

## Supplemental Tables

*Table S1. Reproducibility of PIN3, PIN4, and PIN7 Expression Features.*

Figure	Panel	No. leaves with displayed features /		Assessed expression features
		no. analyzed leaves	no. leaves with displayed features /	
3	A	21/27	14/21	Abaxial epidermis, stronger in upper third of primordium; inner cells on abaxial side of primordium, stronger in its lower third
3	B	14/18	14/14	Marginal epidermis, stronger in top half of primordium; top and bottom of midvein; in and around top half of first loops
2	C	14/17	14/14	Marginal epidermis, stronger in top three-quarters of primordium; whole midvein, stronger at its top and bottom; inner cells in top three-quarters of primordium, stronger in and around first loops
2	D	13/15	13/13	Marginal epidermis, strong throughout; whole midvein, stronger at its top and bottom; inner cells of whole lamina, stronger in and around loops and minor veins
2	E	14/16	14/14	Adaxial and abaxial epidermis, stronger at top of primordium; lower third of midvein and very few inner cells scattered across primordium
2	F	12/15	12/12	Marginal epidermis, stronger at top of primordium; lower third of midvein and very few inner

2	G	13/16	cells scattered across the primordium
2	H	24/26	Marginal epidermis, stronger at top and bottom of primordium; whole midvein and small groups of inner cells scattered across primordium
2	I	15/16	Marginal epidermis, strong throughout; whole midvein, in and around loops, and large groups of inner cells scattered across lamina
2	J	15/18	Abaxial epidermis and inner cells on abaxial side of primordium
2	K	13/14	Bottom half of midvein, stronger in its lower third
2	L	15/16	Marginal epidermis, stronger in top half of primordium; whole midvein, stronger at its top and bottom; in and around first loops, stronger in their top half
			Marginal epidermis, stronger in top three-quarters of lamina; whole midvein, stronger at its top and bottom; inner cells of whole lamina, stronger in and around loops and minor veins

**Table S2. Origin and Nature of Lines**

<i>Line</i>	<i>Origin/Nature</i>
PIN <sub>1</sub> ::gPIN <sub>1</sub> :YFP	(Xu et al., 2006); YFP insertion after +651 of <i>PIN<sub>1</sub></i> (AT1G73590)
PIN <sub>1</sub> ::nYFP	Transcriptional fusion of <i>PIN<sub>1</sub></i> (-4,171 to -1; primers: “PIN <sub>1</sub> transc 4171 forw” and “PIN <sub>1</sub> transc rev”) to HTA6:EYFP (Zhang et al., 2005)
PIN <sub>1</sub> ::gPIN <sub>1</sub> :CFP	(Gordon et al., 2007); CFP insertion after +651 of <i>PIN<sub>1</sub></i>
<i>pin<sub>1</sub>-051</i>	NASC; GK-051A10-012139 (Kleinboelting et al., 2012); contains a T-DNA insertion after +2234 of <i>PIN<sub>1</sub></i>
PIN <sub>1</sub> ::gPIN <sub>1</sub> :GFP	(Xu et al., 2006)
ATML <sub>1</sub> ::cPIN <sub>1</sub> :GFP	Transcriptional fusion of <i>ATML<sub>1</sub></i> (AT4G21750; -5,016 to -1,597; primers “XhoI ATML <sub>1</sub> p F” and “BamHI ATML <sub>1</sub> p R”) to translational fusion of <i>PIN<sub>1</sub></i> cDNA (GenBank accession no. AY093960; ABRC clone no. U12338; primers “BamHI PIN <sub>1</sub> cDNA F” and “KpnI PIN <sub>1</sub> cDNA R”) to EGFP (Clontech; insertion after +651 of <i>PIN<sub>1</sub></i> ; primers “XhoI GFP no ATG Fwd” and “XhoI GFP no* Rev”)
PIN <sub>1</sub> ::cPIN <sub>1</sub> :GFP	Transcriptional fusion of <i>PIN<sub>1</sub></i> (-4,168 to -14; primers “XhoI full length PIN <sub>1</sub> p F” and “BamHI PIN <sub>1</sub> p rev”) to translational fusion of <i>PIN<sub>1</sub></i> cDNA (GenBank accession no. AY093960; ABRC clone no. U12338; primers “BamHI PIN <sub>1</sub> cDNA F” and “KpnI PIN <sub>1</sub> cDNA R”) to EGFP (Clontech; insertion after +651 of <i>PIN<sub>1</sub></i> ; primers “XhoI GFP no ATG Fwd” and “XhoI GFP no* Rev”)
SHR::cPIN <sub>1</sub> :GFP	Transcriptional fusion of <i>SHR</i> (AT4G37650; -2505 to -16; primers “SHR prom SalI Forw2” and “SHR prom BamHI Rev”) to translational fusion of <i>PIN<sub>1</sub></i> cDNA (GenBank accession no. AY093960; ABRC clone no. U12338; primers “BamHI PIN <sub>1</sub> cDNA F” and “KpnI PIN <sub>1</sub> cDNA R”) to EGFP (Clontech; insertion after +651 of <i>PIN<sub>1</sub></i> ; primers “XhoI GFP no ATG Fwd” and “XhoI GFP no* Rev”)
SCL <sub>32</sub> ::cPIN <sub>1</sub> :GFP	Transcriptional fusion of <i>SCL<sub>32</sub></i> (AT3G49950; -2888 to -2; primers “SCL <sub>32</sub> Translational FWD” and “SCL <sub>32</sub> prom BamHI Rev”) to translational fusion of <i>PIN<sub>1</sub></i> cDNA (GenBank accession no. AY093960; ABRC clone no. U12338; primers “BamHI PIN <sub>1</sub> cDNA

