	1.00	O
	53	TCA (S) => TTA (L)	1.00	O		197	TCA (S) => TTA (L)	1.00	O
	71	ACG (T) => ATG (M)	1.00	X		209	TCT (S) => TTT (F)	0.95	O
	82	CGT (R) => TGT (C)	0.71	O		215	CCG (P) => CTG (L)	1.00	O
	85	CGT (R) => TGT (C)	1.00	O		230	TCC (S) => TTC (F)	0.86	X
	89	TCC (S) => TTC (F)	1.00	O		231	TCC (S) => TCT (S)	X	O
	90	TCC (S) => TTT (F)	X	O		233	TCC (S) => TTC (F)	1.00	X
	122	TCG (S) => TTG (L)	1.00	O		238	CGG (R) => TGG (W)	1.00	X
	134	TCC (S) => TTC (F)	1.00	O		247	CCT (P) => TCT (S)	1.00	X
	140	GCG (A) => GTG (V)	0.29	X		266	CCG (P) => CTG (L)	1.00	O
	190	CCC (P) => TTC (F)	0.57	X		275	TCT (S) => TTT (F)	1.00	X
	191	CCC (P) => TTC (F)	0.57	O		277	CGG (R) => TGG (W)	1.00	X

<i>atp4</i>	212	TCT (S) => TTT (F)	X	O
	215	CCG (P) => CTG (L)	0.43	O
	284	TCA (S) => TTA (L)	X	O
	290	CCG (P) => CTG (L)	X	O
	299	ACG (T) => ATG (M)	X	O
	344	TCA (S) => TTA (L)	1.00	O
	368	TCA (S) => TTA (L)	1.00	O
	377	CCT (P) => CTT (L)	1.00	O
	380	CCA (P) => CTA (L)	0.71	O
	463	CCC (P) => TCC (S)	0.57	O
	503	CCG (P) => CTG (L)	0.71	O
	527	TCA (S) => TTA (L)	1.00	O
	538	CAA (Q) => TAA (X)	X	O
<i>atp6</i>	2	ACG (T) => ATG (M)	0.25	O
777	5	CCA (P) => CTA (L)	X	O
	25	CCT (P) => TTT (F)	1.00	O
	26	CCT (P) => TTT (F)	1.00	O
	73	CCA (P) => TCA (S)	1.00	O
	77	TCC (S) => TTC (F)	1.00	O
	85	CCA (P) => TCA (S)	0.75	O
	95	TCC (S) => TTC (F)	1.00	O
	101	CCG (P) => CTG (L)	0.92	O
	116	TCA (S) => TTA (L)	0.75	O
	126	CTC (L) => CTT (L)	X	O
	164	TCA (S) => TTA (L)	1.00	O

<i>nad3</i>	296	TCA (S) => TTA (L)	1.00	O
	305	TCG (S) => TTG (L)	1.00	O
	320	CCC (P) => CTC (L)	0.86	O
	322	CAT (H) => TAT (Y)	1.00	O
	349	CGG (R) => TGG (W)	1.00	O
<i>nad4L</i>	20	TCA (S) => TTA (L)	0.38	O
567	28	CCT (P) => TCT (S)	1.00	O
	41	TCT (S) => TTT (F)	1.00	O
	47	TCA (S) => TTA (L)	1.00	O
	55	CGG (R) => TGG (W)	1.00	O
	68	CCA (P) => CTA (L)	1.00	O
	86	ACT (T) => ATT (I)	X	O
	95	TCA (S) => TTA (L)	1.00	O
	100	CCA (P) => TCA (S)	1.00	O
	110	TCA (S) => TTA (L)	1.00	O
	131	TCG (S) => TTG (L)	0.88	O
	140	TCG (S) => TTG (L)	1.00	O
	148	CCC (P) => TCC (S)	1.00	O
	158	CCG (P) => CTG (L)	1.00	O
	191	TCG (S) => TTG (L)	0.62	O
	230	TCG (S) => TTG (L)	1.00	O
	239	CCG (P) => CTG (L)	0.38	O
	281	TCT (S) => TTT (F)	0.88	O
	289	CGC (R) => TGC (C)	0.38	O
	301	CGA (R) => TGA (X)	0.88	O

<i>atp6</i>	178	CGG (R) => TGG (W)	1.00	O
	188	TCG (S) => TTG (L)	0.83	X
	202	CAT (H) => TAT (Y)	1.00	O
	215	CCG (P) => CTG (L)	1.00	O
	249	TCC (S) => TCT (S)	X	O
	269	TCT (S) => TTT (F)	1.00	O
	272	TCC (S) => TTC (F)	1.00	O
	277	CGC (R) => TGC (C)	0.75	O
	284	TCG (S) => TTG (L)	0.67	O
	292	CTT (L) => TTT (F)	1.00	O
	299	TCT (S) => TTT (F)	1.00	O
	302	TCG (S) => TTG (L)	1.00	O
	305	TCA (S) => TTA (L)	1.00	O
	310	CGT (R) => TGT (C)	1.00	O
	317	CCC (P) => CTC (L)	1.00	O
	341	TCC (S) => TTC (F)	1.00	O
	359	TCT (S) => TTT (F)	1.00	O
	371	TCG (S) => TTG (L)	0.92	O
	379	CCA (P) => TCA (S)	1.00	O
	392	TCT (S) => TTT (F)	1.00	O
	416	TCT (S) => TTT (F)	1.00	O
	440	TCC (S) => TTC (F)	0.58	O
	449	TCC (S) => TTC (F)	X	O
	450	TCC (S) => TTT (F)	X	O
	452	TCA (S) => TTA (L)	1.00	O

<i>nad4</i>	16	CGT (R) => TGT (C)	0.75	X	
	1578	29	TCC (S) => TTC (F)	0.67	O
		30	TCC (S) => TTT (F)	X	O
		44	CCT (P) => CTT (L)	1.00	O
		77	CCT (P) => CTT (L)	0.78	O
		83	TCC (S) => TTC (F)	0.67	O
		117	TTC (F) => TTT (F)	X	O
		137	CCT (P) => CTT (L)	1.00	O
		149	TCG (S) => TTG (L)	0.89	O
		154	CCC (P) => TCC (S)	1.00	O
		156	CCC (P) => TCT (S)	X	O
		158	CCT (P) => CTT (L)	1.00	O
		164	CCC (P) => CTC (L)	0.67	O
		166	CGG (R) => TGG (W)	1.00	O
		184	CCT (P) => TCT (S)	0.89	O
		197	TCC (S) => TTC (F)	1.00	O
		249	TAC (Y) => TAT (Y)	X	O
		251	ACG (T) => ATG (M)	0.22	O
		268	CCC (P) => TCC (S)	1.00	O
		271	CCA (P) => TTA (L)	X	O
		272	CCA (P) => TTA (L)	1.00	O
		278	TCT (S) => TTT (F)	1.00	O
	317	TCA (S) => TTA (L)	1.00	O	
	335	ACG (T) => ATG (M)	0.67	X	
	365	GCA (A) => GTA (V)	X	O	

<i>atp6</i>	488	TCA (S) => TTA (L)	1.00	O
	508	CCT (P) => TCT (S)	1.00	O
	511	CAT (H) => TAT (Y)	1.00	O
	527	TCA (S) => TTA (L)	1.00	O
	548	TCC (S) => TTC (F)	1.00	O
	575	TCA (S) => TTA (L)	1.00	O
	586	CCA (P) => TTA (L)	X	O
	587	CCA (P) => TTA (L)	1.00	O
	601	CGG (R) => TGG (W)	1.00	O
	611	CCA (P) => CTA (L)	1.00	O
	635	TCC (S) => TTC (F)	0.83	O
	647	CCG (P) => CTG (L)	0.92	O
	656	CCA (P) => CTA (L)	0.75	O
	658	CCA (P) => TTA (L)	X	O
	659	CCA (P) => TTA (L)	X	O
	674	CCG (P) => CTG (L)	1.00	O
	683	TCG (S) => TTG (L)	1.00	O
	704	TCA (S) => TTA (L)	1.00	O
	712	CAT (H) => TAT (Y)	1.00	O
	719	TCT (S) => TTT (F)	1.00	O
	728	TCA (S) => TTA (L)	1.00	O
	743	CCG (P) => CTG (L)	1.00	O
	755	ACA (T) => ATA (I)	0.92	O
	761	CCT (P) => CTT (L)	1.00	O
	766	CAA (Q) => TAA (X)	1.00	O

<i>nad4</i>	371	CCA (P) => CTA (L)	0.89	O
	376	CGC (R) => TGC (C)	0.78	O
	393	ATC (I) => ATT (I)	X	O
	401	TCT (S) => TTT (F)	1.00	O
	403	CGC (R) => TGC (C)	1.00	O
	410	CCG (P) => CTG (L)	1.00	O
	419	TCA (S) => TTA (L)	1.00	O
	427	CAT (H) => TAT (Y)	0.89	O
	433	CTT (L) => TTT (F)	1.00	O
	436	CCC (P) => TTC (F)	0.89	O
	437	CCC (P) => TTC (F)	0.89	O
	467	ACT (T) => ATT (I)	1.00	X
	520	CCC (P) => TTC (F)	1.00	O
	521	CCC (P) => TTC (F)	1.00	O
	524	CCA (P) => CTA (L)	1.00	O
	533	TCA (S) => TTA (L)	1.00	O
	537	CTC (L) => CTT (L)	X	O
	547	CTT (L) => TTT (F)	1.00	O
	566	CCG (P) => CTG (L)	1.00	O
	574	CTC (L) => TTC (F)	X	O
	578	TCC (S) => TTC (F)	0.67	O
	611	TCA (S) => TTA (L)	0.89	O
	623	TCC (S) => TTC (F)	0.89	O
	647	CCA (P) => CTA (L)	1.00	O
	659	TCT (S) => TTT (F)	1.00	O

<i>atp8</i>	11	CCG (P) => CTG (L)	1.00	O
480	20	TCC (S) => TTC (F)	0.75	O
	29	TCC (S) => TTC (F)	1.00	O
	30	TCC (S) => TTC (F)	X	O
	43	CGG (R) => TGG (W)	1.00	O
	61	CTC (L) => TTC (F)	0.88	O
	63	CTC (L) => TTT (F)	X	O
	68	TCC (S) => TTC (F)	1.00	O
	69	TCC (S) => TTT (F)	X	O
	70	CAT (H) => TAT (Y)	1.00	O
	77	TCC (S) => TTC (F)	0.38	X
	80	CCA (P) => CTA (L)	0.25	O
	98	CCT (P) => CTT (L)	1.00	X
	116	CCC (P) => CTC (L)	1.00	O
	122	CCA (P) => CTA (L)	1.00	O
	139	CCA (P) => TCA (S)	1.00	X
	194	TCG (S) => TTG (L)	1.00	O
	223	CAT (H) => TAT (Y)	1.00	O
	232	CCC (P) => TCC (S)	0.75	O
	234	CCC (P) => TCT (S)	X	O
	269	GCC (A) => GTC (V)	1.00	X
	310	CGT (R) => TGT (C)	0.75	O
	354	ATC (I) => ATT (I)	X	O
	356	CCA (P) => CTA (L)	0.50	O
	367	CCG (P) => TCG (S)	1.00	X

