王姗姗, 刘琦, 李玉, 王天瑞, 戴锡玲, Gregor Kozlowski, 许瑾, 宋以刚 (2026) 基于叶绿体基因组构建的系统发育关系应慎用于物种鉴定和生物地理学研究: 以枫杨属为例. 生物多样性, 34, 25475. https://www.biodiversity-science.net/CN/10.17520/biods.2025475

附录1　从NCBI数据库获取的枫杨属物种基本信息

Appendix 1　Basic information of *Pterocarya* species obtained from the NCBI database

物种 Species	登录号 GenBank No.	来源 Source
华西枫杨 *Pterocarya macroptera* var. *insignis*	MN262641.1	NCBI数据库
华西枫杨 *Pterocarya macroptera* var. *insignis*	MH188292.1	NCBI数据库
华西枫杨 *Pterocarya macroptera* var. *insignis*	MH188290.1	NCBI数据库
枫杨 *Pterocarya stenoptera*	MN262640.1	NCBI数据库
枫杨 *Pterocarya stenoptera*	MN866892.1	NCBI数据库
枫杨 *Pterocarya stenoptera*	MH188289.1	NCBI数据库
云南枫杨 *Pterocarya macroptera* var. *delavayi*	MW194257.1	NCBI数据库
湖北枫杨 *Pterocarya hupehensis*	MH188293.1	NCBI数据库
高加索枫杨 *Pterocarya fraxinifolia*	MH188291.1	NCBI数据库
越南枫杨 *Pterocarya tonkinensis*	MH188288.1	NCBI数据库
马尾树 *Rhoiptelea chiliantha*	MT701585.1	NCBI数据库
杨梅 *Morella rubra*	KY476635.1	NCBI数据库

附录2　本研究新测序的7个个体的叶绿体基因组注释基因列表

Appendix 2　List of annotated genes in the chloroplast genomes of seven newly sequenced individuals in this study

基因分类 Category	基因分组 Group of genes	基因名称 Name of genes
表达相关基因 Expression-related genes	核糖体RNA基因 Ribosomal RNAs genes	*rrn*4.5*S*(×2), *rrn*5*S*(×2), *rrn*16*S*(×2), *rrn*23*S*(×2)
	转运RNA基因 Transfer RNAs genes	*trnA-UGC**(×2), *trnC-GCA*, *trnD-GUC*, *trnE-UUC*, *trnF-GAA*, *trnG-GCC**, *trnG-UCC*, *trnH-GUG*, *trnI-CAU*(×2), *trnI-GAU**(×2), *trnK-UUU**, *trnL-CAA*(×2), *trnL-UAA**, *trnL-UAG*, *trnM-CAU*, *trnN-GUU*(×2), *trnP-UGG*, *trnQ-UUG*, *trnR-ACG*(×2), *trnR-UCU*, *trnS-GCU*(×2), *trnS-UGA*, *trnT-GGU*, *trnT-UGU*, *trnV-GAC*(×2), *trnV-UAC**, *trnW-CCA*, *trnY-GUA*, *trnfM-CAU*
	核糖体小亚基基因 Ribosomal small subunit gene (SSU gene)	*rps*2, *rps*3, *rps*4, *rps*7(×2), *rps*8(×2), *rps*11, *rps*12**(×2), *rps*14, *rps*15, *rps*16*, *rps*18, *rps*19
	核糖体大亚基基因 Ribosomal large subuni gene (LSUgene)	*rpl*2*(×2), *rpl*14, *rpl*16*, *rpl*20, *rpl*22, *rpl*23(×2), *rpl*32, *rpl*33, *rpl*36
	RNA聚合酶亚基基因 RNA polymerase subunit gene	*rpoA*, *rpoB*, *rpoC*1, *rpoC*2
光合作用相关基因 Photosynthesis-related genes	ATP酶合成基因 ATP synthase gene	*atpA*, *atpB*, *atpE*, *atpF**, *atpH*, *atpI*
	细胞色素复合物基因 Cytochrome b/f complex gene	*petA*, *petB**, *petD**, *petG*, *petL*, *petN*
	NADH 脱氢酶基因 NADH dehydrogenase gene	*ndhA**, *ndhB**(×2), *ndhC*, *ndhD*, *ndhE*, *ndhF*, *ndhG*, *ndhH*, *ndhI*, *ndhJ*, *ndhK*
	光合系统 I 基因 Photosystem I gene	*psaA*, *psaB*, *psaC*, *psaI*, *psaJ*
	光合系统 II 基因 Photosystem II gene	*psbA*, *psbB*, *psbC*, *psbD*, *psbE*, *psbF*, *psbH*, *psbI*, *psbJ*, *psbK*, *psbL*, *psbM*, *psbN*, *psbT*, *psbZ*
	二磷酸核酮糖羧化酶大亚基基因 RubisCO large subunit gene	*rbcL*
	依赖ATP的蛋白酶单元p基因 ATP-dependent protease subunit p gene (clpP)	*clpP***
其他基因 Other genes	成熟酶基因 Maturase gene	*matK*
	包裹膜蛋白基因 Envelop membrane protein gene	*cemA*
	乙酰辅酶 A 羧化酶亚基基因 Acetyl CoA-carboxylase subunit gene	*accD*
	c型细胞色素合成基因 c-type cytochrome synthesis ccsA gene (ccsA)	*ccsA*
	假定叶绿体阅读框 Hypothetical chloroplast reading frames	*ycf*1(×2), *ycf*2(×2), *ycf*3, *ycf*4

*/**: 带有符号的基因是含有单(*)或双(**)内含子的基因; (×2): 位于IR区域的重复基因标记为×2。

*/**, The signed genes are those containing single (*) or double (**) introns; (×2), The duplicate genes in the IR region mark ×2.

