

Supplementary Information

Apicoplast phylogeny reveals the position of *Plasmodium vivax* basal to the Asian primate malaria parasite clade

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Supplementary Fig. S1 Nucleotide/amino acid compositions of the 30 protein coding genes of the 18 *Plasmodium* apicoplast genome. Positions of 6,937 amino acids and 20,811 nucleotides were used for the analysis. Pco: *P. coatneyi*, Pkn: *P. knowlesi*, Pfr: *P. fragile*, Pfi: *P. fieldi*, Pso: *P. simiovale*, Phy: *P. hylobati*, Pin: *P. inui*, Pcy1: *P. cynomolgi* (ceylonensis), Pcy2: *P. cynomolgi* (Berok), Pvi: *P. vivax*, Pgo: *P. gonderi*, Pma: *P. malariae*, Pov: *P. ovale*, Pbe: *P. berghei*, Pyo: *P. yoelii*, Pch: *P. chabaudi*, Pfa: *P. falciparum*, Pga: *P. gallinaceum*.

Supplementary Fig. S2 Nucleotide/amino acid compositions of the nuclear genome encoded 627 protein genes. 330,500 amino acid and first and second codon position of 661,000 nucleotide positions of the seven *Plasmodium* species were used for the analyses. Pco: *P. coatneyi*, Pkn: *P. knowlesi*, Pfr: *P. fragile*, Pin: *P. inui*, Pcy: *P. cynomolgi*, Pvi: *P. vivax*, Pgo: *P. gonderi*,

Supplementary Fig. S3 PCR primer sequences and amplified *Plasmodium* apicoplast genome regions.

Supplementary Table S1 *Plasmodium* species and accession numbers used in this study.

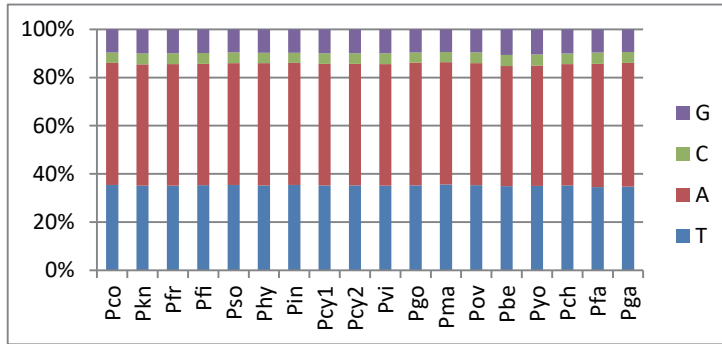
Supplementary Table S2 Gene component and gene length of apicoplast genome in nine *Plasmodium* species that were newly determined in this study.

Supplementary Table S3 Sequence similarities of *Plasmodium* apicoplast genome-encoded genes.

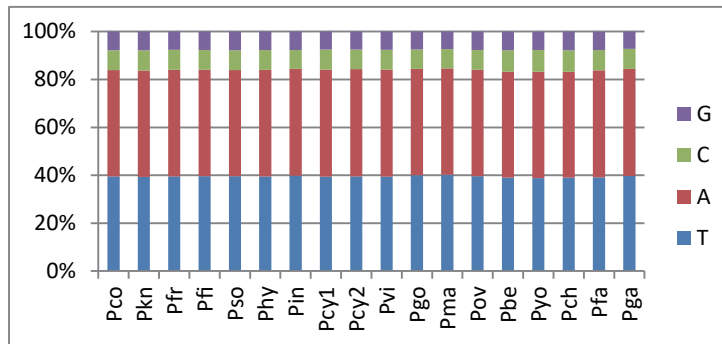
Supplementary Table S4 Gene ID of *Plasmodium vivax*. These genes and their orthologs of six *Plasmodium* species, *P. coatneyi*, *P. knowlesi*, *P. fragile*, *P. inui*, *P. cynomolgi* and *P. gonderi* were used for the phylogenetic analysis.

Supplementary Table S5 Model test for phylogeny using genome encoded gene sequences of seven *Plasmodium* species

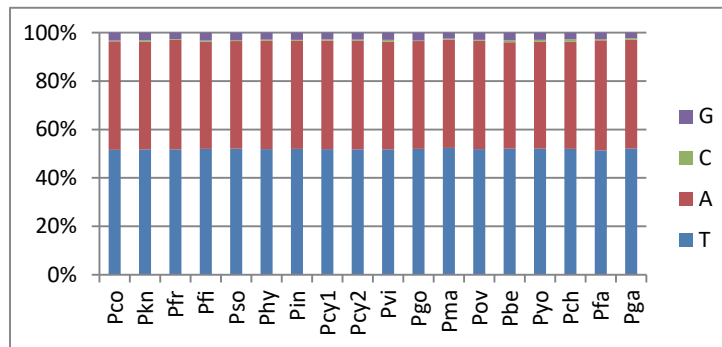
Supplementary Table S6 Approximately unbiased test among 15 tree topologies and several amino acid substitution models.



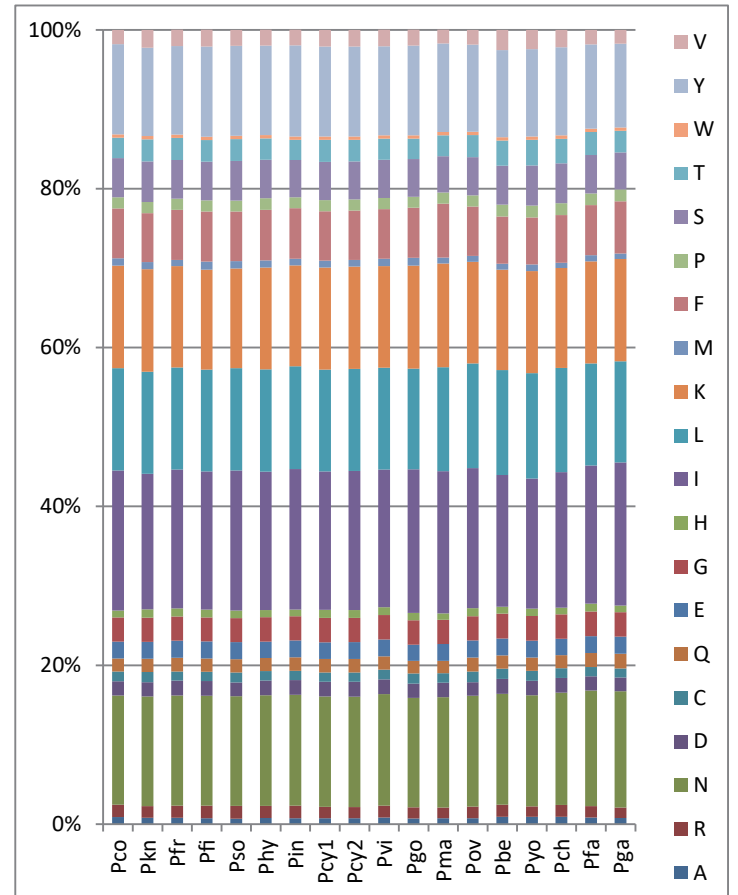
Nucleotide composition (codon-1st)
(AT=84.8 ~ 86.4%)



Nucleotide composition (codon-2nd)
(AT=83.2 ~ 84.7%)



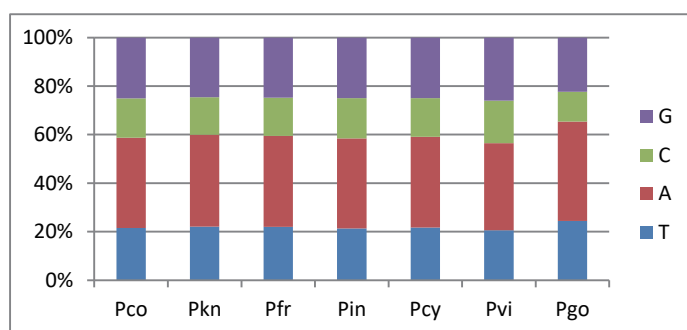
Nucleotide composition (codon-3rd)
(AT=96.0 ~ 97.2%)



