SUPPLEMENTARY DATA

TABLE S1. Primers used for gene cloning in this study

Gene classification	Primer name	Sequences	Gene name (sequenced clone no.)
B-class MADS-box genes	B1	5’- AACAGGCAGGTSACCTAYTC - 3’	*SIchAP3-1* (14), *SIchAP3-2* (5), *SIchAP3-3* (15), *SIchPI* (28)
	B2	5’- TYACTGTTCTMTGTGATGCT - 3’	*DEinAP3-1* (18), *DEinAP3-2* (6), *DEinPI* (38) *HOgrAP3* (44), *HOgrPI* (25)
C-class MADS-box genes	L2	5’- CARGTSACCTTYTGCAARCG - 3’	*SIchAG* (2)
	L5	5’- TCYGTKCTYTGTGATGCWG - 3’	*DEinAG* (2) *HOgrAG1* (3), *HOgrAG2* (3)
E-class MADS-box genes	SEP1	5’ - GAGAACAARATHAACAGGCARG - 3’	*SIchSEP3* (22)
	SEP2	5’ - AGGTTGCTCTMATMATYTTC - 3’	

TABLE S2. Primers used for *in situ* hybridization and RT-PCR in this study

	Gene	Forward primer (5'-3')	Reverse primer (5'-3')
In situ hybridization	*SIchFL1*	TCTGATCTCCAAAGAAAGG	GACATGGTAGAAGAGTCTCC
	SIchFL2	GAGCAGAATAACCAGCTAGG	CCTTCCCATGTCTATTACGC
	SIchAP3-1	TGCGTGGTCTTGAGCAAGAA	CGATGATGGAATGTTAGAGGG
	SIchAP3-2	GGATGAGCCTCAATTCGCAC	CTACTGACCAGGGAAAGTCTG
	SIchAP3-3	TGAGCAAGAAATGGAGAGT	TGAAGATTGGGTTGAGC
	SIchPI	GAAATGGATGGGAATGTGCGA	TATGGCAACCTACGTACAAGC
	SIchAG	ACTCAAACAGGCACTTCA	ACATCGTATTCATTTCCCG
	SIchSEP3	GTGAACTATGGTCGACAGCA	CTCGCACACAAACAAGGATCG
RT-PCR	*SIchAP3-1*	CGGTATCAGCAAACTCTAGG	TTCTTCCTTCCTGAACCAG
	SIchAP3-2	GGCAGAGGATTGGTGGAGATG	GTGCCAAATCCACTTCCATTC
	SIchAP3-3	TCAACAACAACGAAGAGGT	TAGTACCTTCCGTTATCTGC
	SIchPI	AGAGGTTGTGGGATGCTAAGC	GGTAAACGGCATCTGATGAG
	SIchAG	CTCGAAATTGCGCCAACTG	GTTCCGAGAGTCAAATGGTGC

TABLE S3. Representative floral MADS-box genes used in the phylogenetic analysis

Gene classification	Order	Family	Species	Gene name	Accession No.
A-class MADS-box genes	Poales	Poaceae	*Oryza sativa*	*OsMADS14*	AF058697
				OsMADS15	AF058698
	Ranunculales	Eupteleaceae	*Euptelea pleiospermum*	*EUplFL1*	DQ656558
				EUplFL2	DQ656559
		Lardizabalaceae	*Akebia trifoliata*	*AktFL1*	AY627632
				AktFL2	GU357459
			Decaisnea insignis	*DEinFL1*	DQ656556
				DEinFL2	DQ656557
			Sinofranchetia chinensis	*SIchFL1*	DQ656565
				SIchFL2	DQ656566
	Buxales	Buxaceae	*Pachysandra terminalis*	*PAteFL1*	DQ656553
				PatFL2	AY306165
				PAteFL3	DQ656562
	Brassicales	Brassicaceae	*Arabidopsis thaliana*	*AP1*	NM-105581
				CAL	NM-102395
				FUL	NM-125484
				AGL79	NM-113925
	Lamiales	Plantaginaceae	*Antirrhinum majus*	*SQUA*	X63701
	Solanales	Solanaceae	*Petunia x hybrida*	*FBP29*	AF335245
				PFG	AF176782
				FBP26	AF176783
	Asterales	Asteraceae	*Chrysanthemum x morifolium*	*CDM111*	AY173054
				CDM41	AY173055
				CDM8	AY173056
B-class MADS-box genes	Poales	Poaceae	*Oryza sativa*	*SPW1*	AF424549
				OsMADS4	L37527
	Rununculales	Eupteleaceae	*Euptelea pleiospermum*	*EUplAP3-1*	GU357449
				EUplAP3-2	GU357450
				EUplPI	GU357451
		Lardizabalaceae	*Akebia trifoliata*	*AktAP3-1*	AY627630
				AktAP3-2	AY627631
				AktAP3-3	DQ303124
				AktPI	AY627634
			Decaisnea insignis	*DEinAP3-1*	JQ806400
				DEinAP3-2	JQ806401
				DEinPI	JQ806402
			Holboellia grandiflora	*HOgrAP3*	JQ806404
				HOgrPI	JQ806405
			Sinofranchetia chinensis	*SIchAP3-1*	JQ806394
				SIchAP3-2	JQ806395
				SIchAP3-3	JQ806396
				SIchPI	JQ806397
	Buxales	Buxaceae	*Pachysandra terminalis*	*PAteAP3-1*	GU357454