附录3　枫杨属叶绿体基因组核苷酸多样性(Pi)的滑动窗口分析结果

Appendix 3　Sliding window analysis of nucleotide diversity (Pi) in the chloroplast genomes of *Pterocarya*

Window	Midpoint	Pi	Window	Midpoint	Pi
1–806	406	0	12977–13780	13376	0.00223
207–1006	606	0	13177–13981	13580	0.00223
407–1206	806	0	13377–14185	13780	0.00223
607–1413	1006	0	13581–14386	13981	0.00103
807–1614	1206	0	13781–14586	14185	0.00031
1007–1814	1413	0	13982–14786	14386	0.00063
1207–2014	1614	0.00071	14186–14995	14586	0.00134
1414–2214	1814	0.00174	14387–15195	14786	0.00103
1615–2414	2014	0.00174	14587–15395	14995	0.00103
1815–2614	2214	0.00241	14787–15595	15195	0.00071
2015–2814	2414	0.0017	14996–15797	15395	0
2215–3014	2614	0.00165	15196–15997	15595	0.00071
2415–3214	2814	0.00232	15396–16198	15797	0.00103
2615–3414	3014	0.00165	15596–16398	15997	0.00103
2815–3614	3214	0.00237	15798–16598	16198	0.00103
3015–3816	3414	0.00138	15998–16798	16398	0.00103
3215–4018	3614	0.00071	16199–16998	16598	0.00071
3415–4218	3816	0.00071	16399–17198	16798	0.00071
3615–4418	4018	0.00031	16599–17398	16998	0.00071
3817–4620	4218	0.00063	16799–17599	17198	0
4019–4822	4418	0.00263	16999–17799	17398	0.00031
4219–5026	4620	0.00263	17199–17999	17599	0.00134
4419–5226	4822	0.0042	17399–18199	17799	0.00196
4621–5426	5026	0.00388	17600–18399	17999	0.00196
4823–5626	5226	0.00188	17800–18606	18199	0.00545
5027–5832	5426	0.00254	18000–18809	18399	0.00442
5227–6032	5626	0.00067	18200–19009	18606	0.00379
5427–6232	5832	0.00067	18400–19209	18809	0.00379
5627–6442	6032	0.00196	18607–19409	19009	0
5833–6650	6232	0.00129	18810–19609	19209	0
6033–6852	6442	0.00232	19010–19809	19409	0.00071
6233–7055	6650	0.00299	19210–20009	19609	0.00174
6443–7255	6852	0.00241	19410–20209	19809	0.00174
6651–7455	7055	0.00241	19610–20409	20009	0.00205
6853–7655	7255	0.00241	19810–20609	20209	0.00205
7056–7863	7455	0.00228	20010–20809	20409	0.00134
7256–8064	7655	0.00362	20210–21009	20609	0.00134
7456–8264	7863	0.00362	20410–21209	20809	0.00134
7656–8464	8064	0.00259	20610–21409	21009	0.00134
7864–8664	8264	0.00205	20810–21609	21209	0.00134
8065–8864	8464	0	21010–21809	21409	0.00134
8265–9064	8664	0.00031	21210–22009	21609	0.00103
8465–9266	8864	0.00129	21410–22209	21809	0.00031
8665–9469	9064	0.00161	21610–22409	22009	0
8865–9816	9266	0.00375	21810–22609	22209	0
9065–10020	9469	0.00446	22010–22809	22409	0
9267–10333	9816	0.00536	22210–23009	22609	0
9470–10533	10020	0.00504	22410–23209	22809	0
9817–10733	10333	0.0029	22610–23410	23009	0.00134
10021–10933	10533	0.00259	22810–23610	23209	0.00165
10334–11133	10733	0.00071	23010–23810	23410	0.00165
10534–11366	10933	0.00103	23210–24010	23610	0.00165
10734–11569	11133	0.00246	23411–24210	23810	0.00031
10934–11776	11366	0.00263	23611–24410	24010	0
11134–11976	11569	0.00451	23811–24610	24210	0
11367–12176	11776	0.0042	24011–24824	24410	0
11570–12376	11976	0.00348	24211–25041	24610	0
11777–12576	12176	0.00259	24411–25246	24824	0.00103
11977–12776	12376	0.00071	24611–25446	25041	0.00103
12177–12976	12576	0.00071	24825–25646	25246	0.00103
12377–13176	12776	0	25042–25846	25446	0.00174
12577–13376	12976	0	25247–26046	25646	0.00071
12777–13580	13176	0.00152	25447–26246	25846	0.00071

