

Phylogeny and taxonomic revisions of *Piper* (Piperaceae) in Taiwan

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Table S1. The samples included in this study, along with their scientific names and GenBank accession numbers, are provided. For newly collected samples, additional details such as sample numbers, collectors, collection numbers, localities, and the herbaria where they are deposited are also included. Taxa marked with asterisks (*), number signs (#), and dollar signs (\$) represent synonyms of *Piper laosanum*, *P. macropiper*, and *P. leptostachyum* respectively.

Taxon	Sample number	ITS	<i>trnL</i> -F	Collector collection #	Locality	Herbarium
Outgroups						
<i>Houttuynia cordata</i> Thunb.		EU329272	AF332969			
<i>Manekia naranjoana</i> (C.DC.) Callejas ex N. Zamora, Hammel & Grayum		HQ731559	EF422821			
<i>Manekia sydowii</i> (Trel.) T. Arias, Callejas & Bornst.		HQ731554	EF422820			
<i>Peperomia pellucida</i> (L.) Kunth		MH050267				
<i>Peperomia serpens</i> (Sw.) Loudon		FJ424446				
Ingroups						
<i>Piper abbreviatum</i> Opiz		MH493092	MH476599			
<i>Piper acre</i> Blume		MH493102	MH476603			
<i>Piper arborescens</i> Roxb. #	15	PQ893330	PQ892194	P.H. Chen 2197	Taiwan: Taitung County	PPI

<i>Piper arborescens</i> Roxb. #	27	PQ893335	PQ892206	P.H. Chen 3728	Taiwan: Taitung County	TAIE
<i>Piper arcuatum</i> C. Presl		MH493109	MH476606			
<i>Piper arfakianum</i> C.DC.		MH493113	MH476607			
<i>Piper argyrites</i> Ridl. ex C.DC.		MH493122	MH476608			
<i>Piper argyrophyllum</i> Miq.		DQ868704				
<i>Piper attenuatum</i> Buch.-Ham. ex Miq.		MH128790				
<i>Piper austrocaledonicum</i> C.DC.		MH493124	MH476609			
<i>Piper baccatum</i> Blume		OM338975	OM414727			
<i>Piper bantamense</i> Blume		MH493151	MH476657			
<i>Piper bavinum</i> C.DC.		AF275199				
<i>Piper betle</i> L.	17	PQ893321	PQ892196	P.H. Chen 3712	Taiwan: Pingtung County	TAIE
<i>Piper betle</i> L.	18	PQ893322	PQ892197	P.H. Chen 2005	Taiwan: Taitung County	PPI
<i>Piper betle</i> L.	19	PQ893323	PQ892198	P.H. Chen 3713	Taiwan: Pingtung County	TAIE
<i>Piper betle</i> L.	25	PQ893333	PQ892204	P.H. Chen 3726	Taiwan: Taitung County	TAIE
<i>Piper betle</i> L.	32	PQ893340	PQ892211	C.Y. Ou 2301	Taiwan: Taitung County	TAIF
<i>Piper betle</i> L.		EF060065	MH476624			
<i>Piper blumei</i> (Miq.) Backer		MH493212	MH476672			
<i>Piper boehmeriifolium</i> (Miq.) Wall. ex C.DC.		KF924140				
<i>Piper bojonyum</i> C.DC.		MH493219	MH476623			

<i>Piper borneense</i> N.E. Br.	MH493229	MH476626
<i>Piper breviamentum</i> C.DC.	EU581134	
<i>Piper brevifolium</i> C.DC.	MH493232	MH476716
<i>Piper buruanum</i> Miq.	MH493235	MH476627
<i>Piper caducibracteum</i> C.DC.	MH493239	MH476638
<i>Piper caninum</i> Blume	EF060067	MH476633
<i>Piper capense</i> L. f.	AY326200	
<i>Piper celebicum</i> Blume	MH493279	MH476636
<i>Piper celtidiforme</i> Opiz	MH493283	MH476709
<i>Piper chaudocanum</i> C. DC. \$	EU581152	
<i>Piper chlorostachyum</i> C.DC.	MH493286	MH476715
<i>Piper cilibracteum</i> C.DC.	MH493306	MH476643
<i>Piper cubeba</i> L. f.	EF060070	MH476645
<i>Piper curtisii</i> C.DC.	MH493321	MH476646
<i>Piper cyrtostachys</i> Ridl.	MH493327	MH476647
<i>Piper decumanum</i> L.	AF275203	MH476648
<i>Piper dumiformans</i> C.DC.	MH493338	MH476723
<i>Piper excelsum</i> G. Forst.	DQ868716	
<i>Piper febrifugum</i> C.DC.	MH493344	MH476649
<i>Piper flaviflorum</i> C.DC.	MH493352	MH476650