<i>nad4</i>	661	CCC (P) => TTC (F)	1.00	O
	662	CCC (P) => TTC (F)	1.00	O
	667	CCT (P) => TCT (S)	0.89	O
	673	CCC (P) => TCC (S)	X	O
	755	TCG (S) => TTG (L)	1.00	O
	770	TCA (S) => TTA (L)	1.00	O
	794	TCG (S) => TTG (L)	1.00	O
	802	CCC (P) => TCC (S)	1.00	O
	836	TCC (S) => TTC (F)	1.00	O
	863	GCG (A) => GTG (V)	X	O
	887	CCG (P) => CTG (L)	1.00	O
	934	CCA (P) => TCA (S)	1.00	O
	947	ACG (T) => ATG (M)	1.00	O
	953	TCT (S) => TTT (F)	0.44	O
	971	TCC (S) => TTC (F)	1.00	O
	977	CCG (P) => CTG (L)	0.78	O
	1007	CCA (P) => CTA (L)	1.00	O
	1010	CCG (P) => CTG (L)	1.00	O
	1028	CCG (P) => CTG (L)	1.00	O
	1033	CCT (P) => TCT (S)	1.00	O
	1036	CCA (P) => TCA (S)	1.00	O
	1043	CCT (P) => CTT (L)	1.00	O
	1046	TCT (S) => TTT (F)	1.00	O
	1049	CCA (P) => CTA (L)	1.00	O
	1088	CCT (P) => CTT (L)	0.89	O

<i>atp8</i>	391	CCC (P) => TCC (S)	0.75	X	<i>nad4</i>	1091	GCT (A) => GTT (V)	1.00	O
<i>atp9</i>	65	GCC (A) => GTC (V)	0.47	O		1109	TCA (S) => TTA (L)	1.00	O
249	80	GCT (A) => GTT (V)	1.00	O		1129	CCC (P) => TTC (F)	1.00	O
	82	CTT (L) => TTT (F)	1.00	O		1130	CCC (P) => TTC (F)	1.00	O
	92	TCG (S) => TTG (L)	1.00	O		1132	CCT (P) => TCT (S)	1.00	O
	96	ATC (I) => ATT (I)	X	O		1136	ACC (T) => ATC (I)	X	O
	100	CCC (P) => TCC (S)	0.95	O		1148	TCT (S) => TTT (F)	0.89	O
	137	TCT (S) => TTT (F)	1.00	O		1151	TCC (S) => TTC (F)	1.00	O
	142	CAC (H) => TAC (Y)	1.00	O		1152	TCC (S) => TTT (F)	X	O
	185	TCT (S) => TTT (F)	1.00	O		1190	TCT (S) => TTT (F)	1.00	O
	191	TCA (S) => TTA (L)	1.00	O		1205	CCC (P) => CTC (L)	1.00	O
	212	TCA (S) => TTA (L)	1.00	O		1230	ATC (I) => ATT (I)	X	O
	215	TCC (S) => TTC (F)	1.00	O		1289	CCT (P) => CTT (L)	0.78	O
	223	CGA (R) => TGA (X)	1.00	O		1307	GCG (A) => GTG (V)	1.00	O
<i>ccmB</i>	28	CAT (H) => TAT (Y)	0.89	O		1312	CTT (L) => TTT (F)	0.33	O
624	73	CCA (P) => TCA (S)	X	O		1355	CCA (P) => CTA (L)	1.00	O
	74	CCA (P) => CTA (L)	1.00	X		1373	CCG (P) => CTG (L)	X	O
	116	TCT (S) => TTT (F)	1.00	O		1403	GCT (A) => GTT (V)	0.78	O
	131	TCA (S) => TTA (L)	1.00	O		1405	CGG (R) => TGG (W)	1.00	O
	140	TCC (S) => TTC (F)	1.00	O		1417	CAC (H) => TAC (Y)	1.00	O
	151	CCG (P) => TTG (L)	X	O		1430	TCC (S) => TTC (F)	1.00	O
	152	CCG (P) => TTG (L)	1.00	O		1431	TCC (S) => TTT (F)	X	O
	157	CGG (R) => TGG (W)	1.00	O		1433	CCG (P) => CTG (L)	1.00	O
	163	CCT (P) => TCT (S)	0.67	O		1438	CGT (R) => TGT (C)	1.00	O
	175	CCT (P) => TCT (S)	0.89	O		1486	CGA (R) => TGA (X)	0.88	O

<i>ccmB</i>	178	CTT (L) => TTT (F)	1.00	X
	184	CCC (P) => TCC (S)	0.78	X
	186	CCC (P) => CCT (P)	X	O
	197	TCT (S) => TTT (F)	0.89	O
	224	CCC (P) => CTC (L)	1.00	O
	225	CCC (P) => CTT (L)	X	O
	230	TCG (S) => TTG (L)	1.00	O
	239	TCA (S) => TTA (L)	1.00	O
	307	CGT (R) => TGT (C)	0.78	O
	316	CGT (R) => TGT (C)	0.89	O
	341	CCG (P) => CTG (L)	1.00	O
	383	CCA (P) => CTA (L)	0.78	O
	386	CCA (P) => CTA (L)	0.78	O
	394	CCG (P) => TTG (L)	X	O
	395	CCG (P) => TTG (L)	0.89	O
	427	CGT (R) => TGT (C)	0.89	O
	431	TCG (S) => TTG (L)	1.00	O
	478	CCA (P) => TTA (L)	X	O
	479	CCA (P) => TTA (L)	0.89	O
	500	TCG (S) => TTG (L)	1.00	O
	506	CCA (P) => CTA (L)	1.00	O
	517	CGT (R) => TGT (C)	1.00	O
	528	ATC (I) => ATT (I)	X	O
	551	CCT (P) => CTT (L)	0.78	O
	554	TCA (S) => TTA (L)	1.00	O

<i>nad5</i>	20	TCG (S) => TTG (L)	X	O
2004	32	CCC (P) => CTC (L)	0.90	O
	33	CCC (P) => CTT (L)	X	O
	119	TCT (S) => TTT (F)	X	O
	134	ACT (T) => ATT (I)	0.90	X
	140	TCT (S) => TTT (F)	1.00	O
	142	CAT (H) => TAT (Y)	1.00	O
	155	CCG (P) => CTG (L)	1.00	O
	176	CCA (P) => CTA (L)	0.70	O
	190	CGG (R) => TGG (W)	1.00	O
	220	CGG (R) => TGG (W)	1.00	O
	227	TCC (S) => TTC (F)	1.00	O
	242	CCG (P) => CTG (L)	1.00	O
	246	ACC (T) => ACT (T)	X	O
	257	CCA (P) => CTA (L)	1.00	O
	293	CCT (P) => CTT (L)	0.70	O
	295	CAT (H) => TAT (Y)	1.00	O
	298	CCC (P) => TCC (S)	1.00	O
	346	CAT (H) => TAT (Y)	1.00	O
	350	TCA (S) => TTA (L)	1.00	O
	358	CCT (P) => TTT (F)	1.00	O
	359	CCT (P) => TTT (F)	1.00	O
	371	ACG (T) => ATG (M)	1.00	O
	374	CCA (P) => CTA (L)	0.90	O
	380	TCG (S) => TTG (L)	1.00	O

<i>ccmB</i>	557	TCG (S) => TTG (L)	0.89	O
	569	TCC (S) => TTC (F)	0.78	O
	572	TCT (S) => TTT (F)	0.78	O
	575	CCG (P) => CTG (L)	1.00	O
	581	GCA (A) => GTA (V)	0.78	X
	584	TCT (S) => TTT (F)	X	O
	599	TCG (S) => TTG (L)	0.89	O
	614	TCA (S) => TTA (L)	0.89	O
	623	TCA (S) => TTA (L)	0.22	X
<i>ccmC</i>	6	TTC (F) => TTT (F)	X	O
720	10	CCG (P) => TCG (S)	0.62	O
	63	ATC (I) => ATT (I)	X	O
	75	TTC (F) => TTT (F)	X	O
	76	CGG (R) => TGG (W)	0.78	O
	103	CAT (H) => TAT (Y)	1.00	O
	115	CGG (R) => TGG (W)	0.78	O
	128	TCA (S) => TTA (L)	0.56	X
	134	TCT (S) => TTT (F)	0.67	O
	151	CAT (H) => TAT (Y)	0.22	O
	159	ATC (I) => ATT (I)	X	O
	161	ACC (T) => ATC (I)	0.22	O
	163	CAT (H) => TAT (Y)	1.00	O
	179	GCA (A) => GTA (V)	0.78	X
	184	CGG (R) => TGG (W)	1.00	O
	197	CCT (P) => CTT (L)	0.56	O

<i>nad5</i>	387	ACC (T) => ACT (T)	X	O
	413	CCG (P) => CTG (L)	1.00	O
	439	CCA (P) => TCA (S)	1.00	O
	446	TCG (S) => TTG (L)	1.00	O
	449	TCA (S) => TTA (L)	1.00	O
	458	TCC (S) => TTC (F)	1.00	O
	459	TCC (S) => TTT (F)	X	O
	460	CGG (R) => TGG (W)	1.00	O
	464	TCC (S) => TTC (F)	1.00	O
	533	TCA (S) => TTA (L)	1.00	O
	557	TCT (S) => TTT (F)	1.00	O
	581	TCC (S) => TTC (F)	1.00	O
	583	CCG (P) => TCG (S)	0.90	O
	593	TCT (S) => TTT (F)	1.00	O
	598	CGT (R) => TGT (C)	1.00	O
	640	CGC (R) => TGC (C)	0.90	O
	673	CGT (R) => TGT (C)	1.00	O
	678	ATC (I) => ATT (I)	X	O
	680	TCA (S) => TTA (L)	1.00	O
	683	CCC (P) => CTC (L)	0.90	O
	684	CCC (P) => CTT (L)	X	O
	686	TCT (S) => TTT (F)	0.90	O
	722	TCG (S) => TTG (L)	1.00	O
	730	CGG (R) => TGG (W)	1.00	O
	734	TCA (S) => TTA (L)	1.00	O

<i>ccmC</i>	202	CAT (H) => TAT (Y)	1.00	O	<i>nad5</i>	746	ACG (T) => ATG (M)	1.00	O
	232	CTC (L) => TTC (F)	1.00	O		773	CCG (P) => CTG (L)	1.00	O
	236	TCA (S) => TTA (L)	1.00	O		791	ACG (T) => ATG (M)	1.00	O
	260	CCC (P) => CTC (L)	0.78	X		808	CCC (P) => TTC (F)	1.00	O
	268	CCC (P) => TCC (S)	1.00	O		809	CCC (P) => TTC (F)	1.00	O
	281	ACA (T) => ATA (I)	0.56	X		833	CCA (P) => CTA (L)	1.00	O
	299	TCC (S) => TTC (F)	1.00	O		836	TCT (S) => TTT (F)	1.00	O
	300	TCC (S) => TTT (F)	X	O		844	CCA (P) => TCA (S)	0.90	O
	314	TCA (S) => TTA (L)	1.00	O		857	TCG (S) => TTG (L)	1.00	O
	331	CGG (R) => TGG (W)	1.00	O		896	TCC (S) => TTC (F)	0.30	O
	358	CGG (R) => TGG (W)	1.00	O		929	TCA (S) => TTA (L)	1.00	O
	381	ACC (T) => ACT (T)	X	O		946	CAT (H) => TAT (Y)	1.00	O
	382	CCT (P) => TCT (S)	1.00	O		949	CCA (P) => TCA (S)	1.00	O
	395	TCG (S) => TTG (L)	1.00	O		955	CGC (R) => TGC (C)	1.00	O
	398	TCT (S) => TTT (F)	0.78	O		979	CTT (L) => TTT (F)	1.00	O
	400	CTT (L) => TTT (F)	0.89	X		985	CGC (R) => TGC (C)	1.00	O
	410	CCG (P) => CTG (L)	1.00	O		996	TCC (S) => TCT (S)	X	O
	419	CCG (P) => CTG (L)	1.00	O		1016	TCT (S) => TTT (F)	1.00	O
	421	CGT (R) => TGT (C)	0.78	O		1022	TCA (S) => TTA (L)	1.00	O
	425	TCC (S) => TTC (F)	1.00	O		1069	CCA (P) => TCA (S)	1.00	O
	436	CCT (P) => TCT (S)	0.89	O		1103	ACG (T) => ATG (M)	1.00	O
	446	CCG (P) => CTG (L)	0.78	O		1157	CCC (P) => CTC (L)	1.00	O
	451	CCT (P) => TCT (S)	1.00	O		1193	CCA (P) => CTA (L)	1.00	O
	458	TCA (S) => TTA (L)	0.78	O		1207	CCC (P) => TCC (S)	1.00	O
	463	CGT (R) => TGT (C)	1.00	O		1223	TCA (S) => TTA (L)	1.00	O