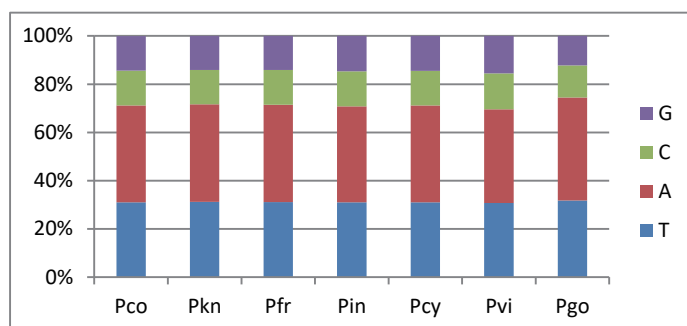
Amino acid composition

Supplementary Fig. S1

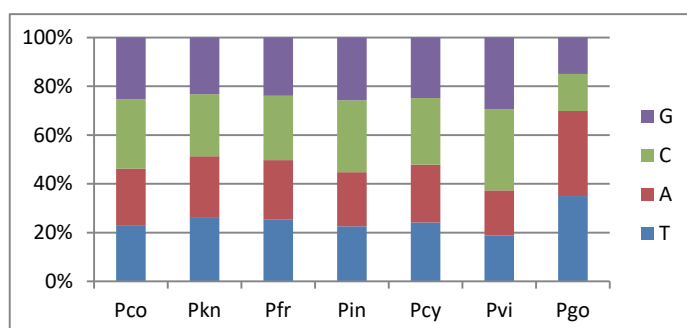
Nucleotide/amino acid compositions of the 30 protein coding genes of the 18 *Plasmodium* apicomplast genome. Positions of 6,937 amino acids and 20,811 nucleotides were used for the analysis. Pco: *P. coatneyi*, Pkn: *P. knowlesi*, Pfr: *P. fragile*, Pfi: *P. fieldi*, Pso: *P. simiovale*, Phy: *P. hylobati*, Pin: *P. inui*, Pcy1: *P. cynomolgi* (ceylonensis), Pcy2: *P. cynomolgi* (Berok), Pvi: *P. vivax*, Pgo: *P. gonderi*, Pma: *P. malariae*, Pov: *P. ovale*, Pbe: *P. berghei*, Pyo: *P. yoelii*, Pch: *P. chabaudi*, Pfa: *P. falciparum*, Pga: *P. gallinaceum*.



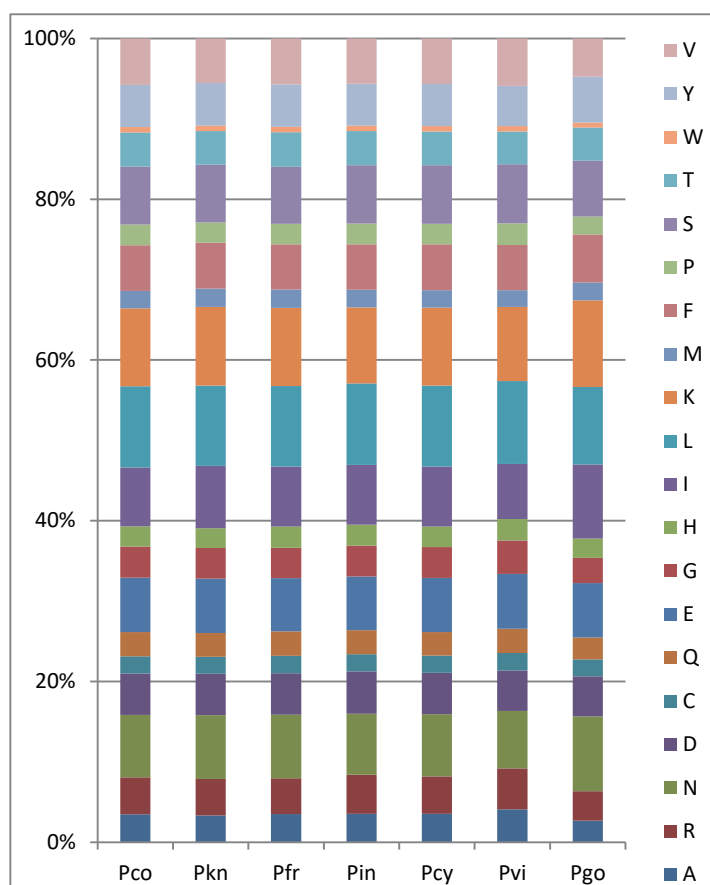
Nucleotide composition (codon-1st)
(AT=56.5 ~ 65.4%)



Nucleotide composition (codon-2nd)
(AT=69.6 ~ 74.5%)



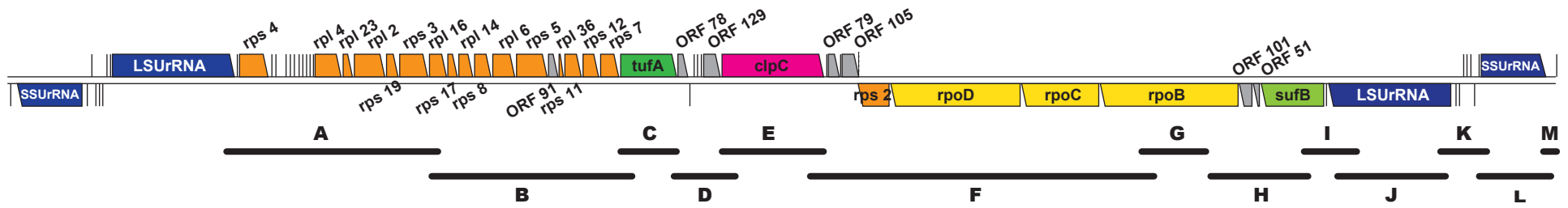
Nucleotide composition (codon-3rd)
(AT=37.4 ~ 69.9%)



Aminoacid composition

Supplementary Fig. S2

Nucleotide/amino acid compositions of the nuclear genome encoded 627 protein genes. 330,500 amino acid and first and second codon position of 661,000 nucleotide positions of the seven *Plasmodium* species were used for the analyses. Pco: *P. coatneyi*, Pkn: *P. knowlesi*, Pfr: *P. fragile*, Pin: *P. inui*, Pcy: *P. cynomolgi*, Pvi: *P. vivax*, Pgo: *P. gonderi*.



Amplified fragment	primer pairs for 1st PCR		primer pairs for nested PCR	
A	Api_Isu-F1	GTCTGTTGCGCTATTAAGCGATACGTGAGCT	Api_Isu-F2	CGTCGTGAGACAGTTCGGTCCATATCTAATATAAGT
	Api_rpl16-R1	CTATAGGTCCTTTACCAGCTCCCATTCTAGTTTTTAAAGA	Api_rpl16-R2	CCCATTCTAGTTTTTAAAGACTTTTTAGTTAAAGATTT
B	Api_rpl16-F1	RTATTGGGGTATAATTTCTWTTAAATTCWGGDTTATTACA	Api_rpl16-F2	CWGGDTTATTACADADAATCMATTRGAARCTTCYARRTT
	Api_tufA-R1	CWGMATGACDGGACAATCWATATGDGCRCAATGTT	Api_tufA-R2	CCYCTTATYTTTTCYTCWGGAGCWGAATCDATATCAGAA
C	Api_tufA-5F1	GGTACTATWGGWCAYGTWGAYCATGGWAA	Api_tufA-5F2	CATGGWAARACAACWTTAACAACAGCAATATCTTA
	Api_tufA-3R1	GTCATTATAGCTCAATGGTAGAGCMATGGATTGA	Api_tufA-3R2	GAAGATCCATRTGTTATCAGTTCAAATCTGAT
D	Api_tufA-F1	CTAAAGAAGAAGGAGGTGTCATAAACCTTTTA	Api_tufA-F2	CCTCAATTTTTTATTCATACAGTAGATGTAAGTGG
	Api_clpC-R1	GCAAATTCAGTTTTACCAGTACCACTAGGACCA	Api_clpC-R2	CTAGGACCACATAAAATCCAACCTACCAATAGGTT
E	Pkn_clpC-5F	CCTATATATTTACATCATACAGAAATATGGGTATTA		
	Pkn_clpC-3R	GGACGAGCTCCATATAAAGGATTATAAGTTAA		
F	Api_clpC-F1	GAYGAAGGTAGAYTAACWGATWCWACRGGTAAATTAA	Api_clpC-F2	CAAGTAAYTTAGGTTGYCCTAAAAATTATRATWYRTAT
	Api_rpoB-F1	CCTATTAAAGGARATACAAARCAAGWGWTCAAAGATTT	Api_rpoB-F2	GAAATGGARGTATGGGCATTAGAAGCTTTTGGRGCTT
G	Api_rpoB-F3	TATATAAACCTATAGTDTGGGTMGWGWAAA	Api_rpoB-F4	TAGGTAAAAATTAGCTATAAAATTCAAATTTATTA
	Api_rpoB-R3	ATAGTATTAGGTAYTAAACTTCTCCWATWATAA	Api_rpoB-R4	GMAGACCATTWATTATTTGTTTAGGATTTAAAA
H	Api_sufB-F1	GCAGATACTGGTAGTAAAAATGTATCATATAGGATCTT	Api_sufB-F2	GTATCATATAGGATCTTATACTAAAAGTTATATAATTTCA
	Api_rpoB-R1	CCGCATCTTCATATTCATAACCTAAATAAGAACCATA	Api_rpoB-R2	CTAAATAAGAACCATATCCTACTAATAAATTATTCCTAA
I	Api_Isu-F1	GTCTGTTGCGCTATTAAGCGATACGTGAGCT	Api_Isu-F2	CGTCGTGAGACAGTTCGGTCCATATCTAATATAAGT
	Api_sufB-R1	GACATWGMTTCTGAMATATTTAATCCACGTTGCAT	Api_sufB-R2	YATAAGGAATWGTACHGTYAAAGAWTTATYCCAAAT
J	Pkn_Isu-5F	GAGCATAAGGAAAGTTTCGTGGATTTCATGCT		
	Pkn_Isu-3R	CAAGCTAATGATGAGATTTGGACTCATAATCTACTGA		
K	Api_Isu-R1	CAATTCGYTCRCCACTACTATGAAATCGTTATTACT	Api_Isu-R2	CCTTTAAGTACTAAGATGATTCAATTCCTTAAGTT
	Api_ssu-R1	CGCTTATTGTAATAATTCCTCACTGCTGATTT	Api_ssu-R2	GGCTTTATTTCAATCCTAATGTGATTGTACATTCT
L	Pkn_ssu-5F	GCGAGTTTGATCCTAGCTTAGAATTAACGCTAGA		
	Api_ssu-R	AGAATGTACAATCACATTAGGATTGAAATAAAGCC		
M	Api_ssu-3F	GATGGAATCACTAGTAATCGCTAATTAGAA		
	Api_Ile-R	ACCCTTATCAAGAGTATGTTTTACCATTAAACTA		