<i>Piper flavimarginatum</i> C.DC.		MH493347	MH476735			
<i>Piper fragile</i> Benth.		MH493355	MH476654			
<i>Piper fragrans</i> Trel.		MH493381	MH476717			
<i>Piper galeatum</i> (Miq.) C.DC.		MH128775				
<i>Piper gibbilimum</i> C.DC.		MH493666	MH476596			
<i>Piper griffithii</i> C.DC.		EU581225				
<i>Piper guahamense</i> C.DC.		MZ308629				
<i>Piper guineense</i> Schumach. & Thonn.		MH493384	MH476656			
<i>Piper hancei</i> Maxim.		MZ602145	EU519602			
<i>Piper hancei</i> Maxim.		MZ636730				
<i>Piper hancei</i> Maxim.	28	PQ893336	PQ892207	Y.H. Cheng	China: Hong Kong	TNM
				2709		
<i>Piper hapnium</i> Buch.-Ham.		MH128773				
<i>Piper hooglandii</i> (I. Hutton & P.S. Green)		AF275192				
M.A. Jaram.						
<i>Piper hookeri</i> Miq.		MH128793				
<i>Piper hymenophyllum</i> Miq.		AY572327				
<i>Piper insectifugum</i> C.DC.		MZ308634				
<i>Piper interruptum</i> Opiz	23	PQ893326	PQ892202	P.H. Chen 3715	Taiwan: Taitung County	TAIE
<i>Piper kadsura</i> (Choisy) Ohwi	4	PQ893311	PQ892183	P.H. Chen 3698	Taiwan: Kaohsiung City	TAIE

<i>Piper kadsura</i> (Choisy) Ohwi	5	PQ893312	PQ892184	P.H. Chen 3704	Taiwan: Kaohsiung City	TAIE
<i>Piper kadsura</i> (Choisy) Ohwi	6	PQ893313	PQ892185	P.H. Chen 3664	Taiwan: Kaohsiung City	TAIE
<i>Piper kadsura</i> (Choisy) Ohwi	8	PQ893329	PQ892187	J.T. Chang s.n.	Japan: Kagoshima Prefecture	TAIE
<i>Piper kadsura</i> (Choisy) Ohwi	9	PQ893315	PQ892188	J.T. Chang s.n.	Japan: Kagoshima Prefecture	TAIE
<i>Piper kadsura</i> (Choisy) Ohwi	10	PQ893316	PQ892189	J.T. Chang s.n.	Japan: Kagoshima Prefecture	TAIE
<i>Piper kadsura</i> (Choisy) Ohwi	11	PQ893317	PQ892190	P.H. Chen 3708	Taiwan: Nantou County	TAIE
<i>Piper kadsura</i> (Choisy) Ohwi	14	PQ893320	PQ892193	P.H. Chen 3711	Taiwan: Taichung City	TAIE
<i>Piper kadsura</i> (Choisy) Ohwi	20	PQ893324	PQ892199	P.H. Chen 3714	Taiwan: Pingtung County	TAIE
<i>Piper kadsura</i> (Choisy) Ohwi	24	PQ893327	PQ892203	P.H. Chen 3716	Taiwan: Ilan County	TAIE
<i>Piper kadsura</i> (Choisy) Ohwi	29	PQ893337	PQ892208	T.C. Hsu 15077	Japan: Okinawa Prefecture	TAIF
<i>Piper kadsura</i> (Choisy) Ohwi	30	PQ893338	PQ892209	T.C. Hsu 15078	Japan: Okinawa Prefecture	TAIF
<i>Piper kadsura</i> (Choisy) Ohwi	33	PQ893341	PQ892212	S.H. Liu 2180	Taiwan: Miaoli County	TAIF
<i>Piper kadsura</i> (Choisy) Ohwi	35	PQ893343	PQ892214	M.T. Hsieh s.n.	Taiwan: Keelung City	TAIE
<i>Piper kadsura</i> (Choisy) Ohwi	36	PQ893344	PQ892215	M.T. Hsieh s.n.	Taiwan: Keelung City	TAIE
<i>Piper kadsura</i> (Choisy) Ohwi	37	PQ893345	PQ892216	C.Y. Ou 2404	Taiwan: Kaohsiung City	TAIF
<i>Piper kadsura</i> (Choisy) Ohwi	40	PQ893346	PQ892217	C.Y. Ou 2407	Taiwan: Kaohsiung City	TAIF
<i>Piper kadsura</i> (Choisy) Ohwi		EF450290	MH476658			