<i>ccmC</i>	473	CCG (P) => CTG (L)	1.00	O	<i>nad5</i>	1263	TTC (F) => TTT (F)	X	O
	497	TCC (S) => TTC (F)	1.00	O		1292	TCT (S) => TTT (F)	0.20	O
	499	CCC (P) => TCC (S)	1.00	O		1300	CCT (P) => TCT (S)	1.00	O
	501	CCC (P) => TCT (S)	X	O		1306	CAC (H) => TAC (Y)	1.00	O
	508	CGG (R) => TGG (W)	1.00	O		1319	TCG (S) => TTG (L)	1.00	O
	521	TCG (S) => TTG (L)	1.00	O		1328	CCG (P) => CTG (L)	1.00	O
	548	TCT (S) => TTT (F)	1.00	O		1337	CCA (P) => CTA (L)	1.00	O
	568	CCT (P) => TCT (S)	1.00	O		1340	GCA (A) => GTA (V)	0.80	O
	612	TTC (F) => TTT (F)	X	O		1351	CCA (P) => TCA (S)	0.90	O
	614	CCA (P) => CTA (L)	0.78	O		1409	TCA (S) => TTA (L)	1.00	O
	619	CGT (R) => TGT (C)	0.78	O		1433	CCT (P) => CTT (L)	0.80	O
	628	CTC (L) => TTC (F)	0.89	X		1467	ATC (I) => ATT (I)	X	O
	650	CCT (P) => CTT (L)	0.78	O		1484	TCT (S) => TTT (F)	1.00	O
	656	CCA (P) => CTA (L)	0.89	O		1486	CGG (R) => TGG (W)	1.00	O
	665	CCC (P) => CTC (L)	0.78	O		1495	CCC (P) => TCC (S)	1.00	O
	673	CCC (P) => TCC (S)	0.78	O		1499	CCT (P) => CTT (L)	0.80	O
<i>ccmFc</i>	11	CCG (P) => CTG (L)	1.00	O		1502	TCC (S) => TTC (F)	0.80	O
1395	35	ACT (T) => ATT (I)	X	O		1559	ACC (T) => ATC (I)	0.90	O
	38	TCC (S) => TTC (F)	0.83	O		1565	CCA (P) => CTA (L)	0.90	O
	50	CCT (P) => CTT (L)	1.00	O		1580	TCT (S) => TTT (F)	1.00	O
	52	CGT (R) => TGT (C)	1.00	O		1661	TCT (S) => TTT (F)	0.80	O
	87	TTC (F) => TTT (F)	X	O		1675	CAT (H) => TAT (Y)	1.00	O
	103	CCC (P) => TCC (S)	1.00	O		1682	TCT (S) => TTT (F)	1.00	O
	107	ACA (T) => ATA (I)	X	O		1702	CCC (P) => TTC (F)	1.00	O
	119	TCT (S) => TTT (F)	1.00	O		1703	CCC (P) => TTC (F)	1.00	O

ccmFc	122	TCC (S) => TTC (F)	1.00	O	nad5	1730	GCC (A) => GTC (V)	0.70	X	
	145	CCT (P) => TTT (F)	X	O		1775	TCA (S) => TTA (L)	1.00	O	
	146	CCT (P) => TTT (F)	1.00	O		1869	TTC (F) => TTT (F)	X	O	
	149	ACA (T) => ATA (I)	1.00	X		1925	TCT (S) => TTT (F)	0.70	O	
	160	CCC (P) => TCC (S)	0.67	X		1927	CGT (R) => TGT (C)	0.70	O	
	164	TCT (S) => TTT (F)	0.33	X		1948	CCT (P) => TCT (S)	0.70	O	
	181	CCC (P) => TCC (S)	0.83	O		1967	TCG (S) => TTG (L)	0.90	O	
	245	CCT (P) => CTT (L)	X	O		1979	TCG (S) => TTG (L)	0.50	O	
	280	CCC (P) => TCC (S)	1.00	X		1997	TCC (S) => TTC (F)	0.20	O	
	305	TCA (S) => TTA (L)	0.83	O		2000	CCA (P) => CTA (L)	X	O	
	314	TCC (S) => TTC (F)	1.00	O	nad6	2	ACG (T) => ATG (M)	X	O	
	319	CTC (L) => TTC (F)	X	O		615	8	TCT (S) => TTT (F)	1.00	O
	368	CCA (P) => CTA (L)	0.83	O		17	TCG (S) => TTG (L)	0.70	O	
	379	CGC (R) => TGC (C)	1.00	O		19	CCG (P) => TCG (S)	0.90	O	
	381	CGC (R) => TGT (C)	X	O		26	CCT (P) => CTT (L)	0.40	O	
	391	CGT (R) => TGT (C)	1.00	O		36	GTC (V) => GTT (V)	X	O	
	406	CGT (R) => TGT (C)	0.83	O		76	CCC (P) => TCC (S)	1.00	O	
	412	CTT (L) => TTT (F)	0.67	X		80	GCT (A) => GTT (V)	0.90	O	
	415	CTC (L) => TTC (F)	1.00	X		83	TCG (S) => TTG (L)	1.00	O	
	422	CCA (P) => CTA (L)	1.00	X		87	TTC (F) => TTT (F)	X	O	
	545	CCC (P) => CTC (L)	0.67	X		88	CCC (P) => TTC (F)	0.70	O	
	551	CCA (P) => CTA (L)	1.00	X		89	CCC (P) => TTC (F)	0.70	O	
	731	GCT (A) => GTT (V)	0.83	X		95	CCA (P) => CTA (L)	1.00	O	
	886	CAT (H) => TAT (Y)	X	O		103	CGC (R) => TGC (C)	1.00	O	
	890	TCA (S) => TTA (L)	1.00	O		142	CTC (L) => TTC (F)	1.00	O	

<i>ccmFc</i>	1049	TCT (S) => TTT (F)	1.00	O	<i>nad6</i>	145	CCT (P) => TTT (F)	1.00	O
	1057	CGT (R) => TGT (C)	X	O		146	CCT (P) => TTT (F)	1.00	O
	1169	GCT (A) => GTT (V)	1.00	O		158	TCC (S) => TTC (F)	1.00	O
	1198	CCA (P) => TTA (L)	X	O		161	CCA (P) => CTA (L)	1.00	O
	1199	CCA (P) => TTA (L)	1.00	O		169	CAT (H) => TAT (Y)	1.00	O
	1208	CCG (P) => CTG (L)	1.00	O		191	TCA (S) => TTA (L)	1.00	O
	1262	CCG (P) => CTG (L)	1.00	O		194	TCC (S) => TTC (F)	1.00	O
	1267	CTT (L) => TTT (F)	1.00	O		195	TCC (S) => TTT (F)	X	O
	1276	CGC (R) => TGC (C)	X	O		199	CCC (P) => TTC (F)	1.00	O
	1282	CGG (R) => TGG (W)	1.00	O		200	CCC (P) => TTC (F)	1.00	O
	1303	CCG (P) => TCG (S)	1.00	O		251	TCG (S) => TTG (L)	0.90	O
	1307	CCG (P) => CTG (L)	1.00	O		260	CCA (P) => CTA (L)	1.00	O
	1352	TCG (S) => TTG (L)	1.00	O		289	CTT (L) => TTT (F)	1.00	O
	1357	CGG (R) => TGG (W)	1.00	O		292	CGG (R) => TGG (W)	0.70	O
	1363	CAA (Q) => TAA (X)	1.00	O		314	CCA (P) => CTA (L)	0.70	O
<i>ccmFn</i>	38	CCG (P) => CTG (L)	1.00	O		325	CAC (H) => TAC (Y)	0.22	O
1728	47	TCC (S) => TTC (F)	1.00	O		335	TCA (S) => TTA (L)	0.78	O
	61	CAC (H) => TAC (Y)	1.00	O		379	CAT (H) => TAT (Y)	0.90	O
	86	TCT (S) => TTT (F)	1.00	O		410	TCG (S) => TTG (L)	1.00	O
	98	CCT (P) => CTT (L)	1.00	O		419	TCG (S) => TTG (L)	1.00	O
	113	ACT (T) => ATT (I)	1.00	X		428	TCA (S) => TTA (L)	1.00	O
	124	CTC (L) => TTC (F)	1.00	O		433	CAT (H) => TAT (Y)	1.00	O
	134	CCT (P) => CTT (L)	1.00	O		446	TCC (S) => TTC (F)	1.00	O
	137	TCG (S) => TTG (L)	1.00	O		451	CGG (R) => TGG (W)	0.70	O
	142	CGT (R) => TGT (C)	1.00	O		458	TCG (S) => TTG (L)	1.00	O

ccmFn	149	ACT (T) => ATT (I)	1.00	X	nad6	470	CCT (P) => CTT (L)	1.00	O	
	151	CCT (P) => TCT (S)	0.83	O		476	CCA (P) => CTA (L)	1.00	O	
	163	CCC (P) => TCC (S)	1.00	O		479	TCA (S) => TTA (L)	1.00	O	
	208	CTT (L) => TTT (F)	1.00	X		500	ACA (T) => ATA (I)	1.00	O	
	254	CCA (P) => CTA (L)	1.00	O		569	TCC (S) => TTC (F)	1.00	O	
	257	CCA (P) => CTA (L)	1.00	O		570	TCC (S) => TTT (F)	X	O	
	259	CGG (R) => TGG (W)	1.00	O		602	CAA (Q) => CTA (L)	X	O	
	265	CGG (R) => TGG (W)	1.00	O	nad7	38	TCG (S) => TTG (L)	0.75	O	
	272	CCA (P) => CTA (L)	0.83	O		1185	45	TTC (F) => TTT (F)	X	O
	290	CCC (P) => CTC (L)	0.67	O		74	GCT (A) => GTT (V)	1.00	O	
	295	CGT (R) => TGT (C)	1.00	O		77	TCA (S) => TTA (L)	1.00	O	
	365	TCC (S) => TTC (F)	0.67	O		83	TCA (S) => TTA (L)	1.00	O	
	372	GTC (V) => GTT (V)	X	O		137	TCA (S) => TTA (L)	1.00	O	
	374	TCG (S) => TTG (L)	0.67	O		160	CTA (L) => TTA (L)	X	O	
	381	TTC (F) => TTT (F)	X	O		209	TCA (S) => TTA (L)	0.88	O	
	403	CTC (L) => TTC (F)	X	O		247	CCT (P) => TCT (S)	1.00	O	
	408	CCC (P) => CCT (P)	X	O		251	TCA (S) => TTA (L)	1.00	O	
	455	CCA (P) => CTA (L)	0.67	X		268	CTG (L) =>TTG (L)	X	O	
	514	CTT (L) => TTT (F)	X	O		274	CGC (R) => TGC (C)	1.00	O	
	584	TCT (S) => TTT (F)	0.50	X		316	CGT (R) => TGT (C)	1.00	O	
	623	TCG (S) => TTG (L)	X	O		335	TCG (S) => TTG (L)	0.88	O	
	697	CCC (P) => TCC (S)	1.00	X		344	TCA (S) => TTA (L)	1.00	O	
	748	CTT (L) => TTT (F)	0.67	X		392	TCC (S) => TTC (F)	1.00	O	
	752	TCC (S) => TTC (F)	1.00	O		404	TCT (S) => TTT (F)	1.00	O	
	758	TCG (S) => TTG (L)	0.83	O		422	TCG (S) => TTG (L)	1.00	O	