	F” and “KpnI PIN1 cDNA R”) to EGFP (Clontech; insertion after +651 of <i>PIN1</i> ; primers “XhoI GFP no ATG Fwd” and “XhoI GFP no* Rev”)
PIN3::gPIN3::YFP	ABRC; (Zhou et al., 2011)
PIN4::gPIN4::YFP	ABRC; (Zhou et al., 2011)
PIN7::gPIN7::YFP	ABRC; (Zhou et al., 2011)
<i>pin1-1</i>	ABRC; WT at the <i>TTG1</i> (ATG24520) locus (Goto N, 1987; Galweiler et al., 1998; Sawchuk et al., 2013)
<i>pin3-3</i>	(Friml et al., 2002b)
<i>pin4-2</i>	(Friml et al., 2002a)
<i>pin7En</i>	(Blilou et al., 2005)

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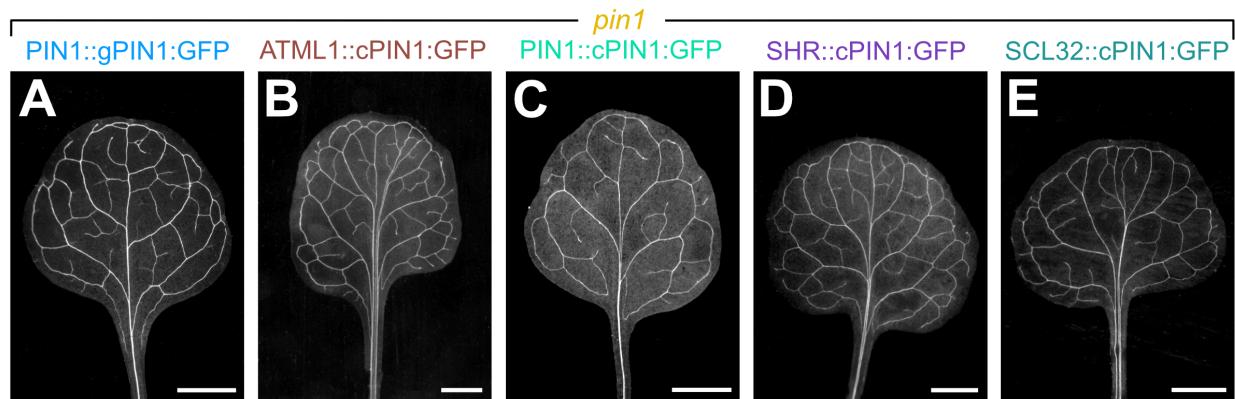
Table S3. Genotyping Strategies