<i>Piper kawakamii</i> Hayata	12	PQ893318	PQ892191	P.H. Chen 3709	Taiwan: Kaohsiung City	TAIE
<i>Piper kawakamii</i> Hayata	13	PQ893319	PQ892192	P.H. Chen 3710	Taiwan: Kaohsiung City	TAIE
<i>Piper kurzii</i> Ridl.		MH493399	MH476659			
<i>Piper kwashoense</i> Hayata	21	PQ893325	PQ892200	P.H. Chen 2218	Taiwan: Taitung County	PPI
<i>Piper kwashoense</i> Hayata	26	PQ893334	PQ892205	P.H. Chen 3727	Taiwan: Taitung County	TAIE
<i>Piper laosanum</i> C.DC.		AY572326				
<i>Piper leptostachyum</i> Wall. ex Miq.		EU581275				
<i>Piper lessertianum</i> C.DC.		MH493408	MH476662			
<i>Piper lolot</i> C.DC.		AY326208				
<i>Piper longivaginans</i> C.DC.		EU581282				
<i>Piper macropiper</i> Pennant		MH493412	MH476664			
<i>Piper majusculum</i> Blume		MH493444	MH476670			
<i>Piper medinillifolium</i> Quisumb.		AY667455				
<i>Piper melchior</i> (Sykes) M.A. Jaram.		AF275191				
<i>Piper mestonii</i> F.M. Bailey		MH493447	MH476673			
<i>Piper methysticum</i> G. Forst.		MH493667	MH476595			
<i>Piper mollissimum</i> Blume		MH493454	MH476676			
<i>Piper montivagum</i> Ridl.		MH493670	MH476597			
<i>Piper mullesua</i> Buch.-Ham. ex D. Don		MH109310	AY032651			
<i>Piper muricatum</i> Blume		EF060076	MH476722			

<i>Piper myrmecophilum</i> C.DC.		AY572328				
<i>Piper nigrum</i> L.	7	PQ893314	PQ892186	P.H. Chen 3707	Taiwan: Kaohsiung City	TAIE
<i>Piper nigrum</i> L.		EF450283	LC637549			
<i>Piper nigrum</i> L.		MZ636719				
<i>Piper novoguineense</i> Warb.		MH493489	MH476713			
<i>Piper oreophilum</i> Ridl.		MH493496	MH476706			
<i>Piper pedicellatum</i> C.DC.		MG208073				
<i>Piper pedicellosum</i> Wall.		MH493501	MH476682			
<i>Piper pentandrum</i> C.DC.		MH493505	MH476731			
<i>Piper philodendron</i> Ridl.		MH493509	MH476683			
<i>Piper pierrei</i> C.DC.		AF275200				
<i>Piper polysyphonum</i> C.DC.		MG208065				
<i>Piper porphyrophyllum</i> N.E. Br.		MH493513	MH476684			
<i>Piper pseudonigrum</i> Velayudhan & Amalraj		MH128782				
<i>Piper puberulirameum</i> C.DC.		MH493526	MH476687			
<i>Piper pullibaccum</i> Trel.		MH493528	MH476660			
<i>Piper quinqueangulatum</i> Miq.		MH493531	MH476690			
<i>Piper ramipilum</i> C.DC.		MH493559	MH476694			

