Supplemental Figure S1. NCED5 has 9-*cis*-epoxicarotenoid dioxygenase activity in vitro.
HPLC profile of the reaction products from 9'-*cis*-neoxanthin incubated with GST-NCED5 (A) or GST-NCED3 fusion protein (C). Putative C_{25} product was eluted at the retention time of 6.2 min. cN, 9'-*cis*-neoxanthin; C_{25}, predicted C_{25} product.
Full-scan mass spectrum of predicted *cis*-xanthoxin produced from the reaction of 9'-*cis*-neoxanthin incubated with GST-NCED5 (B) or GST-NCED3 fusion protein (D).

Supplemental Figure S2. Thermoinhibition resistant germination of seeds from ABA-deficient mutants and lines with T-DNA insertion in *NCED* genes.
(A) T-DNA insertion sites in *NCED2*, *NCED5*, *NCED6* and *NCED9* genes. Arrow indicates 5' to 3' direction of the gene.
(B) Effect of imbibition temperature on germination of *aba1-1*, alleles of *nced* single mutants, *aba2-1* and *aao3-4* seeds. After-ripened seeds were imbibed at 22 ^{o}C (open bars), 33 ^{o}C (gray bars) and 34 ^{o}C (black bars) under continuous illumination for 5 days. Error bars show SD (n=3).

Supplemental Figure S3. Evaluation of embryo and endosperm separation by qRT-PCR of *EPR1* and *GA3ox2* transcripts.
Total RNA was prepared from embryo (open bars) and endosperm/testa (gray bars) separated from Columbia seeds imbibed at 22 ^{o}C under continuous illumination for 24 h. Transcript levels of endosperm marker gene, *EPR1* and embryo marker gene, *GA3ox2* were quantified by qRT-PCR with CYBR Green. Primer sequences of *EPR1* used were described previously (Penfield et al., 2004). Primer sequences of *GA3ox2* were 5'-GTTTCCAAGTGAGAGATGGGTAG-3' and 5'-TCTCCACTTCCCAAACTGGT-3'. A single amplification product in each reaction was confirmed by a dissociation curve.