Supplementary Fig. S3

PCR primer sequences and amplified *Plasmodium* apicoplast genome regions.

Table S1 *Plasmodium* species used in this study.

species	strain	ATCC No.	Accession No. ^a	host
<i>Plasmodium cynomolgi</i>	ceylonensis		AP018101	Asian macaque
<i>P. cynomolgi</i>	Berok		AP018102	Asian macaque
<i>P. knowlesi</i>	H	30158	AP018103	Asian macaque
<i>P. fragile</i>	Hackeri		AP018104	Asian macaque
<i>P. fieldi</i>	A.b.introlatus	30164	AP018105	Asian macaque
<i>P. simiovale</i>		30104	AP018106	Asian macaque
<i>P. hylobati</i>	WAK	30154	AP018107	Gibbon
<i>P. inui</i>	Celebes		AP018108	Asian macaque
<i>P. gonderi</i>		30045	AP018109	African guenon
<i>P. ovale</i>	Nigeria II		AB649417	Human
<i>P. malariae</i>	Kisii 67		AB649418	Human
<i>P. vivax</i>	Salvador I		AB649419	Human
<i>P. coatneyi</i>	CDC		AB649420	Asian macaque
<i>P. berghei</i>	ANKA		AB649421	Rodent
<i>P. yoelii</i>	17XNL		AB649422	Rodent
<i>P. chabaudi</i>	AS		AB649423	Rodent
<i>P. falciparum</i>	C10		X95275, X95276	Human
<i>P. gallinaceum</i>	A8		AB649424	Avian

^a Newly determined in this study were shown in bold.

Table S2 Gene component and gene length of apicoplast genome in nine Plasmodium species that were newly determined in this study.

species strain	<i>P. cynomolgi</i> (ceylonensis)			<i>P. cynomolgi</i> (Berok)			<i>P. knowlesi</i> (H, ATCC30158)			<i>P. fragile</i> (Hackeri)			<i>P. fieldi</i> (ABI, ATCC30164)			<i>P. simiovale</i> (ATCC30104)			<i>P. hylobati</i> (WAK, ATCC30154)			<i>P. inui</i> (Celeves)			<i>P. gonderi</i> (ATCC30045)		
Accession No.	AP018101			AP018102			AP018103			AP018104			AP018105			AP018106			AP018107			AP018108			AP018109		
gene ^a	start	end	length	start	end	length	start	end	length	start	end	length	start	end	length	start	end	length	start	end	length	start	end	length	start	end	length
T(ugu)	1	73	73	1	73	73	1	73	73	1	73	73	1	73	73	1	73	73	1	73	73	1	73	73	1	73	73
rps4	100	714	615	100	714	615	100	714	615	100	714	615	100	714	615	100	714	615	100	714	615	100	714	615	100	714	615
H(gug)	726	797	72	726	797	72	726	797	72	726	797	72	727	798	72	726	797	72	726	797	72	727	798	72	730	801	72
C(gca)	820	891	72	820	891	72	818	888	71	821	892	72	820	891	72	822	893	72	820	891	72	822	893	72	828	900	73
L*(uaa)	904	1132	229	904	1132	229	903	1131	229	906	1134	229	905	1133	229	907	1136	230	905	1123	219	907	1126	220	914	1145	232
==> intron	940	1082	143	940	1082	143	939	1081	143	942	1084	143	941	1083	143	943	1086	144	941	1073	133	943	1076	134	950	1095	146
M(cau)	1141	1227	87	1141	1227	87	1140	1226	87	1143	1229	87	1142	1228	87	1145	1231	87	1132	1218	87	1135	1221	87	1154	1240	87
Y(gua)	1240	1323	84	1240	1323	84	1239	1322	84	1242	1325	84	1241	1324	84	1244	1327	84	1230	1313	84	1235	1318	84	1255	1338	84
S(gcu)	1331	1418	88	1331	1418	88	1330	1422	93	1333	1421	89	1334	1422	89	1333	1421	89	1321	1410	90	1326	1415	90	1344	1440	97
D(guc)	1424	1498	75	1424	1498	75	1428	1502	75	1427	1501	75	1428	1502	75	1427	1501	75	1416	1490	75	1421	1495	75	1454	1528	75
K(uuu)	1508	1580	73	1508	1580	73	1512	1584	73	1511	1583	73	1512	1584	73	1511	1583	73	1500	1572	73	1505	1577	73	1538	1610	73
E(uuc)	1594	1663	70	1594	1663	70	1599	1668	70	1597	1666	70	1598	1667	70	1597	1666	70	1586	1655	70	1592	1661	70	1622	1691	70
P(ugg)	1677	1748	72	1677	1748	72	1682	1753	72	1680	1751	72	1681	1752	72	1680	1751	72	1669	1740	72	1675	1746	72	1699	1769	71
rpl4	1777	2382	606	1777	2382	606	1782	2390	609	1780	2385	606	1781	2383	603	1780	2358	579	1769	2377	609	1775	2371	597	1798	2409	612
rpl23	2394	2618	225	2395	2619	225	2398	2622	225	2394	2618	225	2399	2623	225	2366	2590	225	2388	2615	228	2382	2609	228	2420	2638	219
rpl2	2615	3352	738	2616	3353	738	2619	3356	738	2615	3352	738	2620	3357	738	2587	3324	738	2612	3349	738	2606	3343	738	2635	3372	738
rps19	3378	3647	270	3380	3649	270	3371	3640	270	3379	3648	270	3380	3649	270	3351	3620	270	3376	3645	270	3370	3639	270	3407	3670	264
rps3	3651	4295	645	3653	4297	645	3644	4288	645	3652	4296	645	3654	4298	645	3624	4271	648	3649	4293	645	3643	4287	645	3681	4328	648
rpl16	4313	4705	393	4315	4704	390	4306	4698	393	4309	4701	393	4316	4708	393	4283	4675	393	4313	4708	396	4307	4702	396	4340	4735	396
rps17	4722	4946	225	4721	4945	225	4708	4932	225	4714	4938	225	4721	4945	225	4688	4912	225	4721	4945	225	4715	4939	225	4755	4979	225
rpl14	4943	5305	363	4942	5304	363	4929	5291	363	4935	5297	363	4942	5298	357	4909	5271	363	4942	5304	363	4936	5298	363	4976	5338	363
rps8	5308	5694	387	5307	5693	387	5294	5680	387	5302	5688	387	5301	5687	387	5279	5665	387	5307	5693	387	5301	5687	387	5338	5724	387
rpl6	5713	6234	522	5712	6232	521	5702	6214	513	5707	6225	519	5709	6230	522	5685	6206	522	5707	6228	522	5706	6218	513	5737	6255	519
rps5	6231	6953	723	6229	6951	723	6211	6933	723	6222	6947	726	6227	6949	723	6203	6925	723	6225	6926	702	6215	6943	729	6252	6977	726
ORF91	6957	7199	243	6955	7197	243	6940	7182	243	6953	7195	243	6953	7195	243	6929	7171	243	6930	7172	243	6947	7189	243	6988	7230	243
rpl36	7196	7306	111	7194	7304	111	7179	7289	111	7192	7302	111	7192	7302	111	7168	7278	111	7169	7279	111	7186	7296	111	7227	7337	111
rps11	7303	7704	402	7301	7702	402	7286	7987	702	7299	7700	402	7299	7700	402	7275	7676	402	7276	7677	402	7293	7694	402	7334	7735	402
rps12	7698	8075	378	7696	8072	377	7681	8058	378	7694	8071	378	7694	8071	378	7670	8050	381	7671	8048	378	7688	8062	375	7729	8103	375
rps7	8097	8531	435	8094	8528	435	8072	8494	423	8093	8527	435	8094	8519	426	8078	8497	420	8070	8498	429	8088	8522	435	8110	8532	423
tufA	8605	9834	1230	8602	9831	1230	8568	9797	1230	8599	9828	1230	8600	9829	1230	8570	9799	1230	8570	9799	1230	8585	9814	1230	8595	9824	1230
ORF78	9841	10092	252	9838	10089	252	9804	10055	252	9835	10086	252	9836	10084	249	9806	10057	252	9806	10057	252	9821	10075	255	9836	10084	249
F(gaa)	10069	10140	72	10066	10137	72	10032	10103	72	10063	10134	72	10061	10132	72	10034	10105	72	10034	10105	72	10052	10123	72	10061	10132	72
Q(uug)	10160	10231	72	10157	10228	72	10123	10194	72	10154	10225	72	10153	10224	72	10125	10196	72	10125	10196	72	10143	10214	72	10154	10225	72
G(acc)	10242	10311	70	10239	10308	70	10205	10274	70	10236	10305</																