Window	Midpoint	Pi	Window	Midpoint	Pi
25647–26446	26046	0.00071	38752–39551	39151	0.00071
25847–26646	26246	0	38952–39751	39351	0
26047–26846	26446	0	39152–39953	39551	0.00219
26247–27046	26646	0.00067	39352–40153	39751	0.00219
26447–27246	26846	0.00067	39552–40368	39953	0.00219
26647–27446	27046	0.00067	39752–40568	40153	0.00219
26847–27646	27246	0.00067	39954–40914	40368	0
27047–27846	27446	0	40154–41116	40568	0.00129
27247–28046	27646	0.00067	40369–41328	40914	0.00161
27447–28246	27846	0.00067	40569–41528	41116	0.00161
27647–28446	28046	0.00067	40915–41728	41328	0.00161
27847–28646	28246	0.00067	41117–41928	41528	0.00031
28047–28846	28446	0.00138	41329–42128	41728	0
28247–29046	28646	0.00138	41529–42328	41928	0
28447–29246	28846	0.0017	41729–42528	42128	0
28647–29446	29046	0.00299	41929–42728	42328	0
28847–29646	29246	0.00281	42129–42928	42528	0
29047–29846	29446	0.00424	42329–43128	42728	0
29247–30046	29646	0.00393	42529–43328	42928	0
29447–30246	29846	0.00295	42729–43528	43128	0.00071
29647–30449	30046	0.00174	42929–43728	43328	0.00071
29847–30649	30246	0.00031	43129–43928	43528	0.00071
30047–30849	30449	0.00237	43329–44128	43728	0.00071
30247–31049	30649	0.00205	43529–44328	43928	0
30450–31249	30849	0.00277	43729–44528	44128	0
30650–31449	31049	0.00344	43929–44728	44328	0
30850–31652	31249	0.00138	44129–44928	44528	0
31050–31852	31449	0.00138	44329–45128	44728	0
31250–32052	31652	0.00129	44529–45328	44928	0
31450–32252	31852	0.00205	44729–45528	45128	0
31653–32452	32052	0.00205	44929–45728	45328	0
31853–32652	32252	0.00335	45129–45928	45528	0
32053–32852	32452	0.00272	45329–46128	45728	0.00054
32253–33052	32652	0.00411	45529–46328	45928	0.00054
32453–33252	32852	0.00478	45729–46528	46128	0.00054
32653–33452	33052	0.00446	45929–46728	46328	0.00054
32853–33652	33252	0.00446	46129–46928	46528	0
33053–33852	33452	0.00165	46329–47129	46728	0.00071
33253–34058	33652	0.00362	46529–47329	46928	0.00071
33453–34272	33852	0.00402	46729–47529	47129	0.00125
33653–34472	34058	0.00473	46929–47729	47329	0.00196
33853–34672	34272	0.00473	47130–47929	47529	0.00192
34059–34883	34472	0.0021	47330–48129	47729	0.00192
34273–35083	34672	0.00071	47530–48330	47929	0.00138
34473–35284	34883	0.00071	47730–48530	48129	0.00067
34673–35484	35083	0.00071	47930–48730	48330	0
34884–35696	35284	0.00071	48130–48930	48530	0
35084–35896	35484	0.00196	48331–49131	48730	0
35285–36098	35696	0.00192	48531–49331	48930	0
35485–36327	35896	0.00192	48731–49536	49131	0
35697–36531	36098	0.00397	48931–49736	49331	0.00125
35897–36740	36327	0.00272	49132–49938	49536	0.00188
36099–36950	36531	0.00308	49332–50148	49736	0.00188
36328–37151	36740	0.00308	49537–50348	49938	0.00188
36532–37351	36950	0.00103	49737–50548	50148	0.00094
36741–37551	37151	0.00103	49939–50748	50348	0.00031
36951–37751	37351	0	50149–50948	50548	0.00031
37152–37951	37551	0	50349–51148	50748	0.00031
37352–38151	37751	0	50549–51348	50948	0.00214
37552–38351	37951	0	50749–51548	51148	0.00214
37752–38551	38151	0	50949–51748	51348	0.00246
37952–38751	38351	0	51149–51948	51548	0.00246
38152–38951	38551	0.00071	51349–52148	51748	0.00031
38352–39151	38751	0.00071	51549–52349	51948	0.00031
38552–39351	38951	0.00071	51749–52550	52148	0.00098