				PAteAP3-2	GU357462
				PAtePI	GU357455
	Brassicales	Brassicaceae	*Arabidopsis thaliana*	*AP3*	M86357
				PI	D30807
	Lamiales	Plantaginaceae	*Antirrhinum majus*	*DEF*	X62810
	Solanales	Solanaceae	*Petunia x hybrida*	*phDEF*	X69946
				phTM6	AF230704
				FBP1	AY532265
				pMADS2	X69947
	Asterales	Asteraceae	*Chrysanthemum x morifolium*	*CDM115*	AY173060
				CDM19	AY173064
				CDM86	AY173061
C-class	Asparagales	Agapanthaceae	*Agapanthus praecox*	*ApMADS2*	AB079260
MADS-box	Poales	Poaceae	*Oryza sativa*	*OsMADS3*	L37528
genes				*OsMADS13*	AF151693
	Ranunculales	Eupteleaceae	*Euptelea pleiospermum*	*EUplAG1*	GU357452
				EUplAG2	GU357453
		Lardizabalaceae	*Akebia trifoliata*	*AktAG1*	AY627635
				AktAG2	AY627629
			Decaisnea insignis	*DEinAG*	JQ806403
			Holboellia grandiflora	*HOgrAG1*	JQ806406
				HOgrAG2	JQ806407
			Sinofranchetia chinensis	*SIchAG*	JQ806398
	Buxales	Buxaceae	*Pachysandra terminalis*	*PAteAG*	GU357456
	Brassicales	Brassicaceae	*Arabidopsis thaliana*	*AG*	NM-118013
				SHP1	NM-115740
				SHP2	NM-129844
				STK	NM-117064
	Lamiales	Plantaginaceae	*Antirrhinum majus*	*FAR*	AJ239057
				PLE	S53900
	Solanales	Solanaceae	*Petunia x hybrida*	*pMADS3*	X72912
				FBP6	X68675
				FBP11	X81852
				FBP7	X81651
	Asterales	Asteraceae	*Chrysanthemum x morifolium*	*CDM37*	AY173059
E-class	Asparagales	Asparagaceae	*Asparagus officinalis*	*AOM1*	AY382400
MADS-box				*AOMADS2*	DQ344503
genes				*AOMADS3*	DQ344504
	Poales	Poaceae	*Oryza sativa*	*OsMADS7*	U78891
				OsMADS8	U78892
				OsMADS1	L34271
				OsMADS5	U78890
	Ranunculales	Eupteleaceae	*Euptelea pleiospermum*	*EUplSEP3*	GU357460
				EUplSEP1	GU357461
		Lardizabalaceae	*Akebia trifoliata*	*AktSEP3*	AY627628
				AktSEP1-1	GU357447
				AktSEP1-2	GU357448

			Sinofranchetia chinensis	*SIchSEP3*	JQ806399
	Buxales	Buxaceae	*Pachysandra terminalis*	*PAteSEP3-1*	GU357457
				PAteSEP3-2	GU357458
	Brassicales	Brassicaceae	*Arabidopsis thaliana*	*SEP3*	NM-102272
				SEP1	NM-121585
				SEP2	NM-111098
				SEP4	NM-126418
	Lamiales	Plantaginaceae	*Antirrhinum majus*	*DEFH200*	X95469
				DEFH72	X95468
				DEFH49	X95467
	Solanales	Solanaceae	*Petunia x hybrida*	*FBP2*	M91666
				pMADS12	AY370527
				FBP9	AF335236
				FBP5	AF335235
				FBP4	AF335234
				FBP23	AF335241
	Asterales	Asteraceae	*Chrysanthemum x morifolium*	*CDM44*	AY173057
Outgroup	Brassicales	Brassicaceae	*Arabidopsis thaliana*	*SVP*	NM-127820

