**Supplementary material for online-only publication**

To estimate genetic correlations between traits for each treatment, bivariate models were fit for all pairs of traits in ASReml-R using the following model:

(1)

where ***yi*** and ***yj*** are the stacked vectors of observations for traits 1 and trait 2; ***β*** represents the vector of fixed effects, including an overall mean for each trait;***a(t)*** is the random additive genetic effect within trait, with ***a(t)***∼ *N*(**0**, ***Va*** ⊗ ***A***); ***b(t)*** is the random block effect for each trait and ***c(t)*** is the random clonal effect within trait, with ***c*** ∼ *N*(**0**, ***Vc*** ⊗ ***Ic***); and ***e*** is the error term, with ***e*** ∼ *N*(**0**, ***Ie*** ⊗ ***Vr***). ***A*** is the pedigree-based additive relationship matrix and ***Ic*** and ***Ie*** are a identity matrices of their proper dimension. The matrices ***Va***, ***Vc*** and ***Vr*** are 2 x 2 variance-covariance matrices as defined by the correlation of effects between traits (*ra*, *rc* and *re*, respectively) and unique variances for each trait. The matrices ***X***, ***Z1***, ***Z2***, and ***Z3*** are incidence matrices of their corresponding effects. Phenotypic correlations between traits were calculated as:

(2)

where  are the estimated additive, clonal and residual variance of trait *i* (same for trait *j*), respectively. Genetic correlations were calculated for the combined additive and non-additive genetic variance as:

The significance of the genetic correlation (*H0: rg = 0; H1: rg ≠ 0*) was tested by performing a likelihood-ratio test with two degrees of freedom between the full model in Equation ([1](https://onlinelibrary.wiley.com/doi/full/10.1111/eva.12823#eva12823-disp-0004)) and a reduced model assuming *ra = 0* and  *rc = 0* (i.e., a diagonal ***Va***  and ***Vc*** matrix). The significance of the phenotypic correlation (*H0: rp = 0; H1: rp ≠ 0*) was tested by performing a likelihood-ratio test with three degrees of freedom between the full model in Equation ([1](https://onlinelibrary.wiley.com/doi/full/10.1111/eva.12823#eva12823-disp-0004)) and a reduced model assuming no correlation between traits (i.e., *ra= 0*, *rc = 0*, and *re = 0*).