Table S3 Sequence similarities of *Plasmodium* apicoplast genes.

gene ^b	similarity ^a			similarity ^a	
	aa (%)	nuc(%)		aa (%)	nuc(%)
	18 OTUs	18 OTUs		18 OTUs	18 OTUs
rps4	84.9	90.4	ORF78	83.1	91.3
tRNA-H(gug)	-	96.8	tRNA-F(gaa)	-	98.1
tRNA-C(gca)	-	95.3	tRNA-Q(uug)	-	98.8
tRNA-L(uaa) ^c	-	97.1	tRNA-G(acc)	-	96.5
tRNA-M(cau)	-	95.3	tRNA-W(cca)	-	96.0
tRNA-Y(gua)	-	96.6	ORF129	81.9	89.6
tRNA-S(gcu)	-	94.5	clpC	84.0	89.5
tRNA-D(guc)	-	97.1	tRNA-G(ucc)	-	96.5
tRNA-K(uuu)	-	97.3	ORF79	82.5	89.6
tRNA-E(uuc)	-	98.7	tRNA-S(uga)	-	96.0
tRNA-P(ugg)	-	97.7	ORF105	78.2	88.1
rpl4	75.1	87.2	rps2	84.4	90.9
rpl23	71.0	84.5	rpoD	81.4	88.1
rpl2	89.1	91.5	rpoC	90.4	92.6
rps19	87.4	92.3	rpoB	86.2	90.6
rps3	81.6	89.4	ORF101	76.2	87.1
rpl16	78.7	86.0	ORF51	76.4	86.3
rps17	73.9	84.9	sufB	90.5	92.5
rpl14	78.7	86.0	tRNA-T(ugu)	-	96.0
rps8	80.5	88.8	LSUrRNA	-	95.8
rpl6	74.4	85.5	tRNA-M(cau)	-	100.0
rps5	75.3	85.6	tRNA-R(acg)	-	93.5
ORF91	77.0	86.9	tRNA-V(uac)	-	98.6
rpl36	94.9	95.8	tRNA-R(ucu)	-	99.8
rps11	86.9	90.8	tRNA-L(uag)	-	96.7
rps12	90.8	90.8	tRNA-N(guu)	-	97.7
rps7	87.3	92.4	tRNA-A(ugc)	-	98.3
tufA	91.2	91.5	SSUrRNA	-	96.0

^a Average value of pairwise comparison of 18 OTUs.

^b Protein coding genes are shown in blue.

^c Intron was removed from the comparison because of the ambiguous alignment.

Table S4 Gene ID of *Plasmodium vivax* . These genes and their orthologs of six *Plasmodium* species, *P. coatney*, *P. knowlesi*, *P. fragile*, *P. inui*, *P. cynomolgi* and *P. gonderi* were used for the phylogenetic analysis.

ID_chr1	gene	No of aa position used for the phylogeny	ID_chr2	gene	No of aa position used for the phylogeny	ID_chr3	gene	No of aa position used for the phylogeny	ID_chr4	gene	No of aa position used for the phylogeny
PVX_087670	hypothetical protein, conserved	113	PVX_081200	hypothetical protein, conserved	75	PVX_000005	Plasmodium exported protein, unknown function	224	PVX_002550	hypothetical protein, conserved	154
PVX_087680	chitinase(CTH1)	567	PVX_081205	TatD-like deoxyribonuclease, putative	396	PVX_000525	protein kinase domain containing protein	1684	PVX_002555	Plasmodium exported protein, unknown function	239
PVX_087685	centrin	106	PVX_081210	hypothetical protein, conserved	79	PVX_000530	hypothetical protein, conserved	4307	PVX_002575	replication factor C subunit 1, putative	731
PVX_087690	hypothetical protein, conserved	1205	PVX_081215	hypothetical protein, conserved	297	PVX_000535	thioredoxin, putative	422	PVX_002580	pseudouridine synthetase, putative	278
PVX_087695	hypothetical protein, conserved	177	PVX_081220	hypothetical protein, conserved	115	PVX_000540	hypothetical protein, conserved	757	PVX_002585	ribosome associated membrane protein RAMP4, putative	72
PVX_087700	hypothetical protein, conserved	1044	PVX_081225	hypothetical protein, conserved	213	PVX_000545	serine--tRNA ligase, putative	454	PVX_002590	40S ribosomal protein S30, putative	57
PVX_087705	hypothetical protein, conserved	129	PVX_081230	UMP-CMP kinase, putative	222	PVX_000550	hypothetical protein, conserved	651	PVX_002595	hypothetical protein, conserved	126
PVX_087710	hypothetical protein, conserved	606	PVX_081235	hypothetical protein, conserved	438	PVX_000555	calcium-dependent protein kinase 4, putative (CDPK4)	520	PVX_002600	hypothetical protein, conserved	421
PVX_087715	erythrocyte membrane-associated antigen	1813	PVX_081240	replication factor c, putative	789	PVX_000560	queuine tRNA-ribosyltransferase, putative	494	PVX_002605	nuclear protein SkiP, putative	444
PVX_087720	hypothetical protein, conserved	261	PVX_081245	hypothetical protein, conserved	83	PVX_000565	hypothetical protein, conserved	328	PVX_002610	hypothetical protein, conserved	1082
PVX_087725	hypothetical protein, conserved	170	PVX_081250	kinesin-8, putative	950	PVX_000570	hypothetical protein, conserved	226	PVX_002615	small nuclear ribonucleoprotein Sm D2, putative	99
PVX_087730	hypothetical protein, conserved	549	PVX_081255	adenylate kinase-like protein 1, putative (AKLP1)	173	PVX_000575	hypothetical protein, conserved	616	PVX_002620	DEAD/DEAH box helicase, putative	458
PVX_087735	hypothetical protein, conserved	2803	PVX_081260	transcription initiation factor TFIIIB, putative	361	PVX_000580	hypothetical protein, conserved	169	PVX_002625	rRNA methylase, putative	126
PVX_087740	hypothetical protein, conserved	2248	PVX_081265	chromatin assembly factor 1 protein WD40 domain, putative	446	PVX_000585	transporter/permease protein, putative	321	PVX_002630	hypothetical protein	280
PVX_087745	hypothetical protein, conserved	1751	PVX_081270	phosphatidylinositol-4-phosphate 5- kinase, putative (PIP5K)	870	PVX_000590	eukaryotic translation initiation factor 3 subunit 2, putative	326	PVX_002635	hypothetical protein	242
PVX_087750	tRNA m5C-methyltransferase	853	PVX_081275	bromodomain protein, putative	409	PVX_000595	hypothetical protein, conserved	541	PVX_002640	replication factor C subunit 2, putative	329
PVX_087755	hypothetical protein, conserved	1147	PVX_081277	DNA-directed RNA polymerase 2, putative	161	PVX_000600	cysteine desulfurase, putative (SufS)	482	PVX_002645	hypothetical protein, conserved	450
PVX_087760	phosphoinositide-binding protein	612	PVX_081280	FAD-linked sulfhydryl oxidase ERV1, putative (ERV1)	136	PVX_000604	hypothetical protein, conserved	427	PVX_002650	40S ribosomal protein S26, putative (RPS26)	106
PVX_087765	serine-threonine protein kinase	723	PVX_081285	selenocysteine-specific elongation factor selB homologue, putative	487	PVX_000606	transcription initiation factor IIA subunit 1, putative	147	PVX_002655	hypothetical protein, conserved	203
PVX_087775	ubiquitin transferase	2451	PVX_081290	HP	149	PVX_000610	hypothetical protein, conserved	367	PVX_002660	hypothetical protein, conserved	1110
PVX_087780	hypothetical protein, conserved	879	PVX_081295	hypothetical integral membrane protein, DUF56 family, putative	677	PVX_000615	hypothetical protein, conserved	318	PVX_002665	calcium-dependent protein kinase 1, putative (CDPK1)	513
PVX_087785	hypothetical protein, conserved	850	PVX_081300	phenylalanyl-tRNA synthetase beta chain, putative	515	PVX_000620	protein SDA1, putative (SDA1)	722	PVX_002670	hypothetical protein, conserved	144
PVX_087790	peptide chain release factor	333	PVX_081305	HP	182	PVX_000625	RNA-binding protein, putative	580	PVX_002675	AP-2 complex subunit sigma, putative	140
PVX_087795	hypothetical protein, conserved	838	PVX_081307	cold-shock protein, putative	59	PVX_000630	phosphopantothenate--cysteine ligase, putative,phosphopantothenoylcystei ne synthetase, putative	290	PVX_002680	hypothetical protein, conserved	803
PVX_087800	hypothetical protein, conserved	366	PVX_081310	N-acetyltransferase, putative	158	PVX_000635	hypothetical protein, conserved	282	PVX_002685	ATP synthase alpha chain, putative	517
PVX_087802	hypothetical protein, conserved	956	PVX_081315	tubulin-specific chaperone a, putative	144	PVX_000640	30S ribosomal protein S12, putative	203	PVX_002690	hypothetical protein, conserved	683
PVX_087805	origin recognition complex subunit 2	580	PVX_081320	elongation of very long chain fatty acids protein 3, putative	308	PVX_000645	hypothetical protein, conserved	513	PVX_002695	hypothetical protein, conserved	290
PVX_087810	minchromosome maintenance (MCM) complex subunit	806	PVX_081325	mRNA cleavage factor-like protein, putative	209	PVX_000650	DNA polymerase alpha, putative	1348	PVX_002700	hypothetical protein, conserved	800
PVX_087815	inositol-phosphate phosphatase	1563	PVX_081330	LCCL domain-containing protein (CCp5)	914	PVX_000660	hypothetical protein	2442	PVX_002705	hypothetical protein, conserved	1031
PVX_087820	RNA helicase	755	PVX_081335	HP	153	PVX_000670	hypothetical protein, conserved	389	PVX_002710	hypothetical protein, conserved	308
PVX_087825	40S ribosomal protein S29	53	PVX_081340	hypothetical protein, conserved	337	PVX_000675	hypothetical protein	113	PVX_002715	hypothetical protein, conserved	658
PVX_087830	cysteine-rich secretory protein	157	PVX_081345	secreted ookinete protein, putative (PSOP24)	338	PVX_000680	RNA helicase, putative	762	PVX_002720	vacuolar protein sorting-associated protein 45, putative	622