TABLE S4. Genes used in the phylogenetic analysis of *AP3*-like genes in Ranunculales

Order	Family	Species	Gene name	Accession No.
Ranunculales	Ranunculaceae	*Aconitum sinomontanum*	*AcsAP3-1*	EU481818
			AcsAP3-2	EU481817
			AcsAP3-3	EU481816
		Actaea asiatica	*AcaAP3-1*	HQ647375
			AcaAP3-2	HQ647376
		Adonis vernalis	*AdvAP3-2*	HQ694800
			AdvAP3-3	HQ694799
		Anemone nemorosa	*AnnAP3-1*	AY162841
			AnnAP3-2	AY162842
			AnnAP3-3	AY162843
		Aquilegia alpina	*AqaAP3-1*	AY162849
			AqaAP3-2	AY162850
			AqaAP3-3	AY162851
		Caltha palustris	*CapAP3-1*	EU481813
			CapAP3-2	EU481812
		Cimicifuga racemosa	*CirAP3-1*	AY162862
			CirAP3-2	AY162863
			CirAP3-3	AY162864
		Clematis alpina	*ClaAP3-1*	EU481808
			ClaAP3-2	EU481807
			ClaAP3-3	EU481806
		Clematis integrifolia	*CliAP3-1*	AY162870
			CliAP3-2	AY162871
		Delphinium exaltatum	*DleAP3-1*	EU481804
			DleAP3-2	EU481803
			DleAP3-3	EU481802
		Helleborus hydrida	*HhAP3-1*	Sharma *et al*., 2011
			HhAP3-2	Sharma *et al*., 2011
			HhAP3-3a	Sharma *et al*., 2011
			HhAP3-3b	Sharma *et al*., 2011
		Hepatica henryi	*HeheAP3-1*	HQ647378
			HeheAP3-2	HQ647379
		Hydrastis canadensis	*HycAP3-1*	EU481800
		Nigella sativa	*NgsAP3-2*	HQ694795
			NgsAP3-3	HQ694794
		Ranunculus bulbosus	*RbAP3-1*	AF052876
			RbAP3-2	AF130869
		Ranunculus ficaria	*RfAP3-1*	AF052854
			RfAP3-2	AF130870
			RfAP3-3	AY162883
		Thalictrum dioicum	*ThdAP3-1*	AY867875
			ThdAP3-2a	AY867876
			ThdAP3-2b	AY867877
		Thalictrum thalictroides	*ThtAP3-1*	AY162886

			ThtAP3-2a	AY162887
			ThtAP3-2b	AY162888
		Trautvetteria caroliniensis	*TrcAP3*	AY162904
		Trollius laxus	*TllAP3-1*	AY162890
			TllAP3-2	AY162892
			TllAP3-3	AY162894
		Xanthorhiza simplicissima	*XsAP3-2*	EU481797
			XsAP3-3	EU481796
	Berberidaceae	*Berberis gilgiana*	*BgAP3-1*	AY162857
			BgAP3-2	AY162858
		Epimedium grandiflorum	*EpgAP3-1*	EU481793
			EpgAP3-3	EU481794
		Jeffersonia diphylla	*JdAP3-1*	EU481791
	Circaeasteraceae	*Kingdonia uniflora*	*KiuAP3a*	HQ647371
			KiuAP3b	HQ647372
	Menispermaceae	*Cocculus trilobus*	*CctAP3-1*	HQ694788
			CctAP3-2	HQ694789
			CctAP3-3	HQ694790
		Menispermum dauricum	*MndAP3-1*	EU481786
			MndAP3-2	EU481784
			MndAP3-3	EU481783
	Lardizabalaceae	*Akebia quinata*	*AkqAP3-1*	AY162835
			AkqAP3-2	AY162839
		Decaisnea insignis	*DEinAP3-1*	JQ806400
			DEinAP3-2	JQ806401
		Holboellia coriacea	*HbcAP3-1*	EU481789
			HbcAP3-2	EU481788
		Holboellia grandiflora	*HOgrAP3*	JQ806404
		Sinofranchetia chinensis	*SIchAP3-1*	JQ806394
			SIchAP3-2	JQ806395
			SIchAP3-3	JQ806396
	Papaveraceae	*Eschscholzia californica*	*EcDEF1*	EF378697
			EcDEF2	EF378698
		Papaver nudicaule	*PnAP3-1*	AF052873
			PnAP3-2	AF052874
		Sanguinaria canadensis	*ScAP3*	AF130868
	Fumariaceae	*Dicentra eximia*	*DeAP3*	AF052875
	Eupteleaceae	*Euptelea pleiosperma*	*EupAP3-1*	GU357449
Buxales	Buxaceae	*Pachysandra procumbens*	*PpAP3-1*	DQ479360
			PpAP3-2	DQ479361
			PpAP3-3	DQ479362
Proteales	Nelumbonaceae	*Nelumbo nucifera*	*NnAP3*	DQ453775
Sabiaceae	Sabiaceae	*Meliosma dilleniifolia*	*MdAP3-1*	AY436709
			MdAP3-2	AY436710
			MdAP3-3	AY436711
	Platanaceae	*Platanus occidentalis*	*PloAP3-1*	AAO26529
Trochodendrales	Trochodendraceae	*Trochodendron aralioides*	*TraAP3*	DQ453774