<i>ccmFn</i>	796	CGT (R) => TGT (C)	1.00	O
	805	CCG (P) => TCG (S)	X	O
	818	TCA (S) => TTA (L)	1.00	O
	830	CCG (P) => CTG (L)	1.00	O
	862	CGC (R) => TGC (C)	1.00	O
	979	CGC (R) => TGC (C)	1.00	O
	1108	CTC (L) => TTC (F)	1.00	X
	1114	CTC (L) => TTC (F)	1.00	X
	1208	TCG (S) => TTG (L)	X	O
	1286	CCG (P) => CTG (L)	1.00	O
	1294	CGG (R) => TGG (W)	1.00	O
	1322	CCA (P) => CTA (L)	1.00	O
	1339	CAT (H) => TAT (Y)	1.00	O
	1354	CGG (R) => TGG (W)	1.00	O
	1363	CGG (R) => TGG (W)	1.00	O
	1372	CGG (R) => TGG (W)	1.00	O
	1396	CCT (P) => TTT (F)	1.00	O
	1397	CCT (P) => TTT (F)	1.00	O
	1405	CGG (R) => TGG (W)	1.00	O
	1423	CGT (R) => TGT (C)	1.00	O
	1432	CCA (P) => TCA (S)	1.00	O
	1472	CCC (P) => CTC (L)	0.83	O
	1490	TCA (S) => TTA (L)	1.00	O
	1492	CGC (R) => TGC (C)	1.00	O
	1502	TCA (S) => TTA (L)	1.00	O

<i>nad7</i>	433	CAT (H) => TAT (Y)	1.00	O
	445	CCG (P) => TCG (S)	0.88	O
	566	TCA (S) => TTA (L)	0.88	O
	578	TCA (S) => TTA (L)	0.88	O
	656	TCC (S) => TTC (F)	1.00	O
	657	TCC (S) => TTT (F)	X	O
	671	CCA (P) => CTA (L)	1.00	O
	698	TCG (S) => TTG (L)	1.00	O
	722	GCC (A) => GTC (V)	1.00	O
	724	CAT (H) => TAT (Y)	1.00	O
	734	TCG (S) => TTG (L)	0.88	O
	740	TCT (S) => TTT (F)	1.00	O
	781	CAC (H) => TAC (Y)	1.00	O
	815	CCT (P) => CTT (L)	0.50	O
	836	CCT (P) => CTT (L)	1.00	O
	913	CCC (P) => TCC (S)	1.00	O
	926	TCA (S) => TTA (L)	0.88	O
	944	CCC (P) => CTC (L)	1.00	O
	946	CAT (H) => TAT (Y)	1.00	O
	963	TCC (S) => TCT (S)	X	O
	982	CAT (H) => TAT (Y)	1.00	O
	1057	CGT (R) => TGT (C)	1.00	O
	1079	TCT (S) => TTT (F)	1.00	O
	1083	GCC (A) => GCT (A)	X	O
	1103	TCT (S) => TTT (F)	1.00	O

<i>ccmFn</i>	1511	TCT (S) => TTT (F)	1.00	O	<i>nad7</i>	1124	CCA (P) => CTA (L)	1.00	O
	1514	TCG (S) => TTG (L)	X	O	<i>nad9</i>	2	ACG (T) => ATG (M)	0.92	O
	1532	CCA (P) => CTA (L)	1.00	O	591	28	CCG (P) => TCG (S)	0.75	O
	1537	CCC (P) => TCC (S)	1.00	O		41	TCA (S) => TTA (L)	1.00	O
	1549	CCT (P) => TTT (F)	1.00	O		92	TCA (S) => TTA (L)	X	O
	1550	CCT (P) => TTT (F)	1.00	O		113	CCA (P) => CTA (L)	0.92	O
	1585	CGG (R) => TGG (W)	0.67	X		134	CCG (P) => CTG (L)	0.92	O
<i>cob</i>	24	TTC (F) => TTT (F)	X	O		158	TCC (S) => TTC (F)	0.33	O
1194	25	CCT (P) => TCT (S)	1.00	O		167	TCG (S) => TTG (L)	0.92	O
	32	CCC (P) => CTC (L)	1.00	O		178	CGC (R) => TGC (C)	0.92	O
	33	CCC (P) => CTT (L)	X	O		195	CCC (P) => CCT (P)	X	O
	76	CAT (H) => TAT (Y)	1.00	O		218	GCG (A) => GTG (V)	0.92	O
	118	CCG (P) => TCG (S)	0.92	O		230	TCA (S) => TTA (L)	1.00	O
	133	CGT (R) => TGT (C)	1.00	O		233	CCA (P) => CTA (L)	1.00	O
	137	CCA (P) => CTA (L)	1.00	O		250	CCA (P) => TCA (S)	0.92	O
	140	GCC (A) => GTC (V)	0.92	X		298	CCG (P) => TCG (S)	0.83	O
	167	CCA (P) => CTA (L)	1.00	O		311	CCA (P) => CTA (L)	0.75	O
	178	CAC (H) => TAC (Y)	1.00	O		328	CGG (R) => TGG (W)	1.00	O
	244	CGG (R) => TGG (W)	1.00	O		355	CCC (P) => TTC (F)	1.00	O
	287	TCC (S) => TTC (F)	1.00	O		356	CCC (P) => TTC (F)	1.00	O
	303	CTC (L) => CTT (L)	X	O		357	CCC (P) => TTT (F)	X	O
	325	CAT (H) => TAT (Y)	1.00	O		368	TCC (S) => TTC (F)	1.00	O
	334	CAT (H) => TAT (Y)	1.00	O		413	TCC (S) => TTC (F)	1.00	O
	354	TTC (F) => TTT (F)	X	O		440	TCC (S) => TTC (F)	1.00	O
	358	CGG (R) => TGG (W)	1.00	O		441	TCC (S) => TTT (F)	X	O

<i>cob</i>	403	CCT (P) => TTT (F)	1.00	O		478	CCG (P) => TCG (S)	X	O
	404	CCT (P) => TTT (F)	1.00	O		533	TCT (S) => TTT (F)	1.00	O
	442	CGG (R) => TGG (W)	1.00	O	<i>rpl10</i>	5	CCA (P) => CTA (L)	1.00	O
	467	TCA (S) => TTA (L)	1.00	O	483	74	TCA (S) => TTA (L)	X	O
	514	CGG (R) => TGG (W)	1.00	O		92	TCG (S) => TTG (L)	0.83	O
	545	TCA (S) => TTA (L)	1.00	O		116	CCC (P) => CTC (L)	1.00	O
	568	CAT (H) => TAT (Y)	0.92	O		124	CCA (P) => TTA (L)	X	O
	575	CCC (P) => CTC (L)	1.00	O		125	CCA (P) => TTA (L)	0.83	O
	587	CCA (P) => CTA (L)	0.77	O		146	CCA (P) => CTA (L)	0.83	O
	620	TCG (S) => TTG (L)	1.00	O		215	TCC (S) => TTC (F)	1.00	X
	647	TCG (S) => TTG (L)	1.00	O		274	CCG (P) => TCG (S)	1.00	X
	680	TCT (S) => TTT (F)	1.00	O		290	TCG (S) => TTG (L)	1.00	X
	707	CCA (P) => CTA (L)	1.00	O		307	CGG (R) => TGG (W)	1.00	X
	715	CGG (R) => TGG (W)	1.00	O		335	CCA (P) => CTA (L)	0.83	X
	725	TCC (S) => TTC (F)	1.00	O		338	TCA (S) => TTA (L)	1.00	O
	726	TCC (S) => TTT (F)	X	O		425	TCT (S) => TTT (F)	X	O
	737	TCT (S) => TTT (F)	0.92	O		439	CAT (H) => TAT (Y)	0.83	X
	770	TCG (S) => TTG (L)	1.00	O		458	CCT (P) => CTT (L)	1.00	O
	835	CGG (R) => TGG (W)	1.00	O	<i>rpl16</i>	5	CCA (P) => CTA (L)	1.00	O
	845	CCA (P) => CTA (L)	1.00	O	414	104	ACC (T) => ATC (I)	1.00	O
	853	CAT (H) => TAT (Y)	1.00	O		105	ACC (T) => ATT (I)	X	O
	863	CCT (P) => CTT (L)	1.00	O		164	ACA (T) => ATA (I)	0.89	O
	908	CCA (P) => CTA (L)	1.00	O		196	CGG (R) => TGG (W)	1.00	O
	914	TCT (S) => TTT (F)	1.00	O		218	CCC (P) => CTC (L)	0.56	O
	932	CCA (P) => CTA (L)	1.00	O		293	GCG (A) => GTG (V)	1.00	O

cob	937	CCT (P) => TTT (F)	1.00	O	rpl16	297	TCC (S) => TCT (S)	X	O
	938	CCT (P) => TTT (F)	1.00	O		311	CCA (P) => CTA (L)	1.00	O
	971	TCT (S) => TTT (F)	1.00	O		383	TCG (S) => TTG (L)	0.75	O
	997	CGG (R) => TGG (W)	1.00	O		409	CAA (Q) => TAA (X)	1.00	O
	1015	CGC (R) => TGC (C)	1.00	O	rpl2	2	ACG (T) => ATG (M)	X	O
	1019	TCA (S) => TTA (L)	1.00	O		32	CCT (P) => CTT (L)	1.00	O
	1030	CGG (R) => TGG (W)	1.00	O		41	TCC (S) => TTC (F)	1.00	O
	1047	CCC (P) => CCT (P)	X	O		76	CCA (P) => TCA (S)	1.00	O
	1091	GCT (A) => GTT (V)	0.46	X		89	ACT (T) => ATT (I)	0.75	O
	1097	TCC (S) => TTC (F)	1.00	O		143	TCG (S) => TTG (L)	1.00	O
	1105	CCC (P) => TTC (F)	1.00	O		160	CCT (P) => TCT (S)	1.00	O
	1106	CCC (P) => TTC (F)	1.00	O		367	CCT (P) => TCT (S)	1.00	X
	1124	CCG (P) => CTG (L)	1.00	O		373	CTC (L) => TTC (F)	1.00	X
	1148	ACC (T) => ATC (I)	0.23	X		412	CCT (P) => TCT (S)	0.50	X
	1168	CCA (P) => TTA (L)	X	O		416	TCC (S) => TTC (F)	1.00	X
1169	CCA (P) => TTA (L)	X	O	595	CGG (R) => TGG (W)	1.00	O		
1191	ACC (T) => ACT (T)	X	O	679	CCG (P) => TCG (S)	0.75	X		
cox1	16	CAG (Q) => TAG (X)	X	O	722	TCA (S) => TTA (L)	0.25	O	
	1596	23	TCT (S) => TTT (F)	X	O	737	TCG (S) => TTG (L)	1.00	O
	26	ACG (T) => ATG (M)	X	O	758	ACG (T) => ATG (M)	0.75	O	
	47	CCG (P) => CTG (L)	0.89	O	847	CTT (L) => TTT (F)	1.00	X	
	52	CCC (P) => TCC (S)	1.00	O	974	CCG (P) => CTG (L)	1.00	O	
	54	CCC (P) => TCT (S)	X	O	1004	TCA (S) => TTA (L)	1.00	O	
	80	CCA (P) => CTA (L)	1.00	O	1070	CCG (P) => CTG (L)	1.00	O	
	82	CAT (H) => TAT (Y)	1.00	O	1100	ACA (T) => ATA (I)	1.00	O	

