***ipa1* improves rice drought tolerance at seedling stage mainly through activating abscisic acid pathway**

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**Supplementary table 1 Phenotypic characteristics of *IPA1* and *ipa1* NILs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Tiller numbers** | **Leave numbers** | **Primary branch numbers** | **Secondary branch numbers** | **Spikelet numbers per panicle** |
| **NIL-*IPA1*** | **6.9±1.2** | **14.8±0.5** | **15.8±1.1** | **26.4±6.8** | **178.7±25.7** |
| **NIL-*ipa1*** | **1.4±0.6** | **11.3±0.5** | **20.9±1.3** | **50.4±7.8** | **276.9±24.6** |

Data was from 45 plants of three replications under natural condition in Wuhan, China, in 2017.Values are means ± SD.

C:\Users\63460\Desktop\修订\S1\S1.tif **Supplementary Fig. 1** Stomatal density of the *IPA1*/*ipa1* seedlings. (a) Scanning electron microscopy (SEM) images of the *IPA1*/*ipa1* seedlings. Bar, 100 µm. (b) Numbers of stomata per mm2 in the *IPA1*/*ipa1* seedlings. Data represent the means ± SE (n=3).

C:\Users\63460\Pictures\S2.tif **Supplementary Fig. 2** Contents of soluble sugar (a) and sucrose (b) in sheathes of the *IPA1*/*ipa1* seedlings. Data represent the means ± SE (n=3). \**P*<0.05, *t*-test. \*\**P*<0.01, *t*-test.

C:\Users\63460\Pictures\S3.tif**Supplementary Fig. 3** Expression levels of the genes involved in nitrogen absorption, transport, assimilation and regulating nitrogen metabolism in both shoot (a) and root (b) of the *IPA1/ipa1* seedlings. Data represent the means ± SE (n=3). \**P*<0.05, *t*-test. \*\**P*<0.01, *t*-test.

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**Supplementary Fig. 4** Contents of amino acid derivatives (a), nucleotide and its derivatives (b), antioxidants (c), glycerolipids (d) and ferulic acid-related metabolites (e) in the *IPA1*/*ipa1* seedlings. Data represent the means ± SE (n=3). \* VIP≥0.5, *P*<0.05, *t*-test. \*\* VIP≥0.5, *P*<0.01, *t*-test.

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**Supplementary Fig. 5** Response of the *IPA1*/*ipa1* seedlings to ABA and GA3 treatments. (a) Phenotypes of the *IPA1/ipa1* seedlings treated by ABA and GA3 treatments, respectively. (b) Plant height of the *IPA1*/*ipa1* seedlings under ABA and GA3 treatments. Data represent the means ± SE (n=45). \**P*<0.05, *t*-test. \*\**P*<0.01, *t*-test.

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**Supplementary Fig. 6** The expression levels of genes involved in GA biosynthesis and catabolism in the *IPA1*/*ipa1* seedlings under control and 25% PEG treatment for 6 hours. Data represent the means ± SE (n=3). \**P*<0.05, *t*-test. \*\**P*<0.01, *t*-test.

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**Supplementary Fig. 7** The expression levels of *OsTB1* in the *IPA1*/*ipa1* seedlings at different time points after 25% PEG treatment.Data represent the means ± SE (n=3). \**P*<0.05, *t*-test. \*\**P*<0.01, *t*-test.