**Supplementary Table 1:** Matrices of phenotypic correlations between the different traits for the control, moderate and severe drought stress treatments. Standard errors of estimates are in parentheses. Significance levels: \*, *P* < 0.05; ​ \*\*, *P* < 0.01; ​\*\*\*, *P* < 0.001.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatments** | **Traits** | **Lumen diameter** | **Tracheid length** | **Tracheid diameter** | **Number of pits per tracheid** | **Apical growth** | **Ring width** | **Wood density** | **Biomass index** |
| Control | Specific conductivity | 0.99 (0.00)\*\*\* | 0.22 (0.02)\* | -0.10 (0.04)\* | 0.08 (0.01)\* | -0.04 (0.01)\* | 0.26 (0.06)\* | -0.50 (0.12)\* | -0.34 (0.08)\* |
|  | Lumen diameter |  | -0.21 (0.01)\* | 0.03 (0.01)\* | -0.18 (0.06)\* | -0.21 (0.04)\* | -0.16 (0.04)\*\* | 0.03 (0.01) | -0.14 (0.06) |
|  | Tracheid length |  |  | -0.06 (0.01)\* | 0.32 (0.07)\* | -0.18 (0.01)\* | 0.45 (0.20)\* | 0.24 (0.05)\* | 0.42 (0.13)\* |
|  | Tracheid diameter |  |  |  | -0.01 (0.00) | 0.15 (0.05)\* | -0.07 (0.01) | -0.11 (0.04)\* | -0.04 (0.00) |
|  | Number of pits per tracheid |  |  |  |  | -0.09 (0.02)\* | 0.06 (0.02) | 0.34 (0.15) | 0.21 (0.12) |
|  | Apical growth |  |  |  |  |  | 0.45 (0.13)\*\* | 0.10 (0.02)\*\* | 0.30 (0.07)\*\* |
|  | Ring width |  |  |  |  |  |  | 0.17 (0.05)\* | 0.45 (0.17)\*\* |
|  | Wood density |  |  |  |  |  |  |  | 0.53 (0.12)\*\* |
| Moderate | Specific conductivity | 0.99 (0.00)\*\*\* | 0.03 (0.01) | -0.28 (0.10)\* | 0.01 (0.00) | -0.14 (0.01)\* | 0.38 (0.10)\* | -0.45 (0.18)\* | -0.40 (0.10)\* |
|  | Lumen diameter |  | -0.04 (0.01)\* | 0.03 (0.01)\* | 0.01 (0.00) | 0.00 (0.00) | -0.33 (0.10)\* | -0.05 (0.01)\* | -0.20 (0.09) |
|  | Tracheid length |  |  | 0.23 (0.14) | 0.35 (0.16) | -0.13 (0.02)\* | 0.25 (0.07)\* | 0.09 (0.01)\* | 0.41 (0.14)\* |
|  | Tracheid diameter |  |  |  | 0.07 (0.00) | 0.08 (0.03) | -0.21 (0.05)\* | -0.14 (0.06) | -0.10 (0.03)\* |
|  | Number of pits per tracheid |  |  |  |  | 0.27 (0.10)\* | 0.21 (0.15) | 0.08 (0.01)\* | 0.21 (0.01)\* |
|  | Apical growth |  |  |  |  |  | 0.51 (0.20)\* | 0.10 (0.02)\*\* | 0.30 (0.07)\*\* |
|  | Ring width |  |  |  |  |  |  | 0.16 (0.05)\* | 0.40 (0.14)\*\* |
|  | Wood density |  |  |  |  |  |  |  | 0.45 (0.23)\* |
| Severe | Specific conductivity | 0.99 (0.00)\*\*\* | 0.10 (0.01)\* | -0.28 (0.05)\* | 0.14 (0.05)\* | -0.09 (0.00)\* | 0.11 (0.04)\* | -0.47 (0.17)\* | -0.13 (0.06)\* |
|  | Lumen diameter |  | 0.00 (0.03) | 0.08 (0.02)\* | 0.07 (0.00)\* | -0.36 (0.10)\* | -0.05 (0.01)\* | 0.22 (0.01)\* | -0.02 (0.01) |
|  | Tracheid length |  |  | 0.15 (0.05)\* | 0.25 (0.10)\* | -0.28 (0.10)\* | 0.27 (0.12)\* | 0.18 (0.05)\* | 0.26 (0.12)\* |
|  | Tracheid diameter |  |  |  | 0.03 (0.00) | 0.00 (0.01) | -0.19 (0.11) | 0.04 (0.01)\* | -0.18 (0.06)\* |
|  | Number of pits per tracheid |  |  |  |  | -0.31 (0.18) | 0.21 (0.11) | 0.28 (0.10)\* | 0.22 (0.09)\* |
|  | Apical growth |  |  |  |  |  | 0.63 (0.23)\* | 0.01 (0.00) | 0.23 (0.06)\* |
|  | Ring width |  |  |  |  |  |  | 0.05 (0.00)\* | 0.18 (0.10)\* |
|  | Wood density |  |  |  |  |  |  |  | 0.20 (0.10) |

