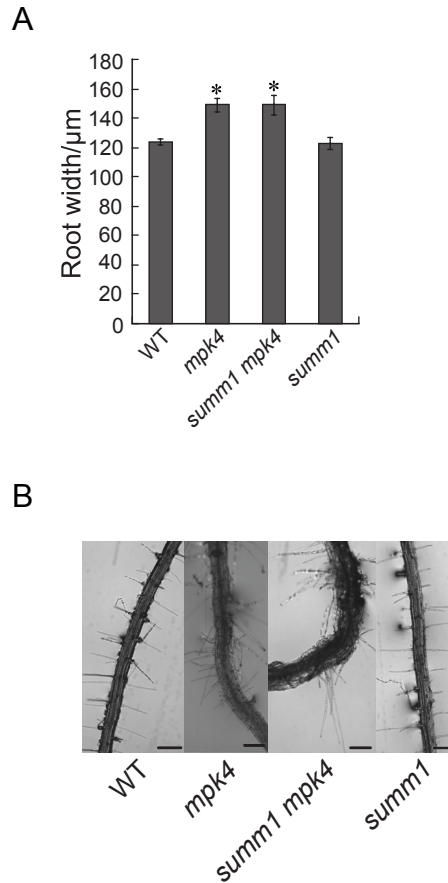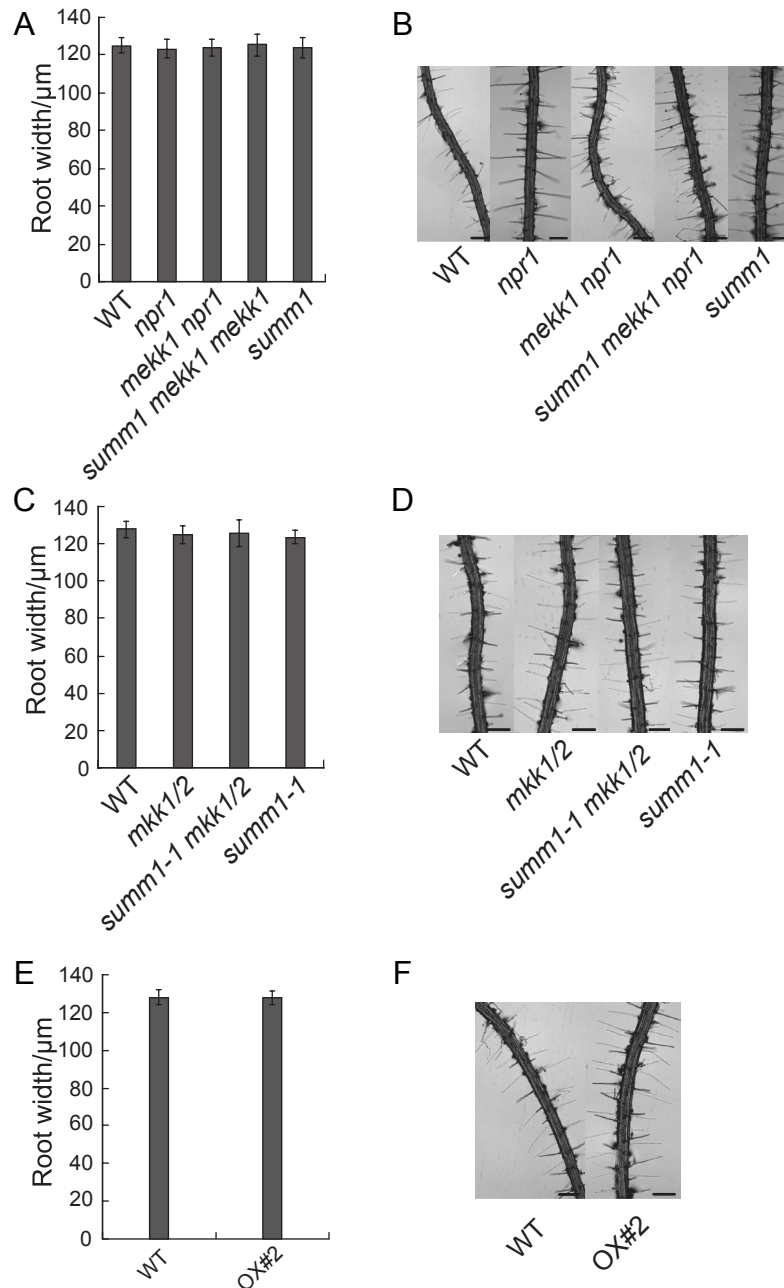**Supplemental Figure 1. Morphological phenotypes of wild type, *mkk1-1 mkk2-1* and different *summ1* mutant alleles.** Plants were grown on soil at 23ºC and photographed approximately four weeks after planting.