<i>cox1</i>	86	TCA (S) => TTA (L)	0.33	O
	134	CCA (P) => CTA (L)	1.00	O
	191	CCT (P) => CTT (L)	1.00	O
	193	CAT (H) => TAT (Y)	1.00	O
	203	TCA (S) => TTA (L)	1.00	O
	221	TCT (S) => TTT (F)	1.00	O
	224	CCA (P) => CTA (L)	1.00	O
	232	CCT (P) => TTT (F)	1.00	O
	233	CCT (P) => TTT (F)	1.00	O
	266	TCT (S) => TTT (F)	1.00	O
	278	TCC (S) => TTC (F)	1.00	O
	290	CCT (P) => CTT (L)	0.89	O
	334	CCA (P) => TCA (S)	1.00	O
	338	TCC (S) => TTC (F)	1.00	O
	340	CGG (R) => TGG (W)	1.00	O
	368	CCA (P) => CTA (L)	1.00	O
	376	CCA (P) => TCA (S)	1.00	O
	383	TCG (S) => TTG (L)	1.00	O
	461	GCT (A) => GTT (V)	1.00	O
	467	CCA (P) => CTA (L)	1.00	O
	476	TCT (S) => TTT (F)	1.00	O
	482	CCT (P) => CTT (L)	1.00	O
	509	TCA (S) => TTA (L)	1.00	O
	523	CTC (L) => TTC (F)	1.00	O
	538	CCC (P) => TTC (F)	1.00	O

<i>rpl2</i>	1123	CCA (P) => TCA (S)	1.00	O
	1142	TCA (S) => TTA (L)	1.00	O
	1147	CCG (P) => TCG (S)	1.00	O
	1171	CCC (P) => TCC (S)	1.00	O
	1201	CCC (P) => TCC (S)	1.00	O
	1414	CAG (Q) => TAG (X)	X	O
<i>rpl5</i>	9	ATC (I) => ATT (I)	X	O
576	34	CAC (H) => TAC (Y)	1.00	O
	58	CCG (P) => TTG (L)	X	O
	59	CCG (P) => TTG (L)	1.00	O
	71	CCG (P) => CTG (L)	0.89	O
	76	CAC (H) => TAC (Y)	1.00	O
	89	ACG (T) => ATG (M)	1.00	X
	104	TCG (S) => TTG (L)	1.00	O
	136	CCA (P) => TCA (S)	0.50	O
	179	CCG (P) => CTG (L)	0.44	O
	181	CGC (R) => TGC (C)	0.89	O
	251	CCC (P) => CTC (L)	1.00	X
	335	TCC (S) => TTC (F)	1.00	O
	350	TCG (S) => TTG (L)	0.44	O
	409	CCG (P) => TCG (S)	0.67	O
	467	TCC (S) => TTC (F)	1.00	O
	500	GCA (A) => GTA (V)	0.89	X
	510	GCC (A) => GCT (A)	X	O
	533	CCA (P) => CTA (L)	0.89	O

<i>cox1</i>	539	CCC (P) => TTC (F)	1.00	O	<i>rpl5</i>	551	TCG (S) => TTG (L)	1.00	O
	575	TCA (S) => TTA (L)	1.00	O	<i>rps10</i>	2	ACG (T) => ATG (M)	1.00	O
	589	CGG (R) => TGG (W)	1.00	O	342	16	CGC (R) => TGC (C)	0.40	X
	599	CCA (P) => CTA (L)	1.00	O		34	CCT (P) => TTT (F)	0.80	O
	623	TCA (S) => TTA (L)	1.00	O		35	CCT (P) => TTT (F)	0.80	O
	638	CCG (P) => CTG (L)	1.00	O		89	TCG (S) => TTG (L)	1.00	O
	662	TCA (S) => TTA (L)	1.00	O		158	TCT (S) => TTT (F)	1.00	O
	692	TCC (S) => TTC (F)	1.00	O		191	ACA (T) => ATA (I)	0.80	O
	736	CTT (L) => TTT (F)	1.00	O		229	CGG (R) => TGG (W)	0.60	O
	739	CGG (R) => TGG (W)	1.00	O		233	TCA (S) => TTA (L)	0.80	O
	746	TCC (S) => TTC (F)	1.00	O		280	CAC (H) => TAC (Y)	0.60	O
	770	CCC (P) => CTC (L)	1.00	O		293	TCG (S) => TTG (L)	1.00	O
	776	CCG (P) => CTG (L)	1.00	O	<i>rps11</i>	178	CCG (P) => CTG (L)	X	O
	817	CCG (P) => TCG (S)	1.00	O	582	238	CAT (H) => TAT (Y)	1.00	X
	842	CCA (P) => CTA (L)	1.00	O		242	TCC (S) => TTC (F)	X	O
	878	CCT (P) => CTT (L)	1.00	O		243	TCC (S) => TTT (F)	X	O
	884	TCT (S) => TTT (F)	1.00	O		244	CCA (P) => TTA (L)	X	O
	887	CCT (P) => CTT (L)	0.67	O		245	CCA (P) => TTA (L)	X	O
	892	CGG (R) => TGG (W)	1.00	O		247	CCA (P) => TCA (S)	1.00	O
	908	TCT (S) => TTT (F)	1.00	O		252	ATC (I) => ATT (I)	X	O
	920	TCA (S) => TTA (L)	1.00	O		266	TCT (S) => TTT (F)	X	O
	940	CAC (H) => TAC (Y)	1.00	O		275	GCG (A) => GTG (V)	X	O
	944	TCT (S) => TTT (F)	1.00	O		323	TCG (S) => TTG (L)	X	O
	992	TCT (S) => TTT (F)	1.00	O		418	CCA (P) => TCA (S)	0.33	X
	997	CGG (R) => TGG (W)	1.00	O		451	CTC (L) => TTC (F)	X	O

<i>cox1</i>	1049	TCT (S) => TTT (F)	1.00	O	<i>rps11</i>	476	CCG (P) => CTG (L)	X	O
	1055	GCA (A) => GTA (V)	1.00	O		482	TCT (S) => TTT (F)	X	O
	1061	TCC (S) => TTC (F)	1.00	O	<i>rps12</i>	11	TCG (S) => TTG (L)	0.29	O
	1070	CCG (P) => CTG (L)	1.00	O	378	20	TCG (S) => TTG (L)	0.94	O
	1073	TCC (S) => TTC (F)	1.00	O		71	TCG (S) => TTG (L)	0.94	O
	1111	CCT (P) => TCT (S)	0.89	O		100	CGC (R) => TGC (C)	1.00	O
	1130	CCG (P) => CTG (L)	1.00	O		104	CCG (P) => CTG (L)	1.00	O
	1141	CAT (H) => TAT (Y)	1.00	O		112	CCG (P) => TCG (S)	0.88	O
	1160	TCC (S) => TTC (F)	1.00	O		139	CCA (P) => TCA (S)	1.00	O
	1174	CCT (P) => TCT (S)	1.00	O		146	CCA (P) => CTA (L)	1.00	O
	1196	TCA (S) => TTA (L)	1.00	O		221	CCG (P) => CTG (L)	0.88	O
	1199	TCT (S) => TTT (F)	1.00	O		232	CCT (P) => TCT (S)	1.00	O
	1208	TCT (S) => TTT (F)	1.00	O		242	TCG (S) => TTG (L)	0.88	O
	1210	CAC (H) => TAC (Y)	1.00	O		278	GCG (A) => GTG (V)	1.00	O
	1216	CGG (R) => TGG (W)	1.00	O		289	CGT (R) => TGT (C)	0.88	O
	1231	CCT (P) => TTT (F)	0.67	O		311	TCG (S) => TTG (L)	1.00	O
	1232	CCT (P) => TTT (F)	0.67	O		320	ACT (T) => ATT (I)	0.94	O
	1270	CTT (L) => TTT (F)	1.00	O	<i>rps13</i>	5	TCA (S) => TTA (L)	0.60	O
	1273	CGG (R) => TGG (W)	1.00	O	489	7	CAT (H) => TAT (Y)	1.00	X
	1282	CTT (L) => TTT (F)	1.00	O		56	CCA (P) => CTA (L)	0.90	O
	1298	TCG (S) => TTG (L)	0.89	O		92	ACT (T) => ATT (I)	0.90	X
	1402	CCT (P) => TCT (S)	1.00	O		100	CGT (R) => TGT (C)	0.90	O
	1426	CGT (R) => TGT (C)	0.67	O		143	TCA (S) => TTA (L)	1.00	O
	1429	CGT (R) => TGT (C)	0.78	O		190	CAT (H) => TAT (Y)	X	O

cox1	1494	CCC (P) => CCT (P)	X	O	rps13	349	CCG (P) => TCG (S)	1.00	X	
	1495	CGG (R) => TGG (W)	1.00	O	rps14	47	GCG (A) => GTG (V)	0.60	X	
	1513	CCA (P) => TCA (S)	1.00	X	303	74	CCT (P) => CTT (L)	0.40	O	
	1523	CCG (P) => CTG (L)	1.00	O		76	CAT (H) => TAT (Y)	1.00	O	
	1552	CTT (L) => TTT (F)	1.00	O		104	CCT (P) => CTT (L)	0.80	O	
	1561	CCT (P) => TTT (F)	1.00	O		127	CAT (H) => TAT (Y)	X	O	
	1562	CCT (P) => TTT (F)	1.00	O		142	CCT (P) => TCT (S)	0.60	O	
cox2	25	CTC (L) => TTC (F)	X	O		149	TCG (S) => TTG (L)	1.00	O	
	807	71	TCT (S) => TTT (F)	1.00	O		163	CCC (P) => TCC (S)	1.00	O
		161	TCA (S) => TTA (L)	0.95	O		235	CCT (P) => TCT (S)	0.80	O
		253	CGG (R) => TGG (W)	1.00	O		248	TCT (S) => TTT (F)	1.00	O
		263	TCT (S) => TTT (F)	0.95	O		275	TCG (S) => TTG (L)	1.00	O
		278	CCG (P) => CTG (L)	1.00	O		298	CGG (R) => TGG (W)	1.00	O
		308	CCG (P) => CTG (L)	1.00	O	rps19	2	GCG (A) => GTG (V)	X	O
		373	CGG (R) => TGG (W)	1.00	O	282	36	GTC (V) => GTT (V)	X	O
		379	CGG (R) => TGG (W)	1.00	O		47	TCG (S) => TTG (L)	1.00	O
		425	CCA (P) => CTA (L)	1.00	O		50	TCG (S) => TTG (L)	0.67	X
		443	ACG (T) => ATG (M)	1.00	O		94	CGG (R) => TGG (W)	1.00	O
		461	TCA (S) => TTA (L)	1.00	O		109	CCC (P) => TCC (S)	0.50	O
		476	TCA (S) => TTA (L)	1.00	O		125	TCT (S) => TTT (F)	1.00	O
		554	GCA (A) => GTA (V)	1.00	O		163	CCT (P) => TTT (F)	1.00	O
		565	CGG (R) => TGG (W)	1.00	O		164	CCT (P) => TTT (F)	1.00	O
		577	CCC (P) => TCC (S)	1.00	O		167	GCT (A) => GTT (V)	1.00	O
		581	TCA (S) => TTA (L)	1.00	O		206	TCT (S) => TTT (F)	0.83	O