<i>Piper relictum</i> Lekhak, Kambale & S.R. Yadav		MH128783				
<i>Piper retrofractum</i> Vahl		AF275196	MH476695			
<i>Piper retrofractum</i> Vahl		EF060081				
<i>Piper rhytidocarpum</i> Hook. f.		MH128806				
<i>Piper ribesioides</i> Wall.		MH128803	MH476697			
<i>Piper rostratum</i> Roxb.		MH493577	MH476704			
<i>Piper rubro-venosum</i> Hort ex Rodigas		MH493582	MH476698			
<i>Piper sarcopodum</i> C.DC.		MH493587	MH476732			
<i>Piper sarmentosum</i> Roxb.	22	PQ893332	PQ892201	P.H. Chen 3090	Taiwan: Kaohsiung City	PPI
<i>Piper sarmentosum</i> Roxb.		KF924096	MH476702			
<i>Piper schizonephos</i> C.DC.		MH493598	MH476734			
<i>Piper sintenense</i> Hatus. *	2	PQ893328	PQ892181	P.H. Chen 3705	Taiwan: Kaohsiung City	TAIE
<i>Piper sintenense</i> Hatus. *	16	PQ893331	PQ892195	P.H. Chen 2021	Taiwan: Taitung County	PPI
<i>Piper subcaniramum</i> C.DC.		MH493602	MH476707			
<i>Piper sulcatum</i> Blume		MH493607	MH476708			
<i>Piper taiwanense</i> Lin & Lu	1	PQ893309	PQ892180	P.H. Chen 3699	Taiwan: Kaohsiung City	TAIE
<i>Piper taiwanense</i> Lin & Lu	3	PQ893310	PQ892182	P.H. Chen 3706	Taiwan: Kaohsiung City	TAIE
<i>Piper thomsonii</i> (C.DC.) Hook. f.		MG208068				
<i>Piper trichostachyon</i> (Miq.) C.DC.		MH128780				

<i>Piper truncatibaccum</i> C.DC.		MH493611	MH476710			
<i>Piper umbellatum</i> L.	31	PQ893339	PQ892210	P.H. Chen 3809	Taiwan: Kaohsiung City	TAIE
<i>Piper umbellatum</i> L.	34	PQ893342	PQ892213	S.H. Liu 2133	Taiwan: Pingtung County	TAIF
<i>Piper umbellatum</i> L.		EF060088	MW925711			
<i>Piper uncinulatum</i> Ridl.		MH493617	MH476711			
<i>Piper urdanetanum</i> C.DC.		AF275207				
<i>Piper versteegii</i> C.DC.		MH493619	MH476712			
<i>Piper wallichii</i> (Miq.) Hand.-Mazz.		EF450289	LC637552			
<i>Piper wightii</i> Miq.		MH128796	KJ635844.1			

Table S2. The universal primers, optimal annealing temperatures, and product sizes for the ITS and *trnL*-F regions in this study.

DNA regions	Primers	Primer Sequences (5' -->3')	Primer Sources	Annealing Temperature (°C)	Product Size (bp)
Nuclear region					
ITS (ITS1 + 5.8S + ITS2)	ITS_4	TCCTCCGCTTATTGATATGC	White et al. 1990	57	692-721
	ITS_5	GGAAGTAAAAGTCGTAACAAGG	White et al. 1990		
Chloroplast regions					
<i>trnL</i> -F (tRNA-Leu gene +	trnLF_c	CGAAATCGGTAGACGCTACG	Taberlet et al. 1991	60	907-946
intergenic spacer <i>trnL</i> - <i>trnF</i>)	trnLF_f	ATTTGAACTGGTGACACGAG	Taberlet et al. 1991		

Table S3. Additional *Piper arboricola*, *P. hancei*, and *P. kadsura* samples from GenBank were analyzed to explore the relationships among these three taxa within the complex. The scientific names, GenBank accession numbers, localities, submission years, relevant articles, submitting institutions, and voucher information of these additional samples are summarized below.