TABLE S5. Genes used in the phylogenetic analysis of *PI*-like genes in Ranunculales

Order	Family	Species	Gene name	Accession No.
Ranunculales	Ranunculaceae	*Aconitum sinomontanum*	*AcsPI*	EU481819
		Actaea asiatica	*AcaPI*	HQ647377
		Adonis vernalis	*AdvPI-1*	HQ694801
			AdvPI-2	HQ694802
		Anemone nemorosa	*AnnPI-1*	AY162845
			AnnPI-2	AY162847
		Aquilegia alpina	*AqaPI*	AY162852
		Cimicifuga racemosa	*CirPI-1*	AY162865
			CirPI-2	AY162867
		Clematis integrifolia	*CliPI-1*	AY162872
			CliPI-2	AY162873
		Caltha palustris	*CapPI*	EU481814
		Clematis alpina	*ClaPI-1*	EU481811
			ClaPI-2	EU481810
		Delphinium exaltatum	*DlePI*	EU481805
		Helleborus hydrida	*HhPI1*	Sharma *et al*., 2011
			HhPI2	Sharma *et al*., 2011
			HhPI3	Sharma *et al*., 2011
		Hepatica henryi	*HehePI*	HQ647380
		Hydrastis canadensis	*HycPI*	EU481801
		Nigella sativa	*NgsPI-1*	HQ694797
			NgsPI-2	HQ694796
		Ranunculus bulbosus	*RbPI-1*	AF052859
			RbPI-2	AF052860
		Ranunculus ficaria	*RfPI-1*	AF052858
			RfPI-1b	AY162884
			RfPI-2	AF130872
			RfPI-3	AY162885
		Thalictrum thalictroides	*ThtPI-1*	AY162889
		Trautvetteria caroliniensis	*TrcPI-1*	AY162905
			TrcPI-2	AY162906
		Trollius laxus	*TllPI-1*	AY162896
			TllPI-2	AY162898
			TllPI-3	AY162900
			TllPI-4	AY162902
		Xanthorhiza simplicissima	*XsPI-1*	EU481799
			XsPI-2	EU481798
	Berberidaceae	*Berberis gilgiana*	*BgPI-1*	AY162860
			BgPI-2	AY162861
		Epimedium grandiflorum	*EpgPI*	EU481795
		Jeffersonia diphylla	*JdPI*	EU481792
		Nandina domestica	*NndPI*	HQ694793
		Podophyllum peltatum	*PdcPI*	HQ694792
	Circaeasteraceae	*Circaeaster agrestis*	*CiaPI*	HQ647374

	Kingdonia uniflora	*KiuPI*	HQ647373
Menispermaceae	*Menispermum dauricum*	*MndPI*	EU481787
	Cocculus trilobus	*CctPI*	HQ694791
Lardizabalaceae	*Akebia trifoliata*	*AktPI*	AY627634
	Akebia quinata	*AkqPI*	AY162837
	Decaisnea insignis	*DEinPI*	JQ806402
	Holboellia coriacea	*HbcPI*	EU481790
	Holboellia grandiflora	*HOgrPI*	JQ806405
	Sinofranchetia chinensis	*SIchPI*	JQ806397
Papaveraceae	*Eschscholzia californica*	*EcGLO*	EF378699
	Papaver nudicaule	*PnPI-1*	AF052855
		PnPI-1	AF052856
	Sanguinaria canadensis	*ScPI*	AF130871
Fumariaceae	*Dicentra eximia*	*DePI*	AF052857
Eupteleaceae	*Euptelea pleiosperma*	*EupPI*	GU357451

FIG. S1. Multiple sequence alignment for AP3-like proteins of representative species from Ranunculales. The conserved MADS domain and K domain are highlighted by a solid line and a dashed line, respectively. The PI-motif-derived and paleoAP3 motifs are indicated with boxes.