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PVX_087835	ATP synthase subunit C	163	PVX_081350	hypothetical protein, conserved	190	PVX_000685	hypothetical protein, conserved	309	PVX_002725	hypothetical protein, conserved	706
PVX_087840	hypothetical protein, conserved	1118	PVX_081355	hypothetical protein, conserved	49	PVX_000690	hypothetical protein, conserved	646	PVX_002730	hypothetical protein, conserved	184
PVX_087845	hypothetical protein, conserved	1199	PVX_081360	hypothetical protein, conserved	212	PVX_000695	hypothetical protein, conserved	193	PVX_002735	hypothetical protein	552
PVX_087851	hypothetical protein, conserved	48	PVX_081365	hypothetical protein, conserved	903	PVX_000700	hypothetical protein, conserved	232	PVX_002740	DEAD/DEAH helicase, putative	1086
PVX_087855	hypothetical protein, conserved	38	PVX_081370	hypothetical protein, conserved	425	PVX_000705	hypothetical protein, conserved	634	PVX_002745	palmitoyltransferase, putative (DHHC11)	255
PVX_087860	60S ribosomal protein L37	91	PVX_081375	proteasome subunit beta type-3, putative	187	PVX_000710	hypothetical protein, conserved	812	PVX_002750	origin recognition complex subunit 5, putative (ORC5)	648
PVX_087865	hypothetical protein, conserved	725	PVX_081380	hypothetical protein, conserved	168	PVX_000715	ribosome biogenesis GTPase A, putative (RbgA)	576	PVX_002755	DNA-directed RNA polymerase II 135 kDa polypeptide, putative	1293
PVX_087870	hypothetical protein, conserved	501	PVX_081385	double-strand break repair protein MRE11, putative	572	PVX_000720	hypothetical protein, conserved	312	PVX_002760	hypothetical protein, conserved	189
PVX_087875	DNA mismatch repair protein, putative (MSH2-2)	764	PVX_081390	hypothetical protein, conserved	335	PVX_000725	hypothetical protein, conserved	197	PVX_002765	hypothetical protein, conserved	441
PVX_087880	hypothetical protein, conserved	1087	PVX_081400	patched family protein, putative	1131	PVX_000730	exosome complex component RRP4, putative (RRP4)	327	PVX_002770	hypothetical protein, conserved	455
PVX_087885	rhoptry associated membrane antigen	468	PVX_081405	hypothetical protein, conserved	159	PVX_000735	protein phosphatase 2C, putative	653	PVX_002775	hypothetical protein, conserved	214
PVX_087895	AAA family ATPase	545	PVX_081410	carbon catabolite repressor protein 4, putative	316	PVX_000750	actin-like protein, putative	403	PVX_002785	ATP-dependent acyl-CoA synthetase, putative	695
PVX_087900	hypothetical protein, conserved	972	PVX_081415	hypothetical protein, conserved	327	PVX_000755	zinc finger protein, putative	423	PVX_002790	rhoptry neck protein 6, putative (RON6)	383
PVX_087905	hypothetical protein, conserved	209	PVX_081420	centrin-1, putative (CEN1)	167	PVX_000760	hypothetical protein, conserved	181	PVX_002795	hypothetical protein, conserved	972
PVX_087910	ubiquitin-protein ligase e3	552	PVX_081425	hypothetical protein, conserved	383	PVX_000765	replication factor a protein, putative	838	PVX_002800	hypothetical protein, conserved	293
PVX_087915	RAP protein	682	PVX_081430	ras-related protein Rab-5C, putative (RAB5c)	212	PVX_000770	hypothetical protein, conserved	341	PVX_002805	calcium-dependent protein kinase 4, putative	639
PVX_087920	TGF beta-inducible nuclear protein	258	PVX_081435	ribosome biogenesis protein BMS1, putative	939	PVX_000775	chaperone DNAJ protein, putative	480	PVX_002810	hypothetical protein, conserved	252
PVX_087925	cytoskeleton associated protein	570	PVX_081445	hypothetical protein, conserved	333	PVX_000780	hypothetical protein, conserved	708	PVX_002815	hypothetical protein, conserved	365
PVX_087930	hypothetical protein, conserved	103	PVX_081450	pre-rRNA-processing protein TSR2, putative	154	PVX_000785	ribosomal processing protein, putative	455	PVX_002820	hypothetical protein	477
PVX_087935	DNA-directed RNA polymerase II	68	PVX_081455	calcium-transporting ATPase, putative	1050	PVX_000790	U4/U6 small nuclear ribonucleoprotein PRP31, putative	478	PVX_002825	50S ribosomal protein L13, putative	211
PVX_087940	hypothetical protein, conserved	645	PVX_081460	hypothetical protein, conserved	192	PVX_000795	hypothetical protein, conserved	1620	PVX_002830	protein transport protein SEC31, putative (SEC31)	1160
PVX_087945	O-sialoglycoprotein endopeptidase	232	PVX_081465	vacuolar ATP synthase subunit c, putative	382	PVX_000800	tRNA N6-adenosine threonylcarbamoyltransferase, putative (KAE1)	656	PVX_002835	T-complex protein 1, theta subunit, putative	542
PVX_087950	HSP86	695	PVX_081470	hypothetical protein, conserved	593	PVX_000805	hypothetical protein, conserved	250	PVX_002840	hypothetical protein, conserved	482
PVX_087955	HSP86 family	343	PVX_081475	DNA binding protein, putative	286	PVX_000810	perforin-like protein 1 (PLP1)	739	PVX_002850	hypothetical protein, conserved	153
PVX_087960	inner membrane complex protein 1d	205	PVX_081480	hypothetical protein, conserved	684	PVX_000815	sporozoite invasion-associated protein 1, putative (SIAP1)	943	PVX_002855	hypothetical protein, conserved	1476
PVX_087965	Cg8 protein	204	PVX_081485	hypothetical protein	608	PVX_000820	flap endonuclease 1, putative (FEN1)	531	PVX_002860	hypothetical protein, conserved	381
PVX_087970	HSP70-z	819	PVX_081490	hypothetical protein, conserved	895	PVX_000825	hypothetical protein, conserved	373	PVX_002865	serine/threonine protein kinase, putative	338
PVX_087975	Cg3 protein	205	PVX_081495	hypothetical protein, conserved	310	PVX_000830	hypothetical protein, conserved	180	PVX_002867	conserved Plasmodium protein, unknown function	47
PVX_087980	chloroquine resistance transporter	395	PVX_081498	hypothetical protein, conserved	117	PVX_000835	hypothetical protein, conserved	389	PVX_002870	hypothetical protein, conserved	121
PVX_087985	Cg1 protein	673	PVX_081502	hypothetical protein, conserved	161	PVX_000840	hypothetical protein, conserved	689	PVX_002875	heat shock protein, putative	324
PVX_087990	glutaredoxin-like protein (GLP3)	161	PVX_081505	hypothetical protein, conserved	518	PVX_000845	hypothetical protein, conserved	142	PVX_002880	hypothetical protein, conserved	165
PVX_087995	Cg2 protein	1487	PVX_081510	hypothetical protein, conserved	136	PVX_000850	AAA family ATPase, putative	569	PVX_002885	Leu/Phe-tRNA protein transferase, putative	289
PVX_088000	Cg7 protein	721	PVX_081515	transporter, putative	443	PVX_000855	hypothetical protein, conserved	766	PVX_002890	hypothetical protein, conserved	446
PVX_088005	hypothetical protein, conserved	129	PVX_081520	transporter, putative	475	PVX_000860	hypothetical protein, conserved	970	PVX_002895	hypothetical protein, conserved	253
PVX_088007	ribonucleases p-mrp protein subunit	610	PVX_081525	hypothetical protein, conserved	749	PVX_000865	hypothetical protein, conserved	455	PVX_002900	secreted protein with altered thrombospondin repeat domain, putative (SPATR)	251
PVX_088010	lysophospholipase	318	PVX_081530	hypothetical protein, conserved	201	PVX_000870	mitochondrial carrier protein, putative	379	PVX_002905	hypothetical protein, conserved	2405
PVX_088015	hypothetical protein, conserved	325	PVX_081535	4-hydroxy-3-methylbut-2-enyl diphosphate reductase, putative	313	PVX_000875	hypothetical protein, conserved	107	PVX_002910	hypothetical protein, conserved	2517