Window	Midpoint	Pi	Window	Midpoint	Pi
51949–52750	52349	0.00098	65258–66057	65657	0.00205
52149–52950	52550	0.00165	65458–66259	65857	0.0021
52350–53150	52750	0.00165	65658–66477	66057	0.00277
52551–53350	52950	0.00098	65858–66677	66259	0.0033
52751–53550	53150	0.00165	66058–66877	66477	0.00192
52951–53795	53350	0.00201	66260–67077	66677	0.00121
53151–53995	53550	0.00201	66478–67278	66877	0.00085
53351–54255	53795	0.00201	66678–67478	67077	0.00031
53551–54455	53995	0.00134	66878–67678	67278	0.00031
53796–54655	54255	0.00031	67078–67878	67478	0.00134
53996–54855	54455	0.00063	67279–68078	67678	0.00103
54256–55056	54655	0.00098	67479–68278	67878	0.00103
54456–55256	54855	0.0017	67679–68606	68078	0.00174
54656–55456	55056	0.00241	67879–68807	68278	0.00103
54856–55657	55256	0.0021	68079–69007	68606	0.00103
55057–55857	55456	0.00143	68279–69219	68807	0.00241
55257–56057	55657	0.00071	68607–69420	69007	0.0017
55457–56262	55857	0	68808–69620	69219	0.00138
55658–56462	56057	0.0021	69008–69820	69420	0.00138
55858–56801	56262	0.00308	69220–70020	69620	0
56058–57002	56462	0.00308	69421–70220	69820	0
56263–57202	56801	0.00339	69621–70420	70020	0.00031
56463–57402	57002	0.00196	69821–70620	70220	0.00031
56802–57602	57202	0.00165	70021–70821	70420	0.00063
57003–57803	57402	0.00196	70221–71026	70620	0.00129
57203–58003	57602	0.00165	70421–71230	70821	0.00241
57403–58203	57803	0.00098	70621–71447	71026	0.00371
57603–58403	58003	0.00031	70822–71647	71230	0.00402
57804–58603	58203	0	71027–71847	71447	0.00335
58004–58803	58403	0	71231–72047	71647	0.00192
58204–59003	58603	0	71448–72247	71847	0.00063
58404–59203	58803	0	71648–72468	72047	0.00031
58604–59403	59003	0	71848–72668	72247	0.00031
58804–59603	59203	0	72048–72869	72468	0.00031
59004–59803	59403	0.00071	72248–73069	72668	0.00031
59204–60003	59603	0.00228	72469–73279	72869	0.00031
59404–60203	59803	0.00228	72669–73480	73069	0.00031
59604–60403	60003	0.00228	72870–73680	73279	0.00063
59804–60617	60203	0.00156	73070–73880	73480	0.00063
60004–60817	60403	0	73280–74080	73680	0.00031
60204–61017	60617	0	73481–74280	73880	0.00031
60404–61217	60817	0.00071	73681–74481	74080	0
60618–61417	61017	0.00071	73881–74681	74280	0.00071
60818–61617	61217	0.00143	74081–74881	74481	0.00071
61018–61817	61417	0.00143	74281–75081	74681	0.00071
61218–62017	61617	0.00071	74482–75281	74881	0.00071
61418–62217	61817	0.00071	74682–75481	75081	0
61618–62417	62017	0.00031	74882–75681	75281	0
61818–62638	62217	0.00063	75082–75891	75481	0
62018–62838	62417	0.00063	75282–76091	75681	0.00031
62218–63038	62638	0.00094	75482–76291	75891	0.00031
62418–63238	62838	0.00129	75682–76491	76091	0.00031
62639–63438	63038	0.00098	75892–76698	76291	0.00085
62839–63638	63238	0.00098	76092–76898	76491	0.00054
63039–63838	63438	0.00067	76292–77098	76698	0.00054
63239–64038	63638	0	76492–77298	76898	0.00125
63439–64249	63838	0.00183	76699–77498	77098	0.00071
63639–64450	64038	0.00214	76899–77698	77298	0.00071
63839–64654	64249	0.00246	77099–77898	77498	0.00125
64039–64854	64450	0.00246	77299–78098	77698	0.00054
64250–65054	64654	0.00063	77499–78298	77898	0.00085
64451–65257	64854	0.00031	77699–78501	78098	0.00116
64655–65457	65054	0.00067	77899–78701	78298	0.00063
64855–65657	65257	0.00067	78099–78901	78501	0.00063
65055–65857	65457	0.00067	78299–79101	78701	0.00031