Line	Strategy
<i>pin1-051</i>	<i>PIN1</i> : “ <i>pin1 GK LP</i> ” and “ <i>pin1 GK RP</i> ”; <i>pin1</i> : “ <i>pin1 GK RP</i> ” and “ <i>o8409</i> ”
<i>pin1-1</i>	“ <i>pin1-1 F</i> ” and “ <i>pin1-1 R</i> ”; <i>TatI</i>
<i>pin3-3</i>	“ <i>pin3-3 F</i> ” and “ <i>pin3-3 R</i> ”; <i>StyI</i>
<i>pin4-2</i>	<i>PIN4</i> : “ <i>PIN4 forw geno II</i> ” and “ <i>PIN4en rev Ikram</i> ”; <i>pin4</i> : “ <i>PIN4en rev Ikram</i> ” and “ <i>en primer</i> ”
<i>pin7En</i>	<i>PIN7</i> : “ <i>PIN7en forw Ikram</i> ” and “ <i>PIN7en rev</i> ”; <i>pin7</i> : “ <i>PIN7en rev Ikram II</i> ” and “ <i>en primer</i> ”

*Table S4. Oligonucleotide Sequences*

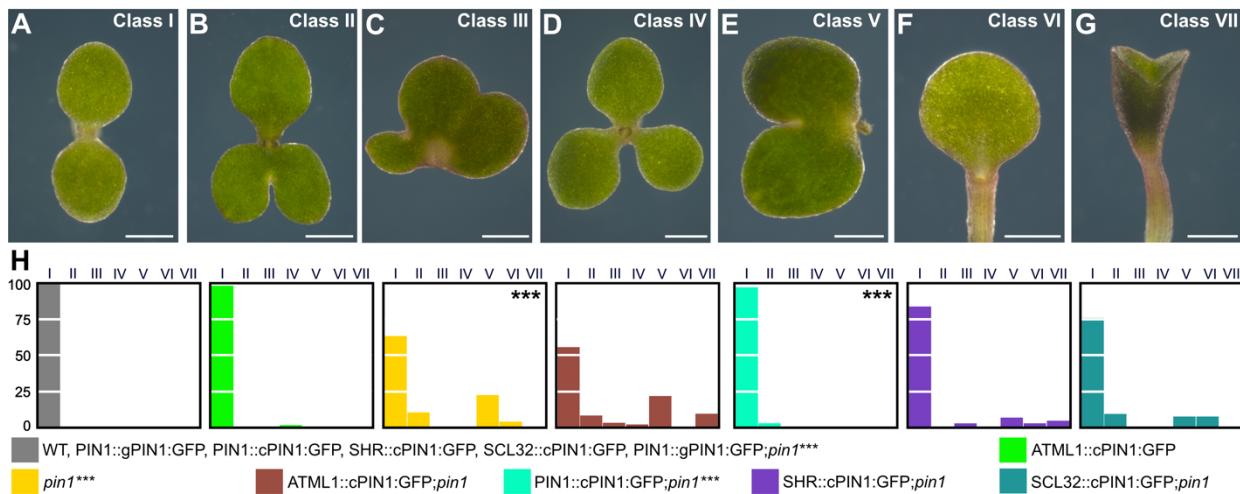
Name	Sequence (5' to 3')
PIN1 transc 4171 forw	GGGGACAAGTTGTACAAAAAAGCAGGCTATGATC CGATTGGATTCTG
PIN1 transc rev	GGGGACCACTTGTACAAGAAAGCTGGTCTTTG TTCGCCGGAGAAG
pin GK LP	ACTCTTGCAACACAAACG
pin1 GK RP	CTCTCAGATGCAGGTCTAGGC
o8409	ATATTGACCATCATACTCATTGC
XhoI ATML1 p F	GCCCTCGAGTTACATTGATTCTGAAGTG
BamHI ATML1p R	GATGGATCCTAACCGGTGGATTCAAGGGAG
BamHI PIN1 cDNA F new	TTAGGATCCATGATTACGGCGGCGGACTTC
KpnI PIN1 cDNA R	CTCGGTACCTCATAGACCCAAGAGAGATGTAG
XhoI GFP no ATG Fwd	TTACTCGAGAGTGAGCAAGGGCGAGGAGCTGTT
XhoI GFP no* Rev	TATCTCGAGTACTTGTACAGCTCGTCCATGCCGAG
XhoI full length PIN1p F	TGTCTCGAGATCCGATTGGATTCCGCTG
BamHI PIN1p rev	AAGGGATCCGAGAAGAGAGAGGGAAAGAGAG
SHR prom SalI Forw2	AAAGTCGACCGAAGAAAGGGACAAAGAAGC
SHR prom BamHI Rev	TGGGGATCCTTAATGAATAAGAAAATGAATAGAAGA AAGGG
SCL32 Translational FWD	AGAGTCGACATCTTAGTAGAAATAAGCGAAC
SCL32 prom BamHI Rev	ACTGGATCCGAGTCTGGTTTAGAGAGAAATG
pin1-1 F	ATGATTACGGCGGGACTTCTA
pin1-1 R	TTCCGACCACCACCAAGGCC
pin3-3 F	GGAGCTCAAACGGGTACCCCG
pin3-3 R	GCTGGATGAGCTACAGCTATATTCT
PIN4 forw geno II	GTCCGACTCCACGGCCTTC
PIN4en rev Ikram	ATCTTCTTCTCACCTCCACTCT
en primer	GAGCGTCGGTCCCCACACTCTATAC
PIN7en forw Ikram	CCTAACGGTTCCACACTCA
PIN7en rev	TAGCTCTTAGGGTTAGCTC
PIN7en rev Ikram II	GGTTTAGCTCTGCTGTGGAGTT