Taxon	GenBank accession #	Locality	Year	Relevant article	Submitter's institute	Voucher information
<i>Piper arboricola</i> C. DC.	AY572319	Viet Nam	2005	Direct Submission	Duke University, USA	MAJ 467
<i>Piper arboricola</i> C. DC.	JF491446	China	2011	Direct Submission	Fudan University, China	
<i>Piper hancei</i> Maxim.	EF450264	China	2008	Direct Submission	Fudan University, China	05120702 Y.Kang, Z.Chao (SHMU)
<i>Piper hancei</i> Maxim.	EF450265	China	2008	Direct Submission	Fudan University, China	05120703 Y.Kang, Z.Chao (SHMU)
<i>Piper hancei</i> Maxim.	EF450266	China	2008	Direct Submission	Fudan University, China	05120704 Y.Kang, Z.Chao (SHMU)
<i>Piper hancei</i> Maxim.	EF450267	China	2008	Direct Submission	Fudan University, China	06050901 Z.Y.Yang, W.B.Liu (SHMU)
<i>Piper hancei</i> Maxim.	EF450268	China	2008	Direct Submission	Fudan University, China	06050902 Z.Y.Yang, W.B.Liu (SHMU)
<i>Piper hancei</i> Maxim.	EF450269	China	2008	Direct Submission	Fudan University, China	06050903 Z.Y.Yang, W.B.Liu (SHMU)
<i>Piper hancei</i> Maxim.	EF450270	China	2008	Direct Submission	Fudan University, China	06050707 Z.Y.Yang, W.B.Liu (SHMU)
<i>Piper hancei</i> Maxim.	EF450271	China	2008	Direct Submission	Fudan University, China	06050708 Z.Y.Yang, W.B.Liu (SHMU)
<i>Piper hancei</i> Maxim.	EF450272	China	2008	Direct Submission	Fudan University, China	06110502 S.L.Pan, S.G.Ji (SHMU)
<i>Piper hancei</i> Maxim.	JF491444	China	2011	Direct Submission	Fudan University, China	
<i>Piper hancei</i> Maxim.	KF924137	China	2014	Direct Submission	Xinglong Tropical Botanical Garden, China	
<i>Piper hancei</i> Maxim.	HQ260457	China	2015	Direct Submission	Fudan University, China	
<i>Piper hancei</i> Maxim.	MZ636730	Viet Nam	2021	Direct Submission	Huế University, Viet Nam	
<i>Piper hancei</i> Maxim.	MZ636731	Viet Nam	2021	Direct Submission	Huế University, Viet Nam	

<i>Piper hancei</i> Maxim.	MZ602144	Viet Nam	2022	Direct Submission	Huế University, Viet Nam	
<i>Piper hancei</i> Maxim.	MZ602145	Viet Nam	2022	Direct Submission	Huế University, Viet Nam	
<i>Piper kadsura</i> (Choisy) Ohwi	DQ868724	Unknown	2008	Direct Submission	University of California, USA	
<i>Piper kadsura</i> (Choisy) Ohwi	EF450290	China	2008	Direct Submission	Fudan University, China	041001 S.L.Pan (SHMU)
<i>Piper kadsura</i> (Choisy) Ohwi	JF491439	China	2011	Direct Submission	Fudan University, China	
<i>Piper kadsura</i> (Choisy) Ohwi	KF924138	China	2014	Direct Submission	Xinglong Tropical Botanical Garden, China	
<i>Piper kadsura</i> (Choisy) Ohwi	MH493388	Japan	2018	Taxon 67 (4), 693-724 (2018)	University of Missouri St. Louis, USA	NT s.n.
<i>Piper kadsura</i> (Choisy) Ohwi	MH493389	Japan	2018	Taxon 67 (4), 693-724 (2018)	University of Missouri St. Louis, USA	NT s.n.
<i>Piper kadsura</i> (Choisy) Ohwi	MH493390	Japan	2018	Taxon 67 (4), 693-724 (2018)	University of Missouri St. Louis, USA	NT s.n.
<i>Piper kadsura</i> (Choisy) Ohwi	MH493391	Japan	2018	Taxon 67 (4), 693-724 (2018)	University of Missouri St. Louis, USA	NT s.n.
<i>Piper kadsura</i> (Choisy) Ohwi	MH493392	Japan	2018	Taxon 67 (4), 693-724 (2018)	University of Missouri St. Louis, USA	NT s.n.
<i>Piper kadsura</i> (Choisy) Ohwi	MH493393	Japan	2018	Taxon 67 (4), 693-724 (2018)	University of Missouri St. Louis, USA	NT s.n.
<i>Piper kadsura</i> (Choisy) Ohwi	OQ023331	China	2022	Direct Submission	Zhoushan Institute for Food and Drug control, China	
<i>Piper kadsura</i> (Choisy) Ohwi	OQ023332	China	2022	Direct Submission	Zhoushan Institute for Food and Drug control, China	
<i>Piper kadsura</i> (Choisy) Ohwi	OQ023333	China	2022	Direct Submission	Zhoushan Institute for Food and Drug control, China	
<i>Piper kadsura</i> (Choisy) Ohwi	OQ023334	China	2022	Direct Submission	Zhoushan Institute for Food and Drug control, China	
<i>Piper kadsura</i> (Choisy) Ohwi	OQ023335	China	2022	Direct Submission	Zhoushan Institute for Food and Drug control, China	
<i>Piper kadsura</i> (Choisy) Ohwi	OQ023336	China	2022	Direct Submission	Zhoushan Institute for Food and Drug control, China	
<i>Piper kadsura</i> (Choisy) Ohwi	OQ023337	China	2022	Direct Submission	Zhoushan Institute for Food and Drug control, China	
<i>Piper kadsura</i> (Choisy) Ohwi	OQ023338	China	2022	Direct Submission	Zhoushan Institute for Food and Drug control, China	