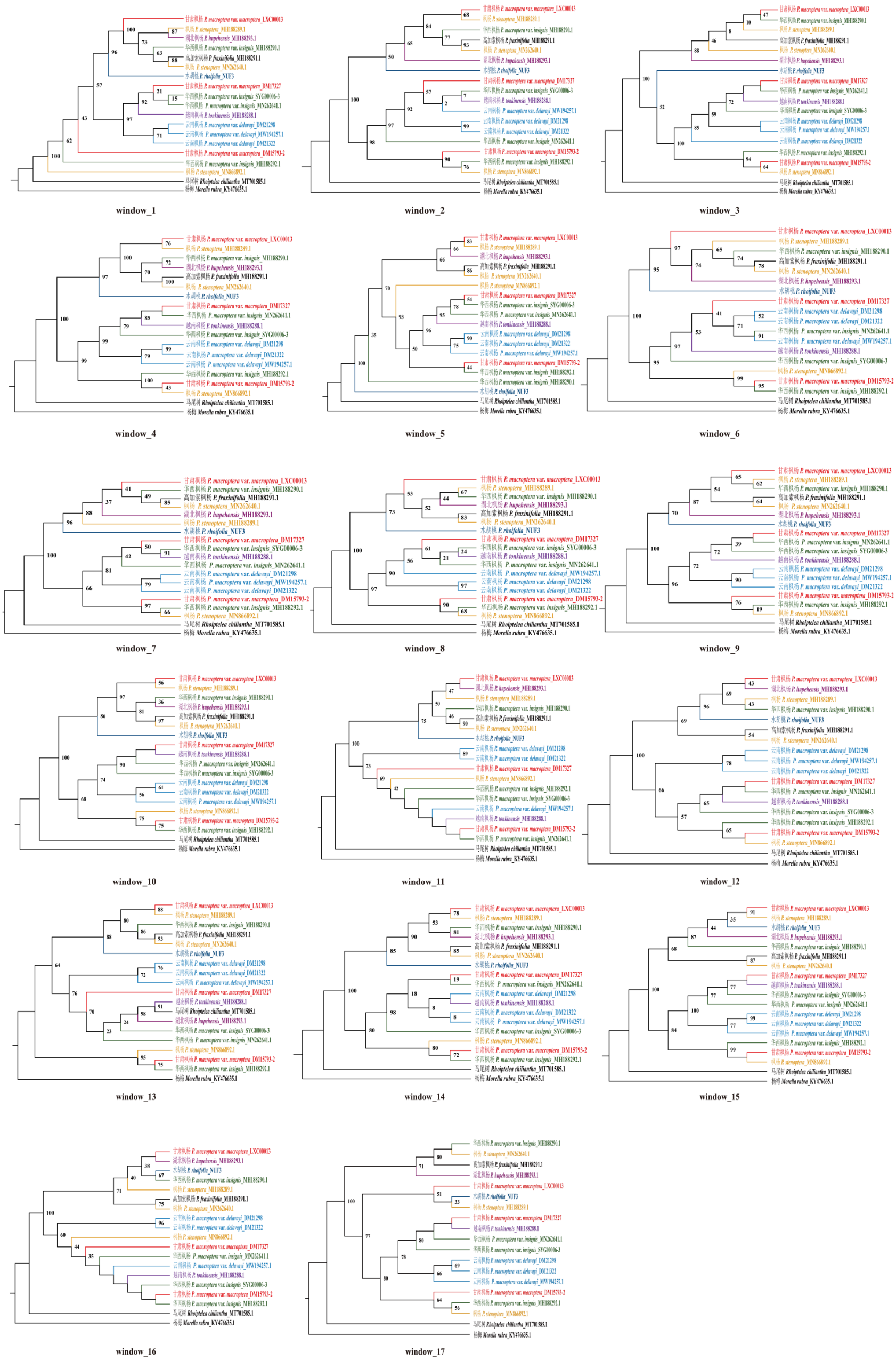
Window	Midpoint	Pi	Window	Midpoint	Pi
78502–79301	78901	0	91554–92353	91953	0
78702–79501	79101	0	91754–92553	92153	0
78902–79701	79301	0	91954–92753	92353	0
79102–79901	79501	0	92154–92953	92553	0
79302–80124	79701	0	92354–93153	92753	0.00067
79502–80324	79901	0	92554–93353	92953	0.00067
79702–80524	80124	0	92754–93553	93153	0.00067
79902–80724	80324	0.00031	92954–93753	93353	0.00067
80125–80924	80524	0.00031	93154–93953	93553	0
80325–81124	80724	0.00031	93354–94153	93753	0.00067
80525–81325	80924	0.00031	93554–94353	93953	0.00067
80725–81525	81124	0	93754–94553	94153	0.00067
80925–81725	81325	0.00138	93954–94765	94353	0.00067
81125–81925	81525	0.00138	94154–94965	94553	0.00031
81326–82125	81725	0.00138	94354–95165	94765	0.00085
81526–82325	81925	0.00138	94554–95365	94965	0.00085
81726–82525	82125	0.00071	94766–95565	95165	0.00085
81926–82725	82325	0.00138	94966–95765	95365	0.00054
82126–82925	82525	0.00138	95166–95965	95565	0
82326–83127	82725	0.0021	95366–96165	95765	0
82526–83327	82925	0.00138	95566–96365	95965	0
82726–83527	83127	0.00071	95766–96565	96165	0
82926–83727	83327	0.00071	95966–96765	96365	0
83128–83928	83527	0.00071	96166–96965	96565	0
83328–84128	83727	0.00071	96366–97165	96765	0
83528–84328	83928	0.00071	96566–97365	96965	0
83728–84528	84128	0.00103	96766–97565	97165	0
83929–84728	84328	0.00031	96966–97765	97365	0
84129–84928	84528	0.00098	97166–97965	97565	0
84329–85128	84728	0.00098	97366–98165	97765	0
84529–85328	84928	0.00138	97566–98365	97965	0
84729–85530	85128	0.00138	97766–98565	98165	0
84929–85730	85328	0.00071	97966–98765	98365	0
85129–85930	85530	0.00134	98166–98965	98565	0
85329–86139	85730	0.00094	98366–99165	98765	0
85531–86339	85930	0.00125	98566–99365	98965	0.00071
85731–86539	86139	0.00125	98766–99565	99165	0.00071
85931–86739	86339	0.00129	98966–99765	99365	0.00103
86140–86939	86539	0.00129	99166–99965	99565	0.00103
86340–87139	86739	0.00098	99366–100165	99765	0.00031
86540–87341	86939	0.0017	99566–100365	99965	0.00031
86740–87541	87139	0.00103	99766–100565	100165	0
86940–87741	87341	0.00071	99966–100765	100365	0
87140–87941	87541	0.00263	100166–100965	100565	0
87342–88141	87741	0.00259	100366–101165	100765	0
87542–88341	87941	0.0033	100566–101365	100965	0
87742–88541	88141	0.0033	100766–101565	101165	0
87942–88741	88341	0.00138	100966–101765	101365	0
88142–88941	88541	0.00103	101166–101965	101565	0
88342–89141	88741	0.00031	101366–102165	101765	0
88542–89341	88941	0.00031	101566–102365	101965	0
88742–89541	89141	0.00031	101766–102565	102165	0
88942–89741	89341	0.00063	101966–102765	102365	0.00054
89142–89941	89541	0.00063	102166–102965	102565	0.00054
89342–90141	89741	0.00116	102366–103173	102765	0.00054
89542–90349	89941	0.00116	102566–103373	102965	0.00085
89742–90549	90141	0.00054	102766–103573	103173	0.00031
89942–90749	90349	0.00054	102966–103773	103373	0.00031
90142–90953	90549	0	103174–103973	103573	0.00031
90350–91153	90749	0	103374–104173	103773	0
90550–91353	90953	0	103574–104373	103973	0
90750–91553	91153	0.00031	103774–104573	104173	0
90954–91753	91353	0.00031	103974–104773	104373	0
91154–91953	91553	0.00031	104174–104973	104573	0
91354–92153	91753	0.00031	104374–105173	104773	0