## Supplemental Figures



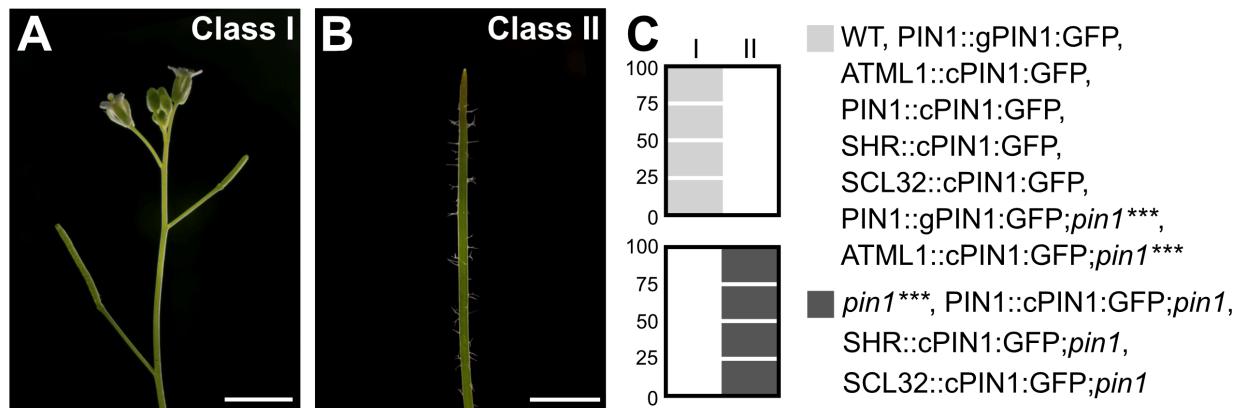
*Figure S1. Effect of Tissue-Specific PIN1 Expression on pin1 Vein Patterns.*

(A-E) Dark-field illumination of mature first leaves. Scale bars: (A-E) 2 mm.