<i>Piper kadsura</i> (Choisy) Ohwi	OQ023340	China	2022	Direct Submission	Zhoushan Institute for Food and Drug control, China
<i>Piper kadsura</i> (Choisy) Ohwi	OQ023341	China	2022	Direct Submission	Zhoushan Institute for Food and Drug control, China
<i>Piper kadsura</i> (Choisy) Ohwi	OQ023342	China	2022	Direct Submission	Zhoushan Institute for Food and Drug control, China
<i>Piper kadsura</i> (Choisy) Ohwi	OQ023343	China	2022	Direct Submission	Zhoushan Institute for Food and Drug control, China
<i>Piper kadsura</i> (Choisy) Ohwi	OQ023344	China	2022	Direct Submission	Zhoushan Institute for Food and Drug control, China
<i>Piper kadsura</i> (Choisy) Ohwi	OQ023345	China	2022	Direct Submission	Zhoushan Institute for Food and Drug control, China
<i>Piper kadsura</i> (Choisy) Ohwi	OQ023346	China	2022	Direct Submission	Zhoushan Institute for Food and Drug control, China
<i>Piper kadsura</i> (Choisy) Ohwi	OQ023347	China	2022	Direct Submission	Zhoushan Institute for Food and Drug control, China

Table S4. The Shimodaira-Hasegawa (SH) and Kishino-Hasegawa (KH) tests indicate that (a) the *trnL*-F and ITS trees differ significantly in topology ($p < 0.05$), whereas (b) the Maximum likelihood (ML) and Bayesian inference (BI) trees do not show significant topological differences ($p > 0.05$).

(a)

	–lnL		KH test (<i>p</i>-value)	SH test (<i>p</i>-value)
<i>trnL</i> -F tree	11728.3365	(best tree)		
ITS tree	13900.0713		<0.0001*	0.0000*

(b)

	–lnL		KH test (<i>p</i>-value)	KH test (<i>p</i>-value)
ML tree	16509.35187	(best tree)		
BI tree	16511.47172		0.7057	0.3441

1 **Table S5.** (a) Morphological comparison between the descriptions of *Piper arboricola*, *P. kadsura*, *P. subglaucescens*, and *P. hancei*,
2 indicating their conspecificity.

3

	<i>P. arboricola</i> C.DC. (de Candolle 1920)	<i>P. subglaucescens</i> C.DC. (de Candolle 1920)	<i>P. kadsura</i> (Choisy) Ohwi (Ohwi 1965)	<i>P. kadsura</i> (Choisy) Ohwi (Lin and Lu 1996)	<i>P. hancei</i> Maximowicz (Tseng et al. 1999)	<i>P. kadsura</i> (Choisy) Ohwi (This study)
Leaf shape	oblong-ovate, elliptic-lanceolate, 10–16 × 5–7 cm	oblong-elliptic, elliptic-lanceolate to lanceolate, 6–6.9 × 1.9–3.3 cm	ovate, 5–8 × 3–4 cm	ovate to oblong, 4–15 × 1–8 cm	ovate-lanceolate or elliptic, 6–12 × 2.5–4.5 cm	oblong, ovate, elliptic, ovate-elliptic, ovate-lanceolate, 5–8 × 2.5–4 cm
Leaf at apex	acuminate	sharply attenuate	long-acuminate	acute	acute or acuminate	acute or acuminate
Leaf at base	rounded, acute and equilateral	equal-sided, acute	rounded	cordate, rounded, obliquely or equilaterally obtuse to acute	gradually tapered, cuneate or rounded	cordate, cuneate or obtuse
Upper leaf surface	glabrous	-	dark green	-	glabrous	glabrous or puberulous

