

Supplementary Material

Title: In-depth genomic and transcriptomic dissection of five potassium (K^+) transporter gene families in soybean confirm their differential expression for nodulation

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Supplementary Figure 1

HAK/KT/KUP Family

Glyma19g45260.1 Glyma03g42480.1 Glyma07g04750.1 Glyma08g19120.1 Glyma15g05880.1 Glyma05g24530.1 Glyma08g07720.1 Glyma18g18822.1 • Glyma08g39840.1 Glyma05g37270.1 · Glyma08g02290.1 · Glyma16g26470.1 • Glyma19g28110.1 Glyma02g39370.1 Glyma18g06790.1 Glyma11g27830.1 Glyma08g06060.1 Glyma01g03850.1 Glyma02g03830.1 Glyma18g18810.1 Glyma08g39860.1 Glyma19g01400.1 Glyma13g23960.1 Glyma05g26210.1 Glyma08g09140.1 Glyma09g05830.1 · Glyma15g17080.3 Glyma08g09720.1



Voltage gated K⁺ channel family



TPK/KCO family



HKT family



Continue...

KEA family



Figure legends

- K⁺ Transporter domain
- 🛑 Ion transport protein
- Oyclic nucleotide-monophosphate binding domain
- KHA, dimerisation domain of potassium ion channel
- Ankyrin repeats
- Ion channel
- TM domain
- TM domain
- 🛑 TrkH domain
- Coiled- coil domain
- Sodium/hydrogen exchanger domain
- TM domain

Supplementary Figure 1. Conserved domain organization in all 70 putative K⁺ transporter genes from soybean. **HAK/KT/KUP** genes possess a K⁺ transporter domain (yellow). The **Voltage-gated channel** family comprises four domains: ion transport protein (dark brown), cyclic nucleotide monophosphate binding domain (light yellow), KHA domain (green), and ankyrin repeats (red). Two ion channels were found in **TPK/KCO** family genes (grey). The **HKT** family has two TrKH and TMD domains (brown

and pink). **KEA** family genes have three coiled-coil domains (light green), a Na^+/H^+ exchanger domain (black), and a TM domain (dark blue).

Supplementary Figure 2





Continue...





Supplementary Figure 2. Conserved motifs across all 70 putative K^+ transporters genes. **HAK/KT/KUP** family is showing the five highly conserved motifs in their peptide sequences. Voltage-gated and **TPK/KCO** channel family genes have three motifs in which a red color motif having selectivity filter is shown across all the channel proteins. Two and three common motifs are shown for **HKT** and **KEA** family peptides.

Supplementary Figure 3

HAK/KT/KUP family





Continue...

Voltage gated K+ channel

TPK/KCO channel family





HKT family





KEA family





KEA6 duplicated genes

Supplementary Figure 3. Paralog and syntenic analysis of all duplicated gene pairs in five K^+ transporter families. Green indicates GC contents in the duplicated gene pairs. Pink indicates the conserved regions during whole genome duplication events in each family.

Supplementary Figure 4



13

Supplementary Figure 4. Exon-intron structure of all 70 K⁺ transporters in soybean. Untranslated regions are shown in blue and introns are shown as grey lines. Yellow indicates the coding sequences of genes. Intron phases are labeled as zero, one, and two.

Supplementary Figure 5











Supplementary Figure 5. Syntenic regions among all the orthologs of five different families identified in five dicots. Almost all annotated protein-coding genes are highly conserved.

Supplementary Figure 6











Supplementary Figure 6. Ortholog clustering of five K⁺ transporter gene families in five dicots. Number of clusters can be observed in the given figures.

Supplementary Figure 7



Dataset: 68 anatomical parts from data selection: GM_AFFY_SOYBEAN-0 11 transcripts from gene selection: GM-0 0% 100%

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Detailed view of selected perturbations (absolute expression levels)

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GLYMAD5G37270.1 (GmaAffx:3555.1.A1_at)

9LYMA13G23960.1 (GmaAffx.69322.2.S1_at) 9LYMA09G05830.1 (GmaAffx.18686.1.S1_at)

3LYMA19601400.1 (Gma.4979.1.S1_at)

3LYMA15G17080.3 (GmaAffx.39759.1.S1_at)

Supplementary Figure 7. Microarray analysis of HAK/KT/KUP family genes. (A) Genes expression across five developmental stages. (B) Genes expression in 68 anatomical parts. (C) Detailed view of genes expressed for *B. japnicum* inoculation to root hairs for nodulation in soybean.

Supplementary Figure 8

Α



6 transcripts from gene selection: GM-1



Dataset: 68 anatomical parts from data selection: GM_AFFY_SOYBEAN-0 6 transcripts from gene selection: GM-1

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Detailed view of selected perturbations (absolute expression levels)

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Percent of Expression Potential

Supplementary Figure 8. Microarray analysis of Voltage gated K^+ channel family genes. (A) Genes expression across five developmental stages. (B) Genes expression in 68 anatomical parts. (C) Detailed view of genes expressed for *B. japnicum* inoculation to root hairs for nodulation in soybean.

Supplementary Figure 9.

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A Dataset: 5 developmental stages from data selection: GM_AFFY_SOYBEAN-0

2 transcripts from gene selection: GM-2



Supplementary Material

B Dataset: 68 anatomical parts from data selection: GM_AFFY_SOYBEAN-0 2 transcripts from gene selection: GM-2

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maturation zone root hair		37
axillary meristem		2
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▼ shoot		432
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blade (lamina) v shoot apex 🚯		21
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root tip 🕦		67
stele pericvcle		3
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root tip (1) root apical meristem (1)		3
nodule		3

Detailed view of selected perturbations (absolute expression levels)



Percent of Expression Potential

Supplementary Figure 9. Microarray analysis of TPK/KCO family genes. (A) Genes expression across five developmental stages. (B) Genes expression in 68 anatomical parts. (C) Detailed view of genes expressed for *B. japnicum* inoculation to root hairs for nodulation in soybean.

Supplementary Figure 10.



Dataset: 68 anatomical parts from data selection: GM_AFFY_SOYBEAN-0 6 transcripts from gene selection: GM-3

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seedling							57
▼ shoot apex (1)							2
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 radicle (1) maturation zone 	-						37
root hair	-			-			37
axillary meristem							2
inflorescence							183
 flower cluster (raceme) 	-					_	3
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Detailed view of selected perturbations (absolute expression levels)

Experimental	6LYMA07608031.1 (6ma.15388.1.S1_at)	GLYMA09639770.1 (GmaAffx:51609.1.S1_at)	6LYMAD7	GLYMA08606890.1 (Gma.13178.1.S1_at)	6LYMA08603320.1 (6maAffx.14508.1.S1_at)	GLYMA17634780.1 (GmaAffx.14073.1.S1_at)
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Percent of Expression Potential

0%

created with GENEVESTIGATOR

100%

Supplementary Figure 10. Microarray analysis of KEA family genes. (A) Genes expression across five developmental stages. (B) Genes expression in 68 anatomical parts. (C) Detailed view of genes expressed for *B. japnicum* inoculation to root hairs for nodulation in soybean.