Window	Midpoint	Pi	Window	Midpoint	Pi
104574–105383	104973	0.00071	117412–118211	117811	0.00071
104774–105583	105173	0.00071	117612–118411	118011	0.00134
104974–105783	105383	0.00071	117812–118611	118211	0.00205
105174–105983	105583	0.00071	118012–118811	118411	0.00272
105384–106183	105783	0	118212–119012	118611	0.00304
105584–106383	105983	0	118412–119223	118811	0.00491
105784–106583	106183	0	118612–119423	119012	0.00487
105984–106783	106383	0	118812–119623	119223	0.00451
106184–106983	106583	0	119013–119823	119423	0.00415
106384–107183	106783	0	119224–120035	119623	0.00196
106584–107383	106983	0	119424–120236	119823	0.00161
106784–107583	107183	0	119624–120436	120035	0.00228
106984–107783	107383	0	119824–120641	120236	0.00161
107184–107983	107583	0	120036–120841	120436	0.00129
107384–108183	107783	0	120237–121041	120641	0.0017
107584–108383	107983	0	120437–121241	120841	0.00071
107784–108583	108183	0	120642–121441	121041	0.00143
107984–108783	108383	0	120842–121641	121241	0.00143
108184–108983	108583	0	121042–121845	121441	0.00103
108384–109183	108783	0	121242–122045	121641	0.00103
108584–109383	108983	0	121442–122245	121845	0.00031
108784–109583	109183	0	121642–122445	122045	0.00098
108984–109783	109383	0	121846–122645	122245	0.00098
109184–109986	109583	0.00063	122046–122845	122445	0.00098
109384–110186	109783	0.00063	122246–123045	122645	0.00098
109584–110386	109986	0.00063	122446–123245	122845	0.00031
109784–110586	110186	0.00063	122646–123445	123045	0.00031
109987–110786	110386	0	122846–123647	123245	0.00031
110187–110986	110586	0	123046–123847	123445	0.00031
110387–111186	110786	0	123246–124047	123647	0.00063
110587–111386	110986	0	123446–124247	123847	0.00031
110787–111586	111186	0	123648–124447	124047	0.00031
110987–111786	111386	0.00031	123848–124648	124247	0.00031
111187–111986	111586	0.00031	124048–124848	124447	0.00067
111387–112186	111786	0.00031	124248–125048	124648	0.00067
111587–112386	111986	0.00031	124448–125248	124848	0.00152
111787–112586	112186	0	124649–125448	125048	0.00152
111987–112786	112386	0	124849–125648	125248	0.00183
112187–112986	112586	0	125049–125848	125448	0.0025
112387–113186	112786	0	125249–126048	125648	0.00196
112587–113386	112986	0	125449–126248	125848	0.00263
112787–113586	113186	0.00071	125649–126448	126048	0.00165
112987–113786	113386	0.00138	125849–126648	126248	0.00098
113187–113986	113586	0.00138	126049–126848	126448	0.00138
113387–114186	113786	0.00138	126249–127057	126648	0.00071
113587–114386	113986	0.00067	126449–127262	126848	0.00134
113787–114586	114186	0	126649–127462	127057	0.00134
113987–114786	114386	0.00214	126849–127662	127262	0.00134
114187–114986	114586	0.00214	127058–127863	127462	0.00134
114387–115186	114786	0.00214	127263–128063	127662	0.00071
114587–115386	114986	0.00246	127463–128263	127863	0.00071
114787–115586	115186	0.00031	127663–128463	128063	0
114987–115786	115386	0.00031	127864–128663	128263	0
115187–115995	115586	0.00031	128064–128863	128463	0
115387–116195	115786	0	128264–129063	128663	0.00071
115587–116539	115995	0.02621	128464–129263	128863	0.00071
115787–116811	116195	0.04076	128664–129463	129063	0.00071
115996–117011	116539	0.04076	128864–129663	129263	0.00071
116196–117211	116811	0.04196	129064–129863	129463	0.00067
116540–117411	117011	0.01679	129264–130064	129663	0.00067
116812–117611	117211	0.00223	129464–130266	129863	0.00067
117012–117811	117411	0.00223	129664–130466	130064	0.00138
117212–118011	117611	0.00103	129864–130666	130266	0.00071