Lower	sparsely hairy	-	palmer beneath, and	glabrous or	glabrous	glabrous or
leaf			often sparsely covered	puberulous		puberulous
surface			with soft hairs			
Infloresc	-	-	pendulous, 3-8 cm	erect	-	erect or pendulous
ences						
Male	ca. 4 cm	ca. 4.2 cm	-	3–12 cm	6–10 cm	4–10 cm
infloresce						
nce						
Stamens	2, rarely 3	2	-	-	2	2 or 3
Female	ca. 1.7 cm	ca. 2.5 cm	-	1–3.5 cm	ca. 3 cm	1.5–3.5 cm
infloresce						
nce						
Stigma	3	4	-	3-5	3-4	3-5
Fruits	ovate, glabrous	-	globose, 3–4 mm	globose, 3–4 mm	subglobose, 2.5–3 mm	globose, ca. 4 mm

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6 **Table S5.** (b) Morphological comparison among the descriptions of *P. insectifugum*, *P. kwashoense*, and *P. philippinum*, indicating
7 their distinctness.

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	<i>P. philippinum</i> Miq. (Miquel 1843)	<i>P. insectifugum</i> C.DC. (de Candolle 1869)	<i>P. kwashoense</i> Hayata = <i>P. lanyuense</i> K.N. Kung & Kun C. Chang (Chang and Kung 2020)	<i>P. kwashoense</i> Hayata (This study)
Petiole	1-1.5 cm	1.6 cm, very finely pubescent	1–4 cm, glabrous	1–4 cm, glabrous
Lamina	membranous	membranous	chartaceous, coriaceous	coriaceous
Leaf shape	elliptical, ovate, slightly obovate-elliptical, 10–10.5 × 3.5–4.5 cm, glabrous	round-ovate, 11.5 × 10 cm	ovate to cordate, 6–12 × 5– 10 cm, glabrous	ovate-cordate, cordate, 10– 15 × 8–12 cm, glabrous
Leaf at base	slightly unevenly rounded or rarely somewhat acute	equally rounded or somewhat truncate	cordate or truncate	cordate, rounded or truncate
Vein	5	9	5–7	5–9, when 9 veins, the

				outermost pair
				inconspicuous
Inflorescence	flexible (pendulous?)	erect	erect	erect
Male	-	shorter than the leaves	4–10 cm	6–12 cm
inflorescence				
Female	10–12 cm	3–9 cm	3–7 cm	3–6 cm
inflorescence				
Fruits	Ovoid, 4–5 mm	subglobose, 2–3 mm	subglobose, red, 4–5 mm	subglobose, red, 4–5 mm

10 **Table S5.** (c) Morphological comparison between the descriptions of *P. laosanum* and *P. sintenense*, indicating their conspecificity.

11

	<i>P. sintenense</i> Hatusima	<i>P. laosanum</i> C.DC.	<i>P. laosanum</i> C.DC.
	(Hatusima 1935; Lin and Lu 1996)	(Suwanphakdee et al. 2023)	(This study)
Petiole	0.5–1 cm long, pilose or velutinous	0.2–1.5 cm long, pilose, hispid or puberulous	0.5–2 cm long, densely to sparsely hispid
Lamina	thin-chartaceous	chartaceous	chartaceous
Leaf shape	ovate-oblong, 5-14 cm × 1.8–6.5 cm	elliptic, ovate-subovate, lanceolate 6.6–12× 3.8–7 cm	ovate, lanceolate, ovate-lanceolate, 5–10 × 2–5 cm
Leaf at base	obliquely cordate, rounded or obtuse	oblique or slightly oblique	cordate, rounded or obtuse, slightly oblique
Upper leaf surface	hairy	hispid or pilose	densely to sparsely hispid
Lower leaf surface	hairy	puberulous or glabrous	densely to sparsely hispid
Inflorescence	pendulous	pendulous	pendulous
Male inflorescence	6–16 cm	5–16 cm	5–15 cm
Stamens	3	3–5	3–5

Female	5–6 cm	4–7 cm	4–6 cm
inflorescence			
Stigma	4 or 5, rarely 3	3–5 lobed	3–5 lobed

12

13

14 **Table S5.** (d) Morphological comparison between the descriptions of *P. kotoense* and *P. macropiper*, indicating their conspecificity.