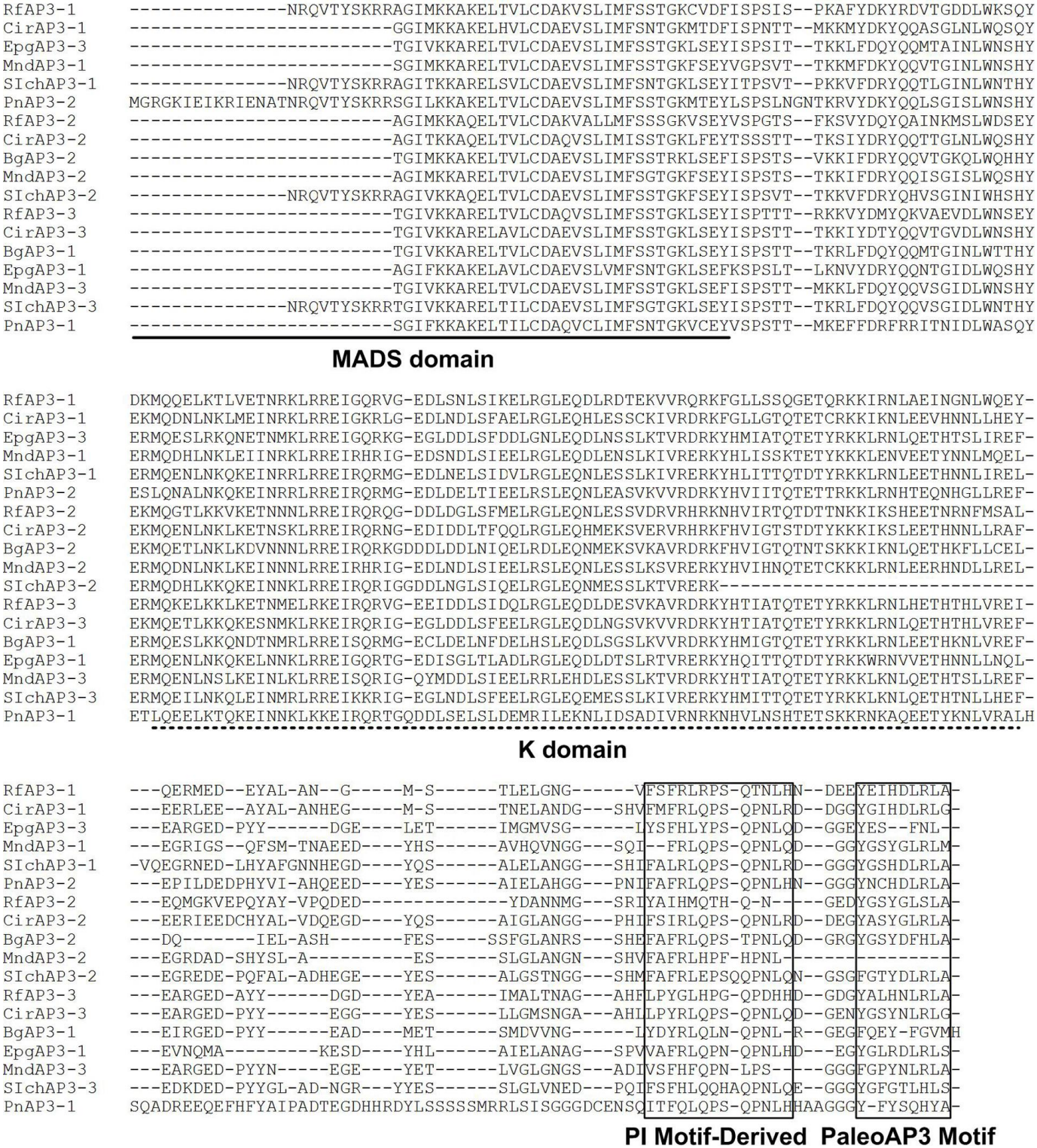

FIG. S2. Maximum-likelihood tree of *PI*-like genes in Ranunculales. Bootstrap values (>50%) are shown above the branches. The inferred small-scale gene duplication events are indicated with dots.