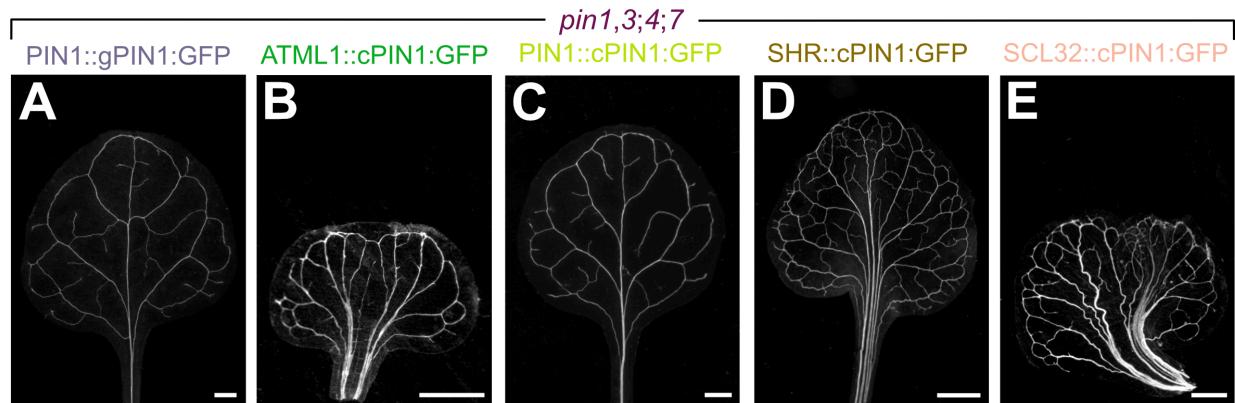
**Figure S2. Tissue-Specific PIN1 Expression in PIN1-dependent Cotyledon Patterning.**

(A–G) Dark-field illumination of 3-day-old seedlings illustrating phenotype classes (top right): class I, two separate cotyledons (A); class II, two fused cotyledons and separate single cotyledon (B); class III, three fused cotyledons (C); class IV, three separate cotyledons (D); class V, two fused cotyledons (E); class VI, single cotyledon (F); class VII, cup-shaped cotyledon, side view (G). (H) Percentages of cotyledons in phenotype classes. Difference between *pin1* and WT, between PIN1::gPIN1:GFP; *pin1* and *pin1*, and between PIN1::cPIN1:GFP; *pin1* and *pin1* was significant at  $P < 0.001$  (\*\*\*\*) by Kruskal-Wallis and Mann-Whitney test with Bonferroni correction. Sample population sizes: WT, 99; *pin1*, 50; PIN1::gPIN1:GFP, 110; ATML1::cPIN1:GFP, 113; PIN1::cPIN1:GFP, 115; SHR::cPIN1:GFP, 63; SCL32::cPIN1:GFP, 103; PIN1::gPIN1:GFP; *pin1*, 111; ATML1::cPIN1:GFP; *pin1*, 183; PIN1::cPIN1:GFP; *pin1*, 47; SHR::cPIN1:GFP; *pin1*, 45; SCL32::cPIN1:GFP; *pin1*, 54. Scale bars: (A–G) 0.5 mm.



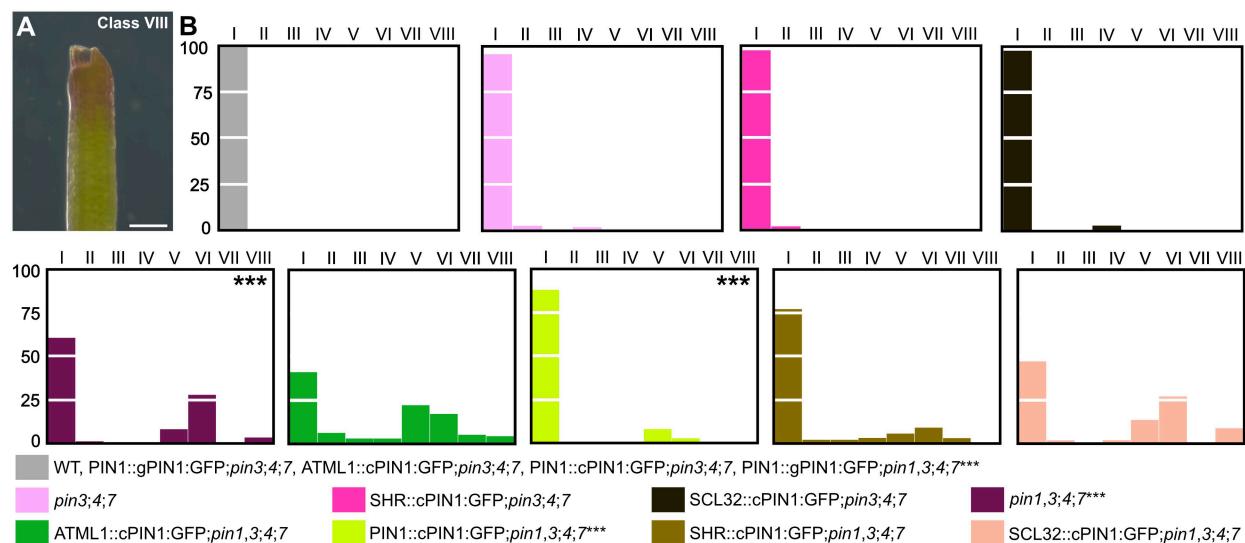
**Figure S3.** Tissue-Specific PIN1 Expression in PIN1-dependent Flower Development.