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	<i>P. macropiper</i> Pennant (Quisumbing 1930)	<i>P. arborescens</i> Roxb. = <i>P. kotoense</i> Yamam. (Yamamoto 1932)	<i>P. macropiper</i> Pennant (This study)
Lamina	chartaceous	membranous to chartaceous	chartaceous
Leaf shape	lanceolate, 8–11 × 2–3.5 cm, glabrous	ovate-lanceolate or ovate, 9–13 × 3–6 cm, glabrous	ovate-lanceolate, ovate-elliptic or ovate, 8–12 × 3–5 cm, glabrous
Vein	5	5	5-7, when 7 veins, the outermost pair inconspicuous
Stigma	3	3	3
Fruits	fusiform, 3–4 mm in diameter	oblong, 1.5 mm long and 0.7 mm in diameter	sub-globose, 1–1.5 mm in diameter

16

17

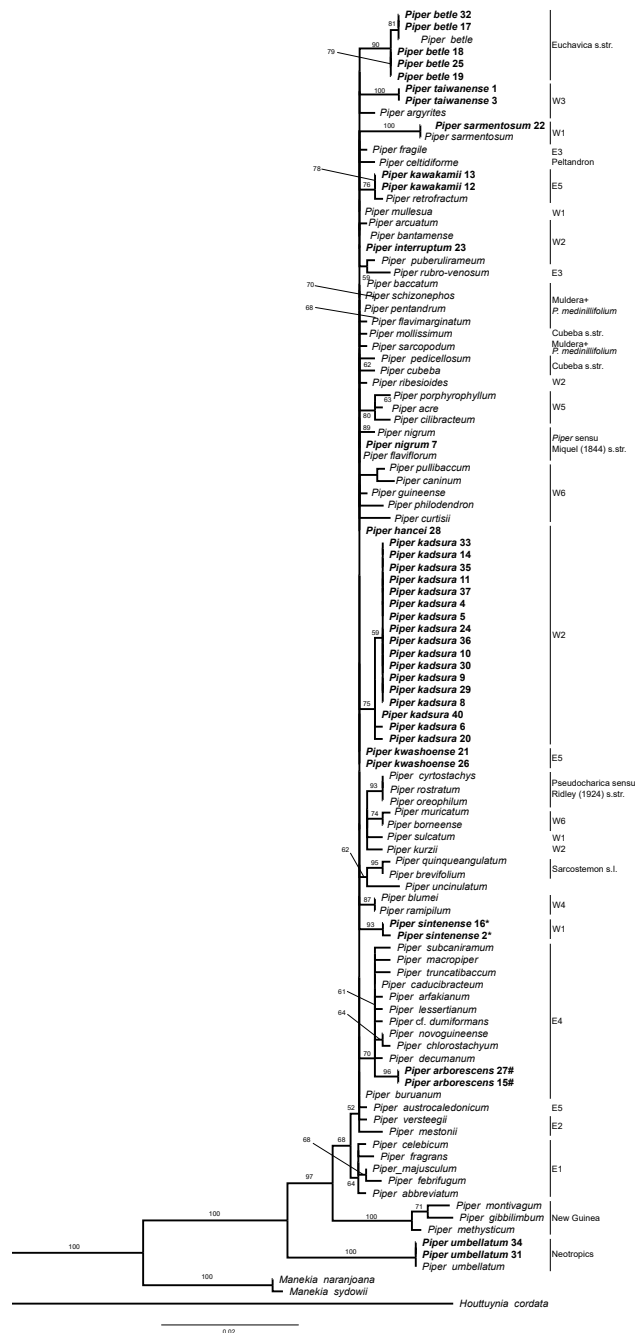


Fig. S1. Maximum likelihood tree based on *trnL-F* region. Vertical lines at the right denote the Asian clades. Numbers following scientific names correspond to the sample numbers listed in Table S1. Taxa marked with asterisks (*) and number signs (#) represent synonyms of *Piper laosanum* and *P. macropiper*, respectively. Bootstrap support values (>50%) are indicated at the corresponding branches. Newly generated sequences are shown in bold.



Fig. S2. Maximum likelihood tree based on the ITS region. Vertical lines at the right denote the Asian clades. Numbers following scientific names correspond to the sample numbers listed in Table S1. Taxa marked with asterisks (*) and number signs (#) represent synonyms of *Piper laos anum* and *P. macropiper*, respectively. Bootstrap support values (>50%) are indicated at the corresponding branches. Newly generated sequences are shown in bold. The crowns of clades W1–W6 and E1–E5 are labeled.