Window	Midpoint	Pi	Window	Midpoint	Pi
130065–130866	130466	0.0021	142279–143078	142678	0
130267–131066	130666	0.0021	142479–143278	142878	0
130467–131266	130866	0.00138	142679–143478	143078	0
130667–131466	131066	0.00138	142879–143678	143278	0
130867–131666	131266	0.00031	143079–143878	143478	0
131067–131866	131466	0.00098	143279–144078	143678	0
131267–132066	131666	0.00241	143479–144278	143878	0
131467–132266	131866	0.00295	143679–144478	144078	0
131667–132466	132066	0.00397	143879–144678	144278	0
131867–132666	132266	0.0033	144079–144878	144478	0
132067–132866	132466	0.00259	144279–145078	144678	0
132267–133066	132666	0.00237	144479–145278	144878	0
132467–133266	132866	0.00165	144679–145478	145078	0
132667–133466	133066	0.00196	144879–145678	145278	0
132867–133666	133266	0.00179	145079–145878	145478	0
133067–133866	133466	0.00201	145279–146088	145678	0.00071
133267–134066	133666	0.00138	145479–146288	145878	0.00071
133467–134266	133866	0.00174	145679–146488	146088	0.00071
133667–134466	134066	0.00183	145879–146688	146288	0.00071
133867–134666	134266	0.00129	146089–146888	146488	0
134067–134866	134466	0.00183	146289–147088	146688	0
134267–135066	134666	0.00451	146489–147288	146888	0
134467–135266	134866	0.00388	146689–147488	147088	0
134667–135475	135066	0.00388	146889–147688	147288	0
134867–135675	135266	0.00335	147089–147888	147488	0
135067–135875	135475	0	147289–148088	147688	0.00031
135267–136075	135675	0.00031	147489–148296	147888	0.00031
135476–136275	135875	0.00031	147689–148496	148088	0.00085
135676–136475	136075	0.00246	147889–148696	148296	0.00085
135876–136675	136275	0.00246	148089–148896	148496	0.00054
136076–136875	136475	0.00214	148297–149096	148696	0.00054
136276–137075	136675	0.00214	148497–149296	148896	0
136476–137275	136875	0	148697–149496	149096	0
136676–137475	137075	0	148897–149696	149296	0
136876–137675	137275	0.00138	149097–149896	149496	0
137076–137875	137475	0.00138	149297–150096	149696	0
137276–138075	137675	0.00138	149497–150296	149896	0
137476–138275	137875	0.00138	149697–150496	150096	0
137676–138475	138075	0	149897–150696	150296	0
137876–138675	138275	0	150097–150896	150496	0
138076–138875	138475	0	150297–151096	150696	0
138276–139075	138675	0	150497–151296	150896	0
138476–139275	138875	0	150697–151496	151096	0
138676–139475	139075	0.00031	150897–151696	151296	0.00031
138876–139675	139275	0.00031	151097–151896	151496	0.00103
139076–139875	139475	0.00031	151297–152096	151696	0.00103
139276–140075	139675	0.00031	151497–152296	151896	0.00103
139476–140275	139875	0	151697–152496	152096	0.00071
139676–140475	140075	0	151897–152696	152296	0
139876–140675	140275	0	152097–152896	152496	0
140076–140875	140475	0	152297–153096	152696	0
140276–141075	140675	0	152497–153296	152896	0
140476–141278	140875	0.00063	152697–153496	153096	0
140676–141478	141075	0.00063	152897–153696	153296	0
140876–141678	141278	0.00063	153097–153896	153496	0
141076–141878	141478	0.00063	153297–154096	153696	0
141279–142078	141678	0	153497–154296	153896	0
141479–142278	141878	0	153697–154496	154096	0
141679–142478	142078	0	153897–154696	154296	0
141879–142678	142278	0	154097–154896	154496	0
142079–142878	142478	0	154297–155096	154696	0

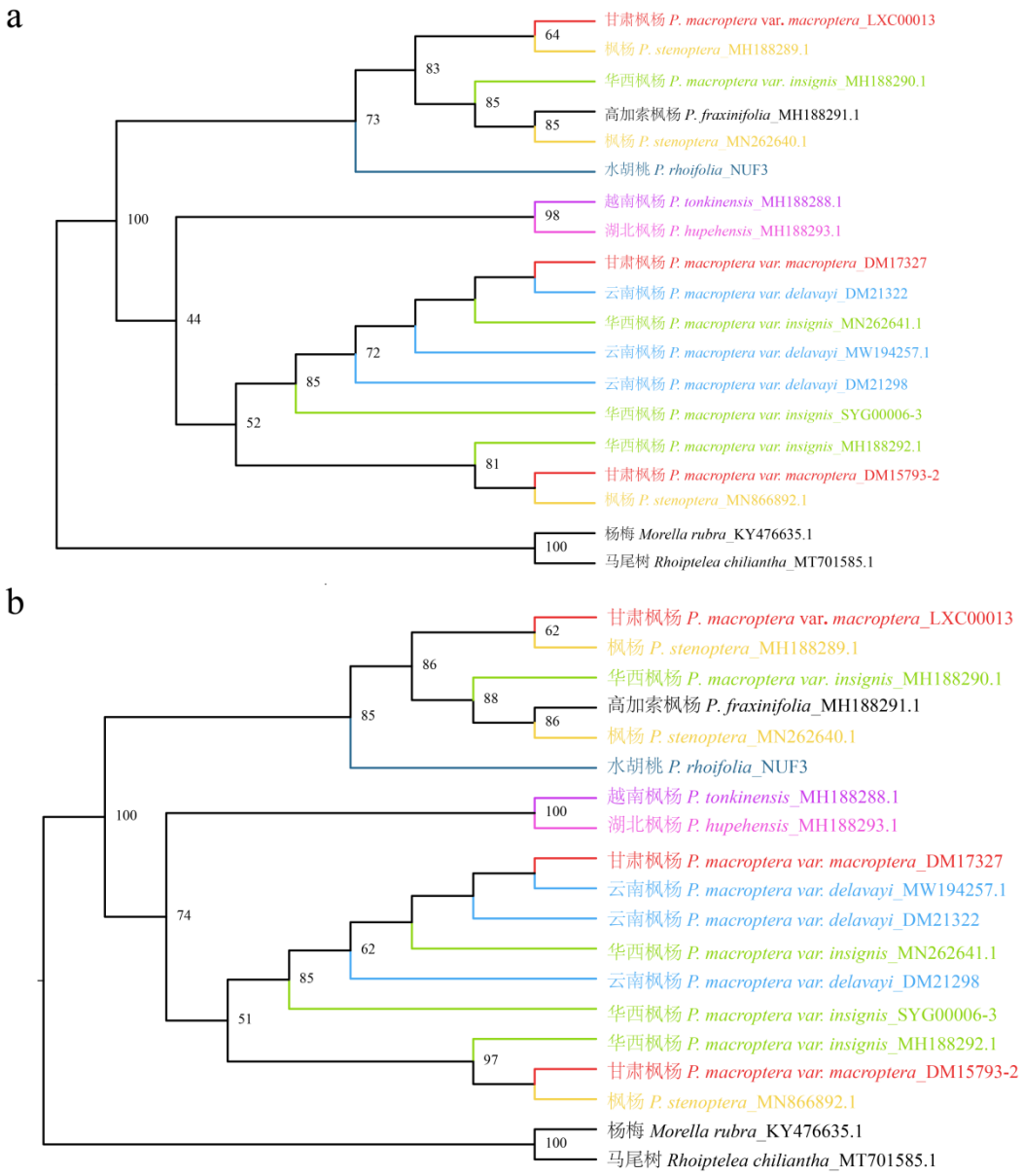
Window	Midpoint	Pi	Window	Midpoint	Pi
154497–155296	154896	0	157509–158308	157908	0.00067
154697–155496	155096	0	157709–158508	158108	0.00067
154897–155696	155296	0	157909–158708	158308	0.00067
155097–155896	155496	0	158109–158908	158508	0.00067
155297–156096	155696	0	158309–159108	158708	0
155497–156296	155896	0.00054	158509–159308	158908	0
155697–156496	156096	0.00085	158709–159508	159108	0
155897–156708	156296	0.00085	158909–159708	159308	0
156097–156908	156496	0.00085	159109–159908	159508	0.00031
156297–157108	156708	0.00098	159309–160108	159708	0.00031
156497–157308	156908	0.00067	159509–160312	159908	0.00031
156709–157508	157108	0.00067	159709–160512	160108	0.00031
156909–157708	157308	0.00067	159909–160712	160312	0
157109–157908	157508	0	160109–160912	160512	0
157309–158108	157708	0	160313–160939	160625	0

