Decreased photosynthesis in the *erect panicle 3 (ep3)* mutant of rice is associated with reduced stomatal conductance and attenuated guard cell development

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### Primer name | Sequences 5’ to 3’ | Intended purpose
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FCAPsEP3 | TCGTGTGCAAACAAAATCTAAGGTCT | Primers used to test ep3 NMU mutant
RCAPsEP3 | TAGTTAGGAGGAGACCCATG | Primers used to test ep3 T-DNA insertion line 1C-03432.
F2EP3 | CATGGGTGTCTCCCCACT | Primers used to test ep3 T-DNA insertion line 1C-03432.
R2EP3 | GGTGAATGGGATCCGGTTGAA | Primers used to test ep3 T-DNA insertion line 1C-03432.
FLB | CTAGGAAGCAATGTCCAGCC | Primers used to construct pBI101.2:HWSpro:EP3 and sequencing
ForEP3 | ATGGGGTCAGAGGAGTGAGTGGAG | Primers used to construct pBI101.2:HWSpro:EP3 and sequencing
RevEP3 | CTAGGAAGCAATGTCCAGCC | Primers used to construct pBI101.2:HWSpro:EP3 and sequencing
RevEP3BamHI | CGGGATCCATGGGATCGAGGAGTGGGAG | Primers used to construct pBI101.2:HWSpro:EP3 and sequencing
RevEP3Smal | TCCCCCGGGCTAGGAAGCAATGTCCAGCC | Primers used to construct pBI101.2:HWSpro:EP3 and sequencing
ForHWS5UTR | AACCGCATTTTCTCTCGC | Primers used to construct pBI101.2:HWSpro:EP3 and sequencing
RevGUS90 | GCTTTCCCACCAACGCTG | Primers used to construct pBI101.2:HWSpro:EP3 and sequencing
SSLPHSfor | GAGAGAGGCTGTGTGATTGTCGGAG | *HWS* specific primers used to identify *hws-1* from WT
SSLPHSrev | GTGCCACTACTCGCGGCAAACCTCG | *HWS* specific primers used to identify *hws-1* from WT

Figure S1. The list of primers.
Figure S2. A/Ci curves generated from gas-exchange and the comparison between ep3 NMU mutant and Hwasunchalbyeo; between the T-DNA insertion line and Hwayoungbyeo.
Figure S3. Analysis of dark adapted Fv/Fm from ep3 NMU mutant, Hwasunchalbyeo, ep3 T-DNA insertion 1C-03432.L and Hwayoungbyeo.

Figure S4. Analysis of stomatal conductance ($g_s$) in response to an alteration in cuvette humidity. A significant decrease in $g_s$ was observed in both ep3 NMU mutant plants (A) ($P<0.001$, paired t-test) and T-DNA insertion plants (B) ($P<0.01$, paired t-test) when compared with Hwasunchalbyeo and Hwayoungbyeo respectively. Error bars in this figure show the SD, n=5.
Figure S5. Rice leaf surface impression showing the measurements of stomatal length (A), width (B) and area (C). Scale bar = 10 µm.

Figure S6. (A) Correlation between stomatal density and stomatal conductance at PAR 1000 µmol m$^{-2}$ s$^{-1}$ (10% blue), relative humidity 50%. Each point represents one biological replicate for $g_s$ and mean of 6 replicates for stomatal density. Stomatal density was calculated from both side of widest part of leaf-6 surface. Regression analysis didn’t show significant correlation at 95% level using equation $y=0.0003x+0.4432$, $R^2=0.0026$. (B) Correlation between stomatal area and stomatal conductance at PAR 1000 µmol m$^{-2}$ s$^{-1}$ (10% blue), relative humidity 50%. Each point represents one biological replicate for $g_s$ and mean of 12 individuals for stomatal area. Stomatal area was calculated from both side of widest part of leaf-6 surface. Regression analysis didn’t show significant correlation at 95% level using equation $y=-0.0007x+0.6029$, $R^2=0.0396$. 
Figure S7. Rice leaf section showing the measurements of anatomical structure (A) The interveinal distance between minor veins; (B) leaf thickness at bulliform cells; (C) leaf thickness at minor vein; (D) width of minor vein; (E) interveinal distance between major vein and minor vein; (F) leaf thickness at major vein; (G) width of major vein. Scale bar = 200 µm.

Figure S8. Single mesophyll cells preparation from (A) ep3 NMU mutant; (B) Hwasunchalbyeo; (C) ep3 T-DNA insertion 1C-03432.L; (D) Hwayoungbyeo. The scale bars indicate 10 µm.
Figure S9. SDS-PAGE gel running of Rubisco larger subunit and standard sample. Lane 1, the standard Rubisco; lane 2-4, the three replicates of ep3 NMU mutant; 5-7, the three replicates of Hwasunchalbyeo; 8-10, the three replicates of ep3 T-DNA insertion 1C-03432.L; 11-13, Hwayoungbyeo.

Figure S10. Gene expression analysis of EP3 in different rice tissues. cDNA templates were generated by reverse-transcription of RNA extracted from rice tissues, including panicles from 80 days old plants, leaves from leaf-6-stage plants and root tissues from leaf-6-stage plants. Rice eEF-1α was used as the control gene. In the T-DNA insertion line, no transcripts of EP3 were observed as the primer was designed to cross the T-DNA insertion.