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PVX_088020	hypothetical protein, conserved	64	PVX_081540	ubiquitin carboxyl-terminal hydrolase 1, putative (UBP1)	1426	PVX_000880	hypothetical protein, conserved	229	PVX_002915	eukaryotic peptide chain release factor subunit 1, putative	402
PVX_088025	hypothetical protein, conserved	1240	PVX_081550	StAR-related lipid transfer protein, putative	314	PVX_000885	peptidyl-tRNA hydrolase, putative	190	PVX_002920	50S ribosomal protein L7/L12, putative	187
PVX_088035	hypothetical protein, conserved	2514	PVX_081555	hypothetical protein, conserved	742	PVX_000890	methyltransferase, putative	297	PVX_002925	hypothetical protein, conserved	400
PVX_088040	hypothetical protein, conserved	387	PVX_081560	hypothetical protein, conserved	156	PVX_000895	hypothetical protein, conserved	197	PVX_002930	GDP-fucose transporter, putative	298
PVX_088045	hypothetical protein, conserved	659	PVX_081565	hypothetical protein, conserved	415	PVX_000900	hypothetical protein, conserved	1115	PVX_002935	hypothetical protein, conserved	337
PVX_088050	hypothetical protein, conserved	203	PVX_081570	actin-related protein (ARP1)	378	PVX_000905	hypothetical protein, conserved	283	PVX_002940	asparagine--tRNA ligase, putative	545
PVX_088055	hypothetical protein, conserved	268	PVX_081572	L-seryl-tRNA(Sec) kinase, putative (PSTK)	364	PVX_000910	hypothetical protein, conserved	822	PVX_002945	tyrosine kinase-like protein, putative (TKL1)	732
PVX_088060	hypothetical protein, conserved	232	PVX_081575	hypothetical protein, conserved	639	PVX_000915	hypothetical protein, conserved	138	PVX_002950	hypothetical protein, conserved	201
PVX_088065	60S ribosomal protein L34a	139	PVX_081580	hypothetical protein, conserved	971	PVX_000920	hypothetical protein, conserved	568	PVX_002955	hypothetical protein, conserved	858
PVX_088070	hypothetical protein, conserved	55	PVX_081585	hypothetical protein, conserved	599	PVX_000925	hydroxyacyl glutathione hydrolase, putative	262	PVX_002960	beta-ketoacyl-acyl carrier protein synthase III precursor, putative	371
PVX_088075	hypothetical protein, conserved	216	PVX_081590	hypothetical protein, conserved	532	PVX_000930	sexual stage antigen s16, putative	103	PVX_002965	hypothetical protein, conserved	291
PVX_088080	mitochondrial ribosomal protein L1 precursor	266	PVX_081595	nucleoside transporter 4 (NT4)	431	PVX_000935	vacuolar ATP synthase subunit b, putative	493	PVX_002970	ras-related protein Rab-5A, putative (RAB5a)	224
PVX_088085	cell division cycle ATPase	792	PVX_081600	vacuolar protein sorting-associated protein 51, putative (VPS51)	837	PVX_000940	hypothetical protein, conserved	369	PVX_002975	hypothetical protein, conserved	1061
PVX_088090	hypothetical protein, conserved	138	PVX_081605	vacuolar protein sorting-associated protein VTA1, putative	212	PVX_000945	apical sushi protein, putative (ASP)	539	PVX_003540	Plasmodium exported protein (PHISTc), unknown function	125
PVX_088095	hypothetical protein, conserved	558	PVX_081610	aspartate--tRNA ligase, putative	538	PVX_000950	hypothetical protein, conserved	102	PVX_003545	Plasmodium exported protein, unknown function	164
PVX_088100	hypothetical protein, conserved	96	PVX_081615	hypothetical protein, conserved	377	PVX_000955	lysine decarboxylase, putative	1395	PVX_003560	hypothetical protein	290
PVX_088105	sin3 associated polypeptide p18-like protein	117	PVX_081620	DNA mismatch repair protein PMS1, putative (PMS1)	748	PVX_000960	secy-independent transporter protein, putative	314	PVX_003570	hypothetical protein, conserved	663
PVX_088110	hypothetical protein, conserved	572	PVX_081625	hypothetical protein, conserved	2727	PVX_000965	hypothetical protein, conserved	223	PVX_003575	octaprenyl pyrophosphate synthase, putative (OPP)	518
PVX_088115	coatomer epsilon subunit	272	PVX_081630	ubiquitin carboxyl-terminal hydrolase family 2, putative	1732	PVX_000970	pre-mRNA-processing-splicing factor 8, putative	2622	PVX_003578	conserved Plasmodium protein, unknown function	118
PVX_088120	ubiquitin regulatory protein	229	PVX_081635	hypothetical protein, conserved	433	PVX_000975	liver specific protein 2, putative (LISP2)	634	PVX_003580	palmitoyltransferase, putative (DHHC12)	224
PVX_088125	plasmepsin X	479	PVX_081640	hypothetical protein, conserved	119	PVX_000980	Plasmodium yoelii blood stage membrane protein ag-1, putative	430	PVX_003585	hypothetical protein, conserved	1507
PVX_088130	hypothetical protein, conserved	729	PVX_081645	defender against cell death 2, putative	106	PVX_000985	protein transport protein Sec24B, putative (SEC24B)	1088	PVX_003590	serine/threonine-specific protein kinase, putative	716
PVX_088140	hypothetical protein, conserved	620	PVX_081650	mitochondrial import inner membrane translocase subunit TIM50, putative (TIM50)	332	PVX_000990	ATP-dependent RNA helicase protein, putative	520	PVX_003595	hypothetical protein, conserved	280
PVX_088145	tyrosyl-tRNA synthetase	349	PVX_081655	vacuolar protein sorting-associated protein 53, putative (VPS53)	729	PVX_000995	6-cysteine protein (P41)	338	PVX_003600	ERCC1 nucleotide excision repair protein, putative	205
PVX_088150	proteasome subunit alpha type 5	297	PVX_081660	hypothetical protein, conserved	661	PVX_001000	hypothetical protein, conserved	282	PVX_003605	hypothetical protein, conserved	90
PVX_088165	hypothetical protein, conserved	467	PVX_081665	cysteine desulfurase, putative	478	PVX_001005	dipeptidyl aminopeptidase 3, putative (DPAP3)	527	PVX_003610	hypothetical protein, conserved	418
PVX_088170	proteasome subunit alpha	259	PVX_081670	DNA (cytosine-5)-methyltransferase, putative (DNMT)	543	PVX_001010	hypothetical protein, conserved	1523	PVX_003615	hypothetical protein, conserved	269
PVX_088175	hypothetical protein, conserved	171	PVX_081675	proteasome subunit alpha type-5, putative	255	PVX_001015	hypothetical protein, conserved	316	PVX_003620	hypothetical protein, conserved	543
PVX_088180	GTPase, Rab18	200	PVX_081680	hypothetical protein, conserved	568	PVX_001020	6-cysteine protein (P52)	409	PVX_003625	5'-3' exonuclease, N-terminal resolvase-like domain, putative	315
PVX_088185	hypothetical protein, conserved	372	PVX_081685	hypothetical protein, conserved	782	PVX_001025	6-cysteine protein (P36)	338	PVX_003630	hypothetical protein, conserved	595
PVX_088190	RNA helicase	617	PVX_081690	hypothetical protein, conserved	640	PVX_001030	hypothetical protein, conserved	350	PVX_003635	hypothetical protein, conserved	1347
PVX_088195	gas41 homologue	216	PVX_081695	cation transporting ATPase, putative	783	PVX_001035	hypothetical protein, conserved	152	PVX_003640	hypothetical protein, conserved	262
PVX_088200	hypothetical protein, conserved	277	PVX_081700	hypothetical protein, conserved	1151	PVX_001040	transcription factor with AP2 domain(s), putative (ApiAP2)	295	PVX_003645	hypothetical protein, conserved	306
PVX_088205	vacuolar proton translocating ATPase subunit A	828	PVX_081705	eukaryotic translation initiation factor 2 alpha subunit, putative	328	PVX_001045	hypothetical protein, conserved	88	PVX_003650	dynein light polypeptide 4, axonemal, putative	106
PVX_088210	hypothetical protein, conserved	192	PVX_081707	conserved Plasmodium protein, unknown function	3423	PVX_001050	SET domain protein, putative (SET8)	922	PVX_003655	aspartate aminotransferase, mitochondrial precursor, putative	401
PVX_088215	hypothetical protein, conserved	1193	PVX_081710	actin-like protein, putative (ALP3)	392	PVX_001055	alpha/beta hydrolase, putative	402	PVX_003660	5'-3' exoribonuclease, putative	662