(A,B) Dark-field illumination of 4-week-old plants illustrating phenotype classes (top right): class I, WT inflorescence (A); class II, pin-shaped inflorescence (B). (C) Percentages of plants in phenotype classes. Difference between *pin1* and WT, between PIN1::gPIN1:GFP;*pin1* and *pin1*, and between ATML1::cPIN1:GFP;*pin1* and *pin1* was significant at  $P<0.001$  (\*\*\*\*) by Kruskal-Wallis and Mann-Whitney test with Bonferroni correction. Sample population sizes: WT, 27; *pin1*, 36; PIN1::gPIN1:GFP, 38; ATML1::cPIN1:GFP, 51; PIN1::cPIN1:GFP, 34; SHR::cPIN1:GFP, 30; SCL32::cPIN1:GFP, 30; PIN1::gPIN1:GFP;*pin1*, 30; ATML1::cPIN1:GFP;*pin1*, 41; PIN1::cPIN1:GFP;*pin1*, 31; SHR::cPIN1:GFP;*pin1*, 36; SCL32::cPIN1:GFP;*pin1*, 38. Scale bars: (A,B) 5 mm.



*Figure S4. Effect of Tissue-Specific PIN1 Expression on *pin1,3;4;7* Vein Patterns.*

(A-E) Dark-field illumination of mature first leaves. Scale bars: (A,C,D) 2 mm; (B,E) 1 mm.



*Figure S5. Tissue-Specific PIN1 Expression in PIN<sub>1</sub>/PIN<sub>3</sub>/PIN<sub>4</sub>/PIN<sub>7</sub>-dependent Cotyledon Patterning.*

(A) Dark-field illumination of 3-day-old seedlings illustrating phenotype class VIII (top right) – small, hood-like outgrowth (side view). (B) Percentages of cotyledons in phenotype classes (classes I–VII defined in Figure S1). Difference between *pin1,3;4;7* and WT, between PIN<sub>1</sub>::gPIN<sub>1</sub>:PIN<sub>1</sub>;pin<sub>1,3;4;7</sub> and *pin1,3;4;7*, and between PIN<sub>1</sub>::cPIN<sub>1</sub>:PIN<sub>1</sub>;pin<sub>1,3;4;7</sub> and *pin1,3;4;7* was significant at  $P<0.001$  (\*\*\*) by Kruskal-Wallis and Mann-Whitney test with Bonferroni correction. Sample population sizes: WT, 102; *pin3;4;7*, 51; *pin1,3;4;7*, 130; PIN<sub>1</sub>::gPIN<sub>1</sub>:GFP;pin<sub>3;4;7</sub>, 65; ATML1::cPIN<sub>1</sub>:GFP;pin<sub>3;4;7</sub>, 108; PIN<sub>1</sub>::cPIN<sub>1</sub>:GFP;pin<sub>3;4;7</sub>, 107; SHR::cPIN<sub>1</sub>:GFP;pin<sub>3;4;7</sub>, 71; SCL32::cPIN<sub>1</sub>:GFP;pin<sub>3;4;7</sub>, 49; PIN<sub>1</sub>::gPIN<sub>1</sub>:GFP;pin<sub>1,3;4;7</sub>, 42; ATML1::cPIN<sub>1</sub>:GFP;pin<sub>1,3;4;7</sub>, 83; PIN<sub>1</sub>::cPIN<sub>1</sub>:GFP;pin<sub>1,3;4;7</sub>, 85; SHR::cPIN<sub>1</sub>:GFP;pin<sub>1,3;4;7</sub>, 60; SCL32::cPIN<sub>1</sub>:GFP;pin<sub>1,3;4;7</sub>, 49. Scale bar: (A) 0.25 mm.