王姗姗, 刘琦, 李玉, 王天瑞, 戴锡玲, Gregor Kozlowski, 许瑾, 宋以刚 (2026) 基于叶绿体基因组构建的系统发育关系应慎用于物种鉴定和生物地理学研究：以枫杨属为例. 生物多样性, 34, 25475. https://www.biodiversity-science.net/CN/10.17520/biods.2025475



附录4　基于17个枫杨属个体滑动窗口序列构建的最大似然系统发育树。自举支持率标注于各分支上。

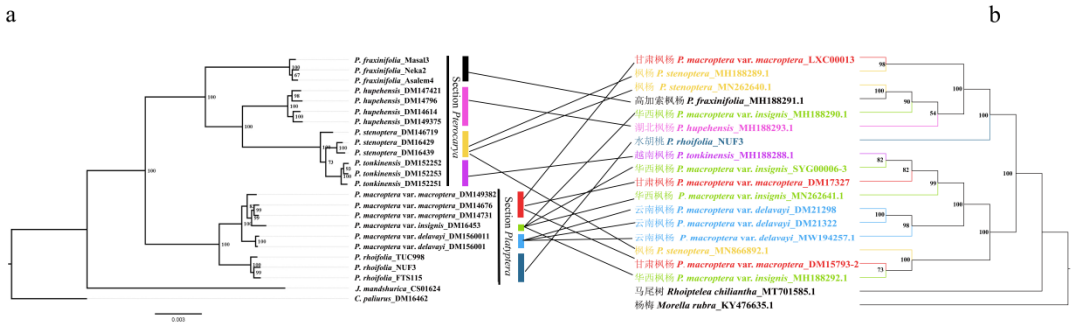
Appendix 4　Phylogenetic relationships of 17 *Pterocarya* individuals inferred using maximum likelihood analysis of sliding window sequences. Bootstrap support (BS) values are labeled at the branches



附录5　基于17个枫杨属个体的高变区*ndhF+ndhC–trnV-UAC*序列(a)和*ndhF+petA–psbJ*序列(b)分别构建的最大似然系统发育树

Appendix 5　Maximum likelihood phylogenetic tree constructed based on the hypervariable region *ndhF+ndhC–trnV-UAC* sequences (a) and *ndhF+petA–psbJ* sequences (b) from 17 *Pterocarya* individuals, respectively

王姗姗, 刘琦, 李玉, 王天瑞, 戴锡玲, Gregor Kozlowski, 许瑾, 宋以刚 (2026) 基于叶绿体基因组构建的系统发育关系应慎用于物种鉴定和生物地理学研究: 以枫杨属为例. 生物多样性, 34, 25475. https://www.biodiversity-science.net/CN/10.17520/biods.2025475



附录6　基于RAD–seq数据对22个枫杨属个体和2个外群类群推断(a)和基于17个枫杨属个体的叶绿体全基因组序列重建(b)分别构建的系统发育树

Appendix 6　Phylogenetic tree inferred from RAD–seq data for 22 *Pterocarya* individuals and 2 outgroup taxa (a) and reconstructed from the complete chloroplast genome sequences of 17 *Pterocarya* individuals (b), respectively