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PVX_088220	kinesin-like protein	399	PVX_081715	hypothetical protein, conserved	194	PVX_001060	splicing factor, putative,CGI-201 protein, short form, putative,crooked neck-like protein 1,	664	PVX_003665	hexose transporter	487
PVX_088225	DnaJ protein	429	PVX_081720	hypothetical protein, conserved	122	PVX_001065	hypothetical protein, conserved	586	PVX_003670	3'-5' exonuclease domain containing protein	342
PVX_088230	glycosyltransferase	145	PVX_081722	conserved Plasmodium protein, unknown function	130	PVX_001070	hypothetical protein	658	PVX_003675	ubiquinone biosynthesis methyltransferase, putative	312
PVX_088235	ferlin like protein	1464	PVX_081725	hypothetical protein, conserved	726	PVX_001075	ubiquitin specific protease, putative	380	PVX_003685	hypothetical protein	78
PVX_088240	hypothetical protein, conserved	821	PVX_081730	alpha/beta hydrolase, putative	441	PVX_001080	hypothetical protein, conserved	2451	PVX_003690	hypothetical protein, conserved	144
PVX_088245	hypothetical protein, conserved	63	PVX_081740	hypothetical protein, conserved	352	PVX_001085	hypothetical protein, conserved	138	PVX_003695	hypothetical protein, conserved	425
PVX_088250	AAA family ATPase	703	PVX_081745	RNA-binding protein, putative	392	PVX_001090	hypothetical protein, conserved	135	PVX_003700	hypothetical protein, conserved	442
PVX_088254	hypothetical protein, conserved	176	PVX_081750	signal recognition particle subunit SRP9, putative (SRP9)	102	PVX_001095	hypothetical protein, conserved	471	PVX_003705	DNA-directed RNA polymerase II 16 kDa subunit, putative	131
PVX_088256	hypothetical protein, conserved	317	PVX_081755	hypothetical protein, conserved	1776	PVX_096015	Plasmodium exported protein, unknown function	215	PVX_003715	hypothetical protein, conserved	559
PVX_088265	serine/threonine protein kinase, FIKK family (TSTK0)	713	PVX_081760	peroxiredoxin, putative	236	PVX_096070	early transcribed membrane protein (ETRAMP)	78	PVX_003720	hypothetical protein, conserved	204
PVX_088270	apicoplast phosphatidic acid phosphatase	260	PVX_081765	60S ribosomal export protein NMD3, putative (NMD3)	674	PVX_096071	conserved Plasmodium protein, unknown function	103	PVX_003725	PH domain containing protein	118
PVX_088275	hypothetical protein, conserved	945	PVX_081770	hypothetical protein, conserved	272	PVX_096075	hypothetical protein, conserved	598	PVX_003730	26S proteasome regulatory subunit RPN1, putative (RPN1)	903
PVX_088280	acetyltransferase	209	PVX_081775	hypothetical protein, conserved	687	PVX_096080	mago nashi domain containing protein	147	PVX_003735	DNA repair endonuclease, putative,RAD2 endonuclease, putative	843
PVX_093495	hypothetical protein, conserved	693	PVX_081780	hypothetical protein, conserved	162	PVX_096085	hypothetical protein, conserved	1051	PVX_003740	cysteine desulfuration protein SufE, putative (SufE)	241
PVX_093500	hypothetical protein, conserved	93	PVX_081785	hypothetical protein, conserved	696	PVX_096090	exonuclease I, putative	516	PVX_003745	pantothenate transporter, putative (PAT)	532
PVX_093505	hypothetical protein, conserved	396	PVX_081790	hypothetical protein, conserved	96	PVX_096095	kinesin-19, putative	1222	PVX_003750	pentafunctional AROM polypeptide, putative (AROM)	1225
PVX_093510	alpha/beta hydrolase	239	PVX_081792	hypothetical protein	4762	PVX_096105	kelch domain-containing protein	357	PVX_003755	hypothetical protein, conserved	518
PVX_093515	GTPase activator	337	PVX_081795	hypothetical protein, conserved	108	PVX_096110	hypothetical protein, conserved	1987	PVX_003760	transcription factor, putative	105
PVX_093520	peptidyl-prolyl cis-trans isomerase	188	PVX_081800	hypothetical protein, conserved	632	PVX_096115	protein kinase, putative	1056	PVX_003765	adenylosuccinate lyase (ASL)	459
PVX_093525	hypothetical protein, conserved	126	PVX_081805	AP-4 complex subunit beta, putative	756	PVX_096120	hypothetical protein, conserved	296	PVX_003770	merozoite surface protein 5	119
PVX_093530	pseudouridylylate synthase	359	PVX_081810	transcription factor with AP2 domain(s), putative (AP2-L)	743	PVX_096125	mitochondrial import inner membrane translocase subunit TIM14, putative (PAM18)	114	PVX_003775	merozoite surface protein 4, putative	103
PVX_093535	hypothetical protein, conserved	2593	PVX_081815	hypothetical protein, conserved	157	PVX_096130	3-demethylubiquinone-9 3- methyltransferase, putative	279	PVX_003780	hypothetical protein, conserved	908
PVX_093540	methionine aminopeptidase	494	PVX_081820	hypothetical protein, conserved	271	PVX_096135	type 2A phosphatase-associated protein 42, putative (TAP42)	313	PVX_003785	iron-sulfur cluster assembly accessory protein, putative	111
PVX_093545	hypothetical protein, conserved	277	PVX_081825	hypothetical protein	231	PVX_096140	hypothetical protein, conserved	58	PVX_003855	hypothetical protein, conserved	1076
PVX_093550	cactin homolog	494	PVX_081830	Plasmodium exported protein, unknown function	456	PVX_096145	Rab GTPase activator and protein kinase, putative	742	PVX_003860	KRR1 small subunit processome component, putative (KRR1)	285
PVX_093555	20S proteasome beta subunit	255	PVX_081832	Plasmodium exported protein, unknown function	99	PVX_096150	hypothetical protein, conserved	719	PVX_003865	hypothetical protein, conserved	915
PVX_093560	tubulin gamma chain (g-tub)	451	PVX_096950	tryptophan-rich antigen (Pv-fam-a)	282	PVX_096155	hypothetical protein, conserved	1089	PVX_003870	hypothetical protein, conserved	871
PVX_093565	hypothetical protein, conserved	437	PVX_096955	Plasmodium exported protein, unknown function	188	PVX_096165	metallo-hydrolase/oxidoreductase, putative	487	PVX_003880	acyl carrier protein, putative (ACP)	119
PVX_093570	AAA family ATPase	695	PVX_096995	tryptophan-rich antigen (Pv-fam-a)	268	PVX_096170	hypothetical protein, conserved	109	PVX_003885	ribosome-recycling factor, putative (RRF1)	222
PVX_093575	DNA repair protein rad54	636	PVX_097005	Plasmodium exported protein, unknown function	141	PVX_096175	dynactin subunit 5, putative	203	PVX_003890	hypothetical protein, conserved	221
PVX_093580	mitogen-activated protein kinase organizer 1	356	PVX_097010	hypothetical protein	88	PVX_096180	hypothetical protein	625	PVX_003895	hypothetical protein, conserved	207
PVX_093585	SF-assemblin	378	total		16240	PVX_096185	hypothetical protein, conserved	291	PVX_003900	6-cysteine protein	1928
PVX_093590	hypothetical protein, conserved	513				PVX_096195	hypothetical protein, conserved	346	PVX_003905	6-cysteine protein	2273
PVX_093595	peptidyl-prolyl cis-trans isomerase	394				PVX_096200	hypothetical protein, conserved	303	PVX_003910	phospholipase A2, putative	635
PVX_093600	hypothetical protein, conserved	120				PVX_096205	hypothetical protein, conserved	237	PVX_003915	hypothetical protein, conserved	267
PVX_093605	protein phosphatase	461				PVX_096210	hypothetical protein, conserved	273	PVX_003920	2C-methyl-D-erythritol 2,4- cyclodiphosphate synthase, putative	192