<i>cox2</i>	614	TCG (S) => TTG (L)	1.00	O	<i>rps19</i>	219	GCC (A) => GCT (A)	X	O
	632	TCG (S) => TTG (L)	0.84	O		241	CCG (P) => TCG (S)	0.83	O
	655	CAC (H) => TAC (Y)	1.00	O	<i>rps1</i> 690	43	CCC (P) => TCC (S)	1.00	O
	676	CGT (R) => TGT (C)	1.00	O		50	TCT (S) => TTT (F)	1.00	O
	695	TCT (S) => TTT (F)	X	O		52	CCC (P) => TTC (F)	1.00	X
	698	ACG (T) => ATG (M)	X	O		53	CCC (P) => TTC (F)	1.00	X
	766	CCA (P) => TCA (S)	0.68	X		82	CCA (P) => TCA (S)	X	O
						95	TCA (S) => TTA (L)	1.00	O
<i>cox3</i> 798	149	TCG (S) => TTG (L)	1.00	O		113	CCG (P) => CTG (L)	1.00	O
	156	TTC (F) => TTT (F)	X	O		128	CCT (P) => CTT (L)	0.67	O
	161	CCA (P) => CTA (L)	0.92	O		145	CGT (R) => TGT (C)	0.67	O
	174	TTC (F) => TTT (F)	X	O		209	TCC (S) => TTC (F)	X	O
	178	CGG (R) => TGG (W)	1.00	O		212	CCG (P) => CTG (L)	0.33	O
	245	CCT (P) => CTT (L)	0.92	O		236	CCG (P) => CTG (L)	1.00	X
	263	CCG (P) => CTG (L)	1.00	O		338	TCG (S) => TTG (L)	0.33	O
	266	TCC (S) => TTC (F)	1.00	O		350	TCT (S) => TTT (F)	1.00	O
	270	ATC (I) => ATT (I)	X	O		359	CCA (P) => CTA (L)	1.00	O
	289	CTC (L) => TTC (F)	0.92	O		377	CCG (P) => CTG (L)	1.00	X
	298	CTT (L) => TTT (F)	1.00	O		497	CCG (P) => CTG (L)	0.67	O
	301	CCT (P) => TTT (F)	1.00	O		536	TCT (S) => TTT (F)	1.00	O
	302	CCT (P) => TTT (F)	1.00	O		542	ACT (T) => ATT (I)	1.00	O
	304	CGG (R) => TGG (W)	1.00	O		565	CCA (P) => TCA (S)	X	O
	311	TCT (S) => TTT (F)	0.92	O		566	CCA (P) => CTA (L)	0.67	X
	322	CCT (P) => TCT (S)	1.00	O		569	GCA (A) => GTA (V)	1.00	O
	326	TCG (S) => TTG (L)	1.00	O		587	ACA (T) => ATA (I)	0.67	O
	355	CGG (R) => TGG (W)	1.00	O					

<i>cox3</i>	380	TCA (S) => TTA (L)	1.00	O	<i>rps1</i>	592	CCC (P) => TTC (F)	1.00	O
	413	CCT (P) => CTT (L)	0.83	O		593	CCC (P) => TTC (F)	1.00	O
	419	CCC (P) => CTC (L)	1.00	O		594	CCC (P) => TTT (F)	X	O
	424	CCA (P) => TCA (S)	1.00	O		596	CCT (P) => CTT (L)	1.00	O
	497	TCA (S) => TTA (L)	0.92	O		608	CCT (P) => CTT (L)	X	O
	512	TCA (S) => TTA (L)	0.75	X		641	TCC (S) => TTC (F)	1.00	O
	550	CAT (H) => TAT (Y)	1.00	O		642	TCC (S) => TTT (F)	X	O
	565	CCC (P) => TTC (F)	0.92	O		644	ACC (T) => ATC (I)	X	O
	566	CCC (P) => TTC (F)	0.92	O		671	ACG (T) => ATG (M)	X	O
	586	CAT (H) => TAT (Y)	1.00	O	<i>rps2</i>	10	CCC (P) => TCC (S)	0.43	X
	601	CCC (P) => TTC (F)	1.00	O		720 14	CCC (P) => CTC (L)	0.67	O
	602	CCC (P) => TTC (F)	1.00	O		38	CCG (P) => CTG (L)	1.00	O
	605	TCA (S) => TTA (L)	1.00	O		83	TCC (S) => TTC (F)	0.71	X
	650	TCC (S) => TTC (F)	1.00	O		104	TCC (S) => TTC (F)	X	O
	653	CCA (P) => CTA (L)	1.00	O		125	CCC (P) => CTC (L)	0.57	O
	661	CGT (R) => TGT (C)	1.00	O		130	CCA (P) => TCA (S)	0.57	O
	733	CGG (R) => TGG (W)	1.00	O		152	TCA (S) => TTA (L)	0.86	O
	740	TCC (S) => TTC (F)	1.00	O		170	TCC (S) => TTC (F)	0.86	O
	754	CGG (R) => TGG (W)	0.92	O		171	TCC (S) => TTT (F)	X	O
	758	TCA (S) => TTA (L)	1.00	O		182	CCC (P) => CTC (L)	0.43	O
	764	CCA (P) => CTA (L)	0.92	O		209	TCC (S) => TTC (F)	0.71	O
	772	CCT (P) => TCT (S)	1.00	O		230	TCC (S) => TTC (F)	1.00	O
<i>matR</i>	71	CCC (P) => CTC (L)	1.00	O		254	GCG (A) => GTG (V)	X	O
	2190 77	TCC (S) => TTC (F)	0.62	X		323	TCG (S) => TTG (L)	0.25	X
	98	CCG (P) => CTG (L)	X	O		346	CCG (P) => TCG (S)	0.75	X

matR	118	CCG (P) => TCG (S)	0.88	X	rps2	421	CGT (R) => TGT (C)	1.00	O	
	283	CTC (L) => TTC (F)	0.62	X		428	GCA (A) => GTA (V)	0.86	O	
	287	ACC (T) => ATC (I)	0.75	X		584	CCA (P) => CTA (L)	1.00	O	
	340	CCT (P) => TCT (S)	1.00	X		587	TCT (S) => TTT (F)	1.00	O	
	389	CCA (P) => CTA (L)	1.00	O		589	CGT (R) => TGT (C)	1.00	O	
	400	CAT (H) => TAT (Y)	1.00	O	596	TCG (S) => TTG (L)	1.00	O		
	404	CCA (P) => CTA (L)	1.00	O	614	CCT (P) => CTT (L)	X	O		
	445	CAC (H) => TAC (Y)	0.75	X	617	CCT (P) => CTT (L)	0.71	O		
	701	TCC (S) => TTC (F)	1.00	X	rps3	2	ACG (T) => ATG (M)	1.00	O	
	743	CCC (P) => CTC (L)	1.00	O		1668	58	CCA (P) => TCA (S)	1.00	O
	869	CCT (P) => CTT (L)	0.88	X		64	CGG (R) => TGG (W)	1.00	O	
	1009	CAC (H) => TAC (Y)	1.00	O		75	GAC (D) => GAT (D)	X	O	
	1034	CCA (P) => CTA (L)	1.00	O		79	CAT (H) => TAT (Y)	1.00	O	
	1109	CCG (P) => CTG (L)	1.00	O		114	CTC (L) => CTT (L)	X	O	
	1169	TCC (S) => TTC (F)	1.00	O		121	CAT (H) => TAT (Y)	1.00	O	
	1172	CCC (P) => CTC (L)	1.00	O		194	TCT (S) => TTT (F)	1.00	X	
	1250	GCA (A) => GTA (V)	1.00	X		221	TCT (S) => TTT (F)	1.00	O	
	1745	ACC (T) => ATC (I)	1.00	X		462	GAC (D) => GAT (D)	X	O	
	1792	CGG (R) => TGG (W)	1.00	O		497	TCA (S) => TTA (L)	0.71	O	
	1817	CCC (P) => CTC (L)	1.00	O		587	CCG (P) => CTG (L)	0.86	X	
	1825	CAC (H) => TAC (Y)	1.00	X		604	CCC (P) => TCC (S)	0.83	X	
	1828	CAT (H) => TAT (Y)	1.00	O		608	TCC (S) => TTC (F)	1.00	X	
	1846	CTC (L) => TTC (F)	X	O		609	TCC (S) => TCT (S)	X	O	
	1885	CGG (R) => TGG (W)	1.00	O		627	TTC (F) => TTT (F)	X	O	
	1898	TCC (S) => TTC (F)	1.00	O		634	CTT (L) => TTT (F)	0.83	X	