A

B

Supplemental Figure 2. Development defects in the roots of *mpk4-3* are not suppressed by *summ1-1*.

(A) Root width of wild type (WT), *mpk4-3* (*mpk4*), *summ1-1 mpk4-3* (*summ1 mpk4*) and *summ1-1* (*summ1*). Root width of six-day-old seedlings grown vertically on 1/2 MS medium was measured at ~200 µm distance from the tip. **P*<0.001, statistical difference from wild-type. Error bars represent standard deviations of fifteen measurements.

(B) Root morphology of wild type (WT), *mpk4-3* (*mpk4*), *summ1-1 mpk4-3* (*summ1 mpk4*) and *summ1-1* (*summ1*). Six-day-old seedlings grown vertically on 1/2 MS medium were photographed under microscopy. Bars = 100µm.

Supplemental Figure 3. *MEKK1, MKK1/MKK2* and *SUMM1* are not required for root development.

(A-B) Root width (A) and morphology (B) of wild type (WT), *npr1-1* (*npr1*), *mekk1-4 npr1-1* (*mekk1 npr1*), *summ1-3 mekk1-4 npr1-1* (*summ1 mekk1 npr1* and *summ1-1* (*summ1*). Error bars represent standard deviations of ten measurements.

(C-D) Root width (C) and morphology (D) of WT, *mkk1/2*, *summ1-1 mkk1/2* and *summ1-1*. Error bars represent standard deviations of ten measurements.

(E-F) Root width (E) and morphology (F) of WT and *SUMM1-FLAG* transgenic line OX#2. Error bars represent standard deviations of ten measurements.

Root width was measured at ~200 μm distance from the tip of six-day-old seedlings grown vertically on 1/2 MS medium. Photographs of the seedlings were taken under microscopy. Bars = 100μm.

Supplemental Table 1. Primers used in this work

primer	5'-3' sequence	purpose
RT-MEKK2-F	gctgatatatggagcctcgg	RT
RT-MEKK2-R	tctacggattagcggagatg	RT
T13D4-F	cataccaagcctacgtcaac	InDel Marker
T13D4-R	aaactccctggatcaggcag	InDel Marker
NGA8-F	gagggcaaatctttatttcgg	InDel Marker
NGA8-R	tggctttcgtttataaacatcc	InDel Marker
F9M13-F	gattcatgagacgtatagag	SNP Marker
F9M13-Col-R	cacaatgtaagtttcggtcaag	SNP Marker
F9M13-Ler-R	cacaatgtaagtttcggtcaac	SNP Marker
T15F16-F	ctttcttcttcgttgacttgg	SNP Marker
T15F16-Col-R	caatttatatactcgttggagga	SNP Marker
T15F16-Ler-R	caatttatatactcgttggaggt	SNP Marker
SUMM1-Promoter-F	cggggtaccattctttcggtcgcgagttg	pCAMBIA1305⁻SUMM1-FLAG
SUMM1-Promoter-R	acgcacgcgtcgacgtgagcgacgatgattggt	pCAMBIA1305⁻SUMM1-FLAG
SUMM1-F	acgcacgcgtcgacatgaagaagtcgtcggataag	pCAMBIA1305⁻SUMM1-FLAG
SUMM1-R	cccaagctttctacggattagcggagatg	pCAMBIA1305⁻SUMM1-FLAG
MPK4-F	acgcgtcgaccatgtcggcggagagttgtttc	pBI880-MPK4
MPK4-R	aaaactgcagtcacactgagtcttgaggattg	pBI880-MPK4
MPK6-F	acgcacgcgtcgacgatggacggtggttcaggtc	pBI880-MPK6
MPK6-R	cgagctagactagtctattgctgatattctggattg	pBI880-MPK6
MEKK2-pBI881-F	acgcacgcgtcgacgatgaagaagtcgtcggataag	pBI881-MEKK2/pBI881-MEKK2-N
MEKK2-pBI881-R	ccggaattctcatctacggattagcggag	pBI881-MEKK2/pBI881-MEKK2-C
MEKK2-N-pBI881-R	ccggaattctcacccagagacacaaatcggtg	pBI881-MEKK2-N
MEKK2-C-pBI881-F	acgcacgcgtcgacgatgggatctatcaatacttcttgg	pBI881-MEKK2-C
MEKK2-N-pET24c-F	gggaattccatatgatgaagaagtcgtcggataag	pET24c-MEKK2-N
MEKK2-N-pET24c-R	ccgctcgagagaagtattgatagatccc	pET24c-MEKK2-N