ID_chr1	gene	No of aa position used for the phylogeny	ID_chr2	gene	No of aa position used for the phylogeny	ID_chr3	gene	No of aa position used for the phylogeny	ID_chr4	gene	No of aa position used for the phylogeny
PVX_093607	hypothetical protein, conserved	202				PVX_096215	hypothetical protein, conserved	416	PVX_003925	hypothetical protein, conserved	447
PVX_093610	adenylyl cyclase beta	1177				PVX_096220	hypothetical protein, conserved	78	PVX_003930	hypothetical protein	325
PVX_093615	inositol phosphatase	897				PVX_096225	hypothetical protein, conserved	450	PVX_003935	amine transporter, putative	925
PVX_093620	hypothetical protein, conserved	387				PVX_096230	hypothetical protein, conserved	211	PVX_003940	RING zinc finger protein, putative	338
PVX_093625	hypothetical protein, conserved	914				PVX_096235	GTP-binding protein, putative	391	PVX_003945	ATP-dependent RNA helicase UAP56, putative (UAP56)	460
PVX_093630	1-cys peroxiredoxin (1-cyspxn)	219				PVX_096240	hypothetical protein, conserved	531	PVX_003950	transport protein SEC61 gamma subunit, putative	81
PVX_093635	transcription factor with AP2 domain(s)	503				PVX_096245	rhoptyr-associated leucine zipper- like protein 1, putative (RALP1)	281	PVX_003955	60S ribosomal protein L37a, putative	95
PVX_093640	glutamate dehydrogenase	1022				PVX_096250	PelOta protein homologue, putative	352	PVX_003960	hypothetical protein, conserved	1539
PVX_093645	hypothetical protein, conserved	1066				PVX_096253	conserved Plasmodium protein, unknown function	77	PVX_003965	transporter, putative	455
PVX_093650	mannose-6-phosphate isomerase	617				PVX_096255	hypothetical protein, conserved	103	PVX_003970	50S ribosomal protein L33, putative	118
PVX_093655	sentrin-specific protease 2	812				PVX_096260	hypothetical protein, conserved	455	PVX_003975	hypothetical protein, conserved	848
PVX_093660	hypothetical protein, conserved	123				PVX_096265	40S ribosomal protein S5, putative	194	PVX_003980	hypothetical protein, conserved	445
PVX_093665	hypothetical protein, conserved	523				PVX_096271	conserved Plasmodium protein, unknown function	219	PVX_003985	syntaxin, putative	304
PVX_093670	protein kinase	493				PVX_096273	DEAD/DEAH box ATP-dependent RNA helicase, putative	578	PVX_003990	hypothetical protein, conserved	354
PVX_093675	von willebrand factor a-domain- related protein (WARP)	264				PVX_096275	hypothetical protein, conserved	590	PVX_003995	hypothetical protein, conserved	286
PVX_093680	Phist protein (Pf-fam-b)	183				PVX_096280	hypothetical protein, conserved	219			
	total	9402				PVX_096285	hypothetical protein, conserved	1685			total
						PVX_096289	hypothetical protein	167			7020
						PVX_096292	HAM1 domain containing protein	197			
						PVX_096295	hypothetical protein, conserved	1359			
						PVX_096300	hypothetical protein, conserved	225			
						PVX_096302	conserved Plasmodium protein, unknown function	133			
						PVX_096305	ferredoxin reductase, putative	599			
						PVX_096307	conserved Plasmodium protein, unknown function	104			
						PVX_096320	exosome complex component CSL4, putative (CSL4)	188			
						PVX_096325	hypothetical protein, conserved	1493			
						PVX_096330	hypothetical protein, conserved	384			
						PVX_096335	40S ribosomal protein S10, putative	132			
						PVX_096340	60S ribosomal protein L11, putative	172			
						PVX_096345	hypothetical protein, conserved	311			
						PVX_096350	hypothetical protein, conserved	570			
						PVX_096355	actin-related protein, putative (ARP6)	588			
						PVX_096360	serine/threonine-protein kinase NEK4, putative	309			
						PVX_096365	hypothetical protein	176			
						PVX_096370	hypothetical protein, conserved	131			
						PVX_096380	conserved Plasmodium protein, unknown function	247			
						PVX_096385	hypothetical protein, conserved	272			
						PVX_096395	hypothetical protein, conserved	544			
						PVX_096400	prefoldin subunit 3, putative	188			
						PVX_096405	30S ribosomal protein S8, putative	128			
						PVX_096410	cysteine repeat modular protein 2, putative (CRMP2)	2428			
						total		17875			

Table S5 Model test for phylogeny using genome encoded gene sequences of seven *Plasmodium* species

Model	-Ln	No of parameters				AIC	Bootstrap
		branch(2n-3)	+F	+G	total		
GTR+Γ	-1956269.6	11	208	1	220	3,912,979	all 100
BLOSUM62+Γ	-2052737.1	11	0	1	12	4,105,498	all 100
CPREV+Γ	-2034964.4	11	0	1	12	4,069,953	all 100
JTT+Γ	-2008632.9	11	0	1	12	4,017,290	all 100
LG+Γ	-2021124.7	11	0	1	12	4,042,273	all 100
VT+Γ	-2031452.3	11	0	1	12	4,062,929	all 100
WAG+Γ	-2034598.8	11	0	1	12	4,069,222	all 100
BLOSUM62+Γ+F	-2029042.9	11	19	1	31	4,058,148	all 100
CPREV+Γ+F	-2010443.7	11	19	1	31	4,020,949	all 100
JTT+Γ+F	-1977359.6	11	19	1	31	3,954,781	all 100
LG+Γ+F	-1997772.3	11	19	1	31	3,995,607	all 100
VT+Γ+F	-2005338.9	11	19	1	31	4,010,740	all 100
WAG+Γ+F	-2001293.2	11	19	1	31	4,002,648	all 100

Table S6 Approximately unbiased tese of 15 Ttree topologies

[illegible]