<i>matR</i>	1904	CCT (P) => CTT (L)	1.00	O	<i>rps3</i>	637	CTC (L) => TTC (F)	1.00	X
	1943	CCA (P) => CTA (L)	0.88	O		659	ACG (T) => ATG (M)	X	O
	1961	TCA (S) => TTA (L)	0.88	O		725	TCG (S) => TTG (L)	0.86	O
	2098	CAG (Q) => TAG (X)	0.50	X		740	TCC (S) => TTC (F)	0.57	O
<i>mttB</i>	2	ACG (T) => ATG (M)	0.38	O		767	TCT (S) => TTT (F)	1.00	O
	750	14	TCG (S) => TTG (L)	0.88	O	796	CAT (H) => TAT (Y)	X	O
		26	CCG (P) => CTG (L)	0.88	X	867	TCC (S) => TCT (S)	X	O
		35	GCT (A) => GTT (V)	0.75	X	1010	CCG (P) => CTG (L)	1.00	O
		52	CGG (R) => TGG (W)	0.88	X	1090	CCA (P) => TCA (S)	X	O
		74	TCG (S) => TTG (L)	0.62	O	1091	CCA (P) => CTA (L)	1.00	X
		88	CGT (R) => TGT (C)	0.88	X	1094	CCA (P) => TCA (S)	X	O
		91	CAT (H) => TAT (Y)	1.00	O	1121	TCA (S) => TTA (L)	0.86	O
		100	CCG (P) => TCG (S)	1.00	X	1145	CCG (P) => CTG (L)	0.29	O
		110	TCA (S) => TTA (L)	0.50	O	1344	ATC (I) => ATT (I)	X	O
		119	CCA (P) => CTA (L)	1.00	O	1382	CCA (P) => CTA (L)	1.00	O
		122	TCA (S) => TTA (L)	1.00	O	1409	CCG (P) => CTG (L)	0.86	O
		134	TCT (S) => TTT (F)	0.88	O	1441	CTT (L) => TTT (F)	1.00	O
		137	CCG (P) => CTG (L)	1.00	O	1510	CCA (P) => TCA (S)	1.00	O
		154	CCG (P) => TCG (S)	0.62	O	1520	TCG (S) => TTG (L)	1.00	O
		161	TCC (S) => TTC (F)	1.00	O	1580	GCA (A) => GTA (V)	1.00	X
		162	TCC (S) => TTT (F)	X	O	1583	TCT (S) => TTT (F)	0.86	O
		166	CGT (R) => TGT (C)	1.00	O	1600	CAC (H) => TAC (Y)	1.00	O
		176	TCG (S) => TTG (L)	0.75	O	1607	TCT (S) => TTT (F)	X	O
		188	TCT (S) => TTT (F)	0.62	O	1651	CGG (R) => TGG (W)	1.00	O
	191	TCA (S) => TTA (L)	X	O	<i>rps4</i>	2	ACG (T) => ATG (M)	X	O

<i>mttB</i>	212	CCA (P) => CTA (L)	0.50	O	1053	86	CCC (P) => CTC (L)	1.00	O
	224	TCC (S) => TTC (F)	X	O		95	TCG (S) => TTG (L)	0.83	O
	230	TCC (S) => TTC (F)	1.00	O		133	CCG (P) => TCG (S)	0.67	X
	242	TCC (S) => TTC (F)	0.50	O		134	CCG (P) => CTG (L)	X	O
	265	CCT (P) => TTT (F)	1.00	O		182	TCG (S) => TTG (L)	1.00	O
	266	CCT (P) => TTT (F)	1.00	O		184	CCC (P) => TCC (S)	0.83	O
	269	TCG (S) => TTG (L)	0.75	O		191	TCT (S) => TTT (F)	0.83	O
	274	ATC (I) => ATT (I)	X	O		193	CAT (H) => TAT (Y)	1.00	O
	319	CAC (H) => TAC (Y)	0.62	X		244	CAT (H) => TAT (Y)	1.00	O
	323	CCA (P) => CTA (L)	1.00	O		257	CCA (P) => CTA (L)	1.00	O
	334	CGC (R) => TGC (C)	0.88	O		266	CCA (P) => CTA (L)	0.83	O
	344	CCG (P) => CTG (L)	0.88	O		278	TCG (S) => TTG (L)	0.67	O
	361	CTT (L) => TTT (F)	X	O		290	CCG (P) => CTG (L)	0.83	O
	367	CGG (R) => TGG (W)	0.62	O		307	CGT (R) => TGT (C)	0.50	O
	385	CGG (R) => TGG (W)	1.00	O		335	CCG (P) => CTG (L)	1.00	O
	395	CCA (P) => CTA (L)	0.75	O		355	CGT (R) => TGT (C)	1.00	X
	404	GCG (A) => GTG (V)	0.62	X		359	GCG (A) => GTG (V)	0.83	O
	460	CAT (H) => TAT (Y)	0.88	O		389	TCT (S) => TTT (F)	0.50	O
	470	TCA (S) => TTA (L)	0.88	O		410	CCA (P) => CTA (L)	0.33	O
	485	TCG (S) => TTG (L)	0.88	O		435	GTC (V) => GTT (V)	X	O
	529	CGT (R) => TGT (C)	0.88	O		467	TCC (S) => TTC (F)	1.00	O
	536	CCA (P) => CTA (L)	0.62	O		469	CAT (H) => TAT (Y)	1.00	O
	563	TCC (S) => TTC (F)	0.75	O		482	TCA (S) => TTA (L)	1.00	O
	593	TCC (S) => TTC (F)	0.88	X		497	GCG (A) => GTG (V)	X	O
	594	TCC (S) => TCT (S)	X	O		509	CCA (P) => CTA (L)	0.83	O

<i>mttB</i>	595	CCG (P) => TCG (S)	1.00	O	<i>rps4</i>	517	CCG (P) => TCG (S)	X	O	
	602	CCC (P) => CTC (L)	0.62	O		589	CTA (L) => TTA (L)	X	O	
	605	ACA (T) => ATA (I)	X	O		593	CCA (P) => CTA (L)	1.00	O	
	652	CGT (R) => TGT (C)	0.62	O		608	TCG (S) => TTG (L)	1.00	O	
	659	CCT (P) => CTT (L)	0.50	O		658	CCC (P) => TCC (S)	X	O	
	668	CCG (P) => CTG (L)	0.50	O		660	CCC (P) => TCT (S)	X	O	
	687	ATC (I) => ATT (I)	X	O		662	TCT (S) => TTT (F)	1.00	X	
	689	TCT (S) => TTT (F)	1.00	O		668	TCA (S) => TTA (L)	X	O	
	698	TCG (S) => TTG (L)	0.75	O		725	TCG (S) => TTG (L)	0.67	O	
<i>nadI</i>	2	ACG (T) => ATG (M)	0.80	O	730	CAT (H) => TAT (Y)	X	O		
	981	29	CCT (P) => CTT (L)	1.00	O	734	TCT (S) => TTT (F)	0.75	X	
	49	CTA (L) => TTA (L)	X	O	782	CCT (P) => CTT (L)	0.80	X		
	97	CTC (L) => TTC (F)	0.70	O	821	TCA (S) => TTA (L)	0.60	O		
	134	TCG (S) => TTG (L)	X	O	845	TCT (S) => TTT (F)	X	O		
	215	TCT (S) => TTT (F)	0.90	O	876	ATC (I) => ATT (I)	X	O		
	221	TCT (S) => TTT (F)	1.00	O	911	TCG (S) => TTG (L)	0.83	O		
	245	TCT (S) => TTT (F)	1.00	O	922	CAT (H) => TAT (Y)	0.83	O		
	265	CGG (R) => TGG (W)	1.00	O	932	CCG (P) => CTG (L)	0.67	O		
	286	CAT (H) => TAT (Y)	1.00	O	947	TCT (S) => TTT (F)	1.00	O		
	299	TCG (S) => TTG (L)	0.90	O	998	CCG (P) => CTG (L)	0.83	O		
	301	CCA (P) => TCA (S)	1.00	O	1007	CCC (P) => CTC (L)	1.00	O		
	308	TCG (S) => TTG (L)	1.00	O	1012	CGG (R) => TGG (W)	1.00	O		
	325	CAT (H) => TAT (Y)	1.00	O	<i>rps7</i>	143	ACC (T) => ATC (I)	0.38	O	
	332	TCT (S) => TTT (F)	1.00	O		588	185	TCA (S) => TTA (L)	0.75	O
	381	TCC (S) => TCT (S)	X	O		200	ACG (T) => ATG (M)	1.00	O	

nadI	388	CCG (P) => TCG (S)	1.00	O	rps7	224	GCT (A) => GTT (V)	0.62	X
	404	CCA (P) => CTA (L)	1.00	O		236	GCT (A) => GTT (V)	0.88	X
	476	CCA (P) => CTA (L)	0.90	O		247	CTC (L) => TTC (F)	0.75	X
	490	CCT (P) => TCT (S)	1.00	O		257	CCA (P) => CTA (L)	0.75	O
	493	CGT (R) => TGT (C)	1.00	O		281	ACC (T) => ATC (I)	1.00	X
	555	CCC (P) => CCT (P)	X	O		356	ACT (T) => ATT (I)	0.62	X
	580	CGT (R) => TGT (C)	1.00	O		358	CAT (H) => TAT (Y)	0.62	O
	584	CCA (P) => CTA (L)	1.00	O		461	TCA (S) => TTA (L)	0.88	O
	607	CTT (L) => TTT (F)	1.00	O		476	TCT (S) => TTT (F)	0.62	X
	635	TCA (S) => TTA (L)	1.00	O		488	CCG (P) => CTG (L)	0.88	O
	653	GCA (A) => GTA (V)	1.00	O		536	CCT (P) => CTT (L)	1.00	O
	674	TCT (S) => TTT (F)	0.90	O		545	CCG (P) => CTG (L)	1.00	O
	680	CCT (P) => CTT (L)	1.00	O		550	CCC (P) => TCC (S)	0.62	O
683	TCT (S) => TTT (F)	1.00	O	sdh3	26	ACG (T) => ATG (M)	1.00	X	
734	TCG (S) => TTG (L)	0.90	O		564	56	CCT (P) => CTT (L)	0.75	O
739	CCT (P) => TTT (F)	1.00	O		64	CAC (H) => TAC (Y)	1.00	O	
740	CCT (P) => TTT (F)	1.00	O		82	CCG (P) => TCG (S)	1.00	O	
743	CCA (P) => CTA (L)	1.00	O		91	CCA (P) => TCA (S)	1.00	O	
751	CGG (R) => TGG (W)	1.00	O		109	CCC (P) => TCC (S)	0.86	O	
755	CCG (P) => CTG (L)	1.00	O		137	TCG (S) => TTG (L)	0.86	O	
764	CCA (P) => CTA (L)	0.80	O		145	CCC (P) => TTC (F)	0.20	X	
779	TCC (S) => TTC (F)	0.90	X		146	CCC (P) => TTC (F)	0.20	O	
827	TCC (S) => TTC (F)	1.00	O		149	CCT (P) => CTT (L)	0.57	O	
830	CCG (P) => CTG (L)	1.00	O		157	CCG (P) => TTG (L)	X	O	
834	TTC (F) => TTT (F)	X	O		158	CCG (P) => TTG (L)	0.57	O	

<i>nad1</i>	884	TCA (S) => TTA (L)	1.00	O	<i>sdh3</i>	178	CTC (L) => TTC (F)	0.57	O
	893	CCT (P) => CTT (L)	1.00	O		180	CTC (L) => TTT (F)	X	O
	898	CGG (R) => TGG (W)	1.00	O		193	CTC (L) => TTC (F)	1.00	O
	928	CGG (R) => TGG (W)	1.00	O		202	CTT (L) => TTT (F)	0.71	X
	938	TCC (S) => TTC (F)	X	O		228	TTC (F) => TTT (F)	X	O
	939	TCC (S) => TTT (F)	X	O		230	CCG (P) => CTG (L)	0.33	X
	953	CCA (P) => CTA (L)	1.00	O		239	ACT (T) => ATT (I)	0.86	X
	976	CAA (Q) => TAA (X)	0.90	X		263	TCA (S) => TTA (L)	X	O
<i>nad2</i>	16	CCA (P) => TTA (L)	X	O		272	CCG (P) => CTG (L)	0.86	O
1473	17	CCA (P) => TTA (L)	0.89	O		274	CGC (R) => TGC (C)	0.43	O
	41	CCC (P) => CTC (L)	0.44	O		326	TCC (S) => TTC (F)	0.83	X
	116	TCA (S) => TTA (L)	0.89	O		332	TCC (S) => TTC (F)	0.33	X
	119	GCA (A) => GTA (V)	0.67	X		337	CCA (P) => TCA (S)	0.67	X
	146	CCC (P) => CTC (L)	1.00	O		361	CCT (P) => TTT (F)	0.25	X
	147	CCC (P) => CTT (L)	X	O		362	CCT (P) => TTT (F)	0.25	O
	214	CGG (R) => TGG (W)	0.67	O		365	ACG (T) => ATG (M)	1.00	X
	242	TCT (S) => TTT (F)	0.89	O		383	TCA (S) => TTA (L)	X	O
	266	CCA (P) => CTA (L)	1.00	O		390	TTC (F) => TTT (F)	X	O
	335	TCC (S) => TTC (F)	1.00	O		418	CGA (R) => TGA (X)	X	O
	336	TCC (S) => TTT (F)	X	O	<i>sdh4</i>	8	CCG (P) => CTG (L)	X	O
	341	TCC (S) => TTC (F)	0.67	O	396	15	TTC (F) => TTT (F)	X	O
	345	ATC (I) => ATT (I)	X	O		29	TCG (S) => TTG (L)	X	O
	350	TCA (S) => TTA (L)	1.00	O		33	GTC (V) => GTT (V)	X	O
	359	CCT (P) => CTT (L)	0.89	O		39	CCC (P) => CCT (P)	X	O
	361	CCT (P) => TCT (S)	1.00	O		47	CCC (P) => CTC (L)	X	O

<i>nad2</i>	367	CGC (R) => TGC (C)	1.00	O
	374	ACG (T) => ATG (M)	1.00	O
	388	CCG (P) => TCG (S)	1.00	O
	394	CAT (H) => TAT (Y)	1.00	O
	401	TCA (S) => TTA (L)	1.00	O
	428	CCT (P) => CTT (L)	1.00	O
	437	TCA (S) => TTA (L)	1.00	O
	481	CCC (P) => TCC (S)	1.00	O
	497	TCG (S) => TTG (L)	1.00	O
	506	TCG (S) => TTG (L)	0.67	O
	523	CCC (P) => TCC (S)	1.00	O
	526	CCT (P) => TCT (S)	1.00	O
	536	TCA (S) => TTA (L)	0.89	O
	543	TTC (F) => TTT (F)	X	O
	609	ACC (T) => ACT (T)	X	O
	626	TCG (S) => TTG (L)	0.50	O
	683	TCT (S) => TTT (F)	1.00	O
	696	ATC (I) => ATT (I)	X	O
	774	ATC (I) => ATT (I)	X	O
	815	TCT (S) => TTT (F)	1.00	O
	820	CAT (H) => TAT (Y)	0.56	O
	859	CTC (L) => TTC (F)	1.00	O
	862	CGC (R) => TGC (C)	0.89	O
	874	CCT (P) => TCT (S)	1.00	O
	934	CAT (H) => TAT (Y)	1.00	O

<i>sdh4</i>	83	ACA (T) => ATA (I)	0.43	X
	152	TCC (S) => TTC (F)	0.75	X
	155	CCA (P) => CTA (L)	0.88	O
	189	TCC (S) => TCT (S)	X	O
	200	CCG (P) => CTG (L)	0.75	O
	217	CGG (R) => TGG (W)	1.00	O
	256	CAT (H) => TAT (Y)	0.88	O
	305	TCG (S) => TTG (L)	0.62	X
	310	CTT (L) => TTT (F)	X	O
	343	CCC (P) => TTC (F)	X	O
	344	CCC (P) => TTC (F)	0.50	O
	345	CCC (P) => TTT (F)	X	O
	347	GCT (A) => GTT (V)	1.00	O
	356	CCG (P) => CTG (L)	X	O

<i>nad2</i>	964	CGT (R) => TGT (C)	0.78	O
	968	ACC (T) => ATC (I)	1.00	O
	1027	CAT (H) => TAT (Y)	1.00	O
	1034	TCA (S) => TTA (L)	0.78	O
	1052	TCC (S) => TTC (F)	1.00	O
	1064	CCA (P) => CTA (L)	1.00	O
	1112	CCA (P) => CTA (L)	1.00	O
	1162	CCA (P) => TCA (S)	1.00	O
	1195	CGT (R) => TGT (C)	1.00	O
	1214	TCC (S) => TTC (F)	1.00	O
	1217	TCC (S) => TTC (F)	1.00	O
	1247	CCA (P) => CTA (L)	1.00	O
	1282	CGT (R) => TGT (C)	1.00	O
	1304	GCG (A) => GTG (V)	1.00	O
	1318	CCC (P) => TTC (F)	1.00	O
	1319	CCC (P) => TTC (F)	1.00	O
	1394	TCT (S) => TTT (F)	X	O
	1397	TCC (S) => TTC (F)	0.89	O
	1398	TCC (S) => TTT (F)	X	O
	1406	TCA (S) => TTA (L)	0.67	O
	1409	TCC (S) => TTC (F)	1.00	O
	1415	CCG (P) => CTG (L)	1.00	O
	1422	CCC (P) => CCT (P)	X	O
	1430	TCG (S) => TTG (L)	1.00	O
	1451	ACG (T) => ATG (M)	1.00	O

Table S8. Predicted repeat pairs in *Abies koreana* plastid genome.

Repeat	Length	Start	End	Direction
Repeat_1	1186	76335	77520	plus
Repeat_1	1186	121341	120156	minus
Repeat_2	151	67585	67735	plus
Repeat_2	151	67623	67773	plus
Repeat_3	139	13793	13931	plus
Repeat_3	139	68361	68223	minus
Repeat_4	113	67585	67697	plus
Repeat_4	113	67623	67735	plus
Repeat_4	113	67661	67773	plus
Repeat_5	102	30979	31080	plus
Repeat_5	102	98082	98183	plus
Repeat_6	80	43637	43716	plus
Repeat_6	80	43685	43764	plus
Repeat_7	75	67585	67659	plus
Repeat_7	75	67623	67697	plus
Repeat_7	75	67661	67735	plus
Repeat_7	75	67699	67773	plus
Repeat_8	73	55560	55632	plus
Repeat_8	73	67327	67399	plus
Repeat_9	53	47852	47904	plus
Repeat_9	53	47876	47928	plus
Repeat_10	52	31133	31184	plus
Repeat_10	52	98238	98289	plus
Repeat_11	46	119387	119432	plus
Repeat_11	46	119432	119387	minus
Repeat_12	44	90736	90779	plus
Repeat_12	44	90779	90736	minus
Repeat_13	42	13934	13975	plus
Repeat_13	42	68220	68179	minus
Repeat_14	41	43590	43630	plus
Repeat_14	41	43611	43651	plus
Repeat_15	39	96786	96824	plus
Repeat_15	39	96825	96863	plus
Repeat_16	37	67585	67621	plus
Repeat_16	37	67623	67659	plus
Repeat_16	37	67661	67697	plus
Repeat_16	37	67699	67735	plus
Repeat_16	37	67737	67773	plus
Repeat_17	37	47754	47790	plus
Repeat_17	37	47826	47862	plus
Repeat_18	34	100535	100568	plus
Repeat_18	34	100568	100535	minus
Repeat_19	32	43637	43668	plus
Repeat_19	32	43685	43716	plus
Repeat_19	32	43733	43764	plus

Table S9. Summary of *Abies* plastid genomes.

Taxon	Plastome size (bp)	LSC (bp)	SSC (bp)	IR (bp)	GC content (%)	Protein genes	tRNA genes	rRNA genes	GenBank number
<i>A. kawakamii</i>	121,803	76,339	43,104	1,180	38.3	72	35	4	MZ868721
<i>A. nephrolepis</i>	121,221	76,266	42,583	1,186	38.3	72	34	4	MZ504153
<i>A. pindrow</i>	119,981	76,270	41,343	1,184	38.3	72	34	4	MZ868720
<i>A. sachalinensis</i>	121,333	76,256	42,705	1,186	38.3	72	34	4	MZ504158
<i>A. sibirica</i>	121,256	76,274	42,622	1,180	38.3	72	34	4	MZ868722
<i>A. spectabilis</i>	119,914	76,310	41,260	1,172	38.3	72	34	4	MZ868723
<i>A. veitchii</i>	121,371	76,291	42,708	1,186	38.2	72	34	4	MZ504157
<i>A. firma</i>	121,282	76,322	42,588	1,186	38.2	72	34	4	SRR12710828
<i>A. alba</i>	121,243	75,783	43,108	1,176	38.3	72	34	4	NC_042410
<i>A. balsamea</i>	121,574	76,039	43,165	1,185	38.2	72	34	4	NC_042778
<i>A. beshanzuensis</i>	121,399	76,398	42641	1,180	38.3	72	34	4	NC_045884
<i>A. beshanzuensis</i> var. <i>ziyuanensis</i>	121,274	76,317	42,597	1,180	38.3	72	34	4	MH706705
<i>A. chensiensis</i>	121,329	76,291	42,678	1,180	38.3	72	34	4	NC_041464
<i>A. concolor</i>	120,427				38.3	72	34	4	NC_039581

<i>A. delavayi</i>		120,141	76,332	41,449	1,180	38.3	72	34	4	NC_057313
<i>A. delavayi</i>	subsp.	120,094	76,386	43,360	1,174	38.3	72	34	4	MK607416
<i>A. fansipanensis</i>										
<i>A. ernestii</i>		121,841	76,359	43,122	1,180	38.3	72	34	4	MH706707
<i>A. ernestii</i>	var.	121,681	76,199	43,122	1,180	38.3	72	34	4	ON184013
<i>A. salouenensis</i>										
<i>A. fabri</i>		120,027	76,311	41,356	1,180	38.3	72	34	4	NC_057314
<i>A. fanjingshanensis</i>		120,057	76,353	41,356	1,174	38.3	72	34	4	NC_042777
<i>A. fargesii</i>		121,799	76,334	43,113	1,176	38.3	72	34	4	NC_042775
<i>A. ferreana</i>		120,049	76,341	41,348	1,180	38.3	72	34	4	NC_062889
<i>A. forrestii</i>		120,022	76,309	43,353	1,180	38.3	72	34	4	MH706715
<i>A. georgei</i> var. <i>smithii</i>		121,191	76,274	42,557	1,180	38.3	72	34	4	NC_054152
<i>A. nukiangensis</i>		120,017	76,311	41,358	1,174	38.3	72	34	4	NC_057315
<i>A. religiosa</i>		119,423				38.4	72	34	4	NC_039582
<i>A. yuanbaoshanensis</i>		121,795	76,347	43,088	1,180	38.3	72	34	4	NC_050849

Large single-copy region; LSC, Small single-copy region; SSC, Inverted repeats; IR, Bolded species name indicate plastomes that were generated for this study.

Table S10. Summary of *Abies* mitochondrial genomes.

Taxon	Genome size (Mb)	Mitochondrial scaffolds	Scaffolds Len. (Mb)	GC content (%)	Protein genes	tRNA genes	rRNA genes	GenBank number or reference
<i>A. koreana</i>	1.17	1	-	45.9	41	9	3	ON897690
<i>A. alba</i>	1.43	11	1.43	45.98	41	9	3	ON378818-ON378828/ Kersten et al., 2022
<i>A. firma</i>	1.33	172	1.33	45.78	41			Kan et al, 2021
<i>A. sibirica</i>	1.49	237	1.49	45.7	41			Guo et al, 2020

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