**Supplementary Table 2:** Matrices of genotypic (genetic) correlations between the different traits for the control, moderate and severe drought stress treatments. Standard errors of estimates are in parentheses**.** Significance levels: \*, *P* < 0.05; ​ \*\*, *P* < 0.01; ​\*\*\*, *P* < 0.001.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatments** | **Traits** | **Lumen diameter** | **Tracheid length** | **Tracheid diameter** | **Number of pits per tracheid** | **Apical growth** | **Ring width** | **Wood density** | **Biomass index** |
| Control | Specific conductivity | 0.99 (0.00)\*\*\* | 0.78 (0.21)\* | -0.18 (0.45) | 0.28 (0.22) | -0.05 (0.37) | 0.86 (0.40)\* | -0.84 (0.14)\* | -0.93 (0.18)\* |
|  | Lumen diameter |  | -0.24 (0.01)\* | 0.80 (0.33)\* | -0.26 (0.10)\*\* | 0.50 (0.23)\*\* | -0.60 (0.30)\*\* | -0.52 (0.35)\*\* | -0.56 (0.21)\*\* |
|  | Tracheid length |  |  | -0,55 (0.20)\* | 0.59 (0.25)\* | -0.25 (0.04)\* | 0.80 (0.27)\*\* | 0.82 (0.18)\* | 0.99 (0.04)\* |
|  | Tracheid diameter |  |  |  | -0.60 (0.30) | 0.80 (0.17)\* | -0.61 (0.30)\* | -0.82 (0.18)\* | -0.69 (0.34) |
|  | Number of pits per tracheid |  |  |  |  | -0.10 (0.01) | 0.35 (0.10)\* | 0.95 (0.12)\* | 0.82 (0.33)\* |
|  | Apical growth |  |  |  |  |  | -0.95 (0.21)\*\* | 0.24 (0.10)\* | 0.75 (0.32)\* |
|  | Ring width |  |  |  |  |  |  | 0.85 (0.29)\*\* | 0.85 (0.24)\*\* |
|  | Wood density |  |  |  |  |  |  |  | 0.92 (0.20)\*\* |
| Moderate | Specific conductivity | 0.95 (0.00)\*\*\* | 0.68 (0.10)\* | -0.12 (0.13) | 0.20 (0.00)\* | -0.01 (0.01) | 0.80 (0.41)\* | -0.80 (0.18)\* | -0.85 (0.23)\* |
|  | Lumen diameter |  | 0.00 (0.00) | 0.70 (0.07)\* | -0.59 (0.28)\*\* | 0.58 (0.20)\*\* | -0.57 (0.40)\* | -0.55 (0.32)\* | -0.70 (0.40) |
|  | Tracheid length |  |  | -0.57 (0.30)\* | 0.39 (0.03)\*\* | 0.08 (0.01)\* | 0.41 (0.29)\* | 0.17 (0.01)\* | 0.78 (0.29)\* |
|  | Tracheid diameter |  |  |  | -0.10 (0.01)\* | 0.42 (0.18)\* | -0.10 (0.01)\* | -0.48 (0.23) | -0.55 (0.29) |
|  | Number of pits per tracheid |  |  |  |  | 0.75 (0.49) | 0.70 (0.30)\* | 0.70 (0.37)\* | 0.59 (0.38) |
|  | Apical growth |  |  |  |  |  | -0.15 (0.10)\* | 0.14 (0.08) | 0.55 (0.10)\* |
|  | Ring width |  |  |  |  |  |  | 0.58 (0.21)\* | 0.86 (0.20)\* |
|  | Wood density |  |  |  |  |  |  |  | 0.71 (0.24)\* |
| Severe | Specific conductivity | 0.90 (0.00)\*\*\* | 0.65 (0.08)\* | -0.10 (0.13) | 0.00 (0.00) | 0.00 (0.00) | 0.76 (0.41) | -0.77 (0.15)\* | -0.82 (0.17)\* |
|  | Lumen diameter |  | 0.49 (0.30) | 0.73 (0.07)\* | -0.65 (0.29)\* | 0.49 (0.21)\* | -0.50 (0.43) | -0.70 (0.40) | -0.75 (0.45) |
|  | Tracheid length |  |  | -0.32 (0.10)\* | 0.51 (0.05)\*\* | -0.50 (0.29)\* | 0.21 (0.07)\* | 0.63 (0.28)\* | 0.70 (0.20)\* |
|  | Tracheid diameter |  |  |  | -0.50 (0.30) | 0.37 (0.10)\* | -0.51 (0.15)\* | -0.43 (0.13)\* | -0.75 (0.25)\* |
|  | Number of pits per tracheid |  |  |  |  | 0.77 (0.45) | 0.72 (0.27)\* | 0.49 (0.27) | 0.71 (0.31)\* |
|  | Apical growth |  |  |  |  |  | -0.15 (0.10) | 0.50 (0.20)\* | 0.45 (0.01)\*\* |
|  | Ring width |  |  |  |  |  |  | 0.58 (0.21)\* | 0.49 (0.28) |
|  | Wood density |  |  |  |  |  |  |  | 0.65 (0.12)\*\* |

**Supplementary Table 3:** Individual tree-level narrow sense () et broad-sense () heritability estimates for specific conductivity, lumen diameter, tracheid length, tracheid diameter and number of pits per tracheid. Standard errors of estimates are in parentheses.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Treatments** | **Traits** |  | |  |
| Control | Specific conductivity | 0.20 (0.10) | 0.25 (0.15) | |
|  | Lumen diameter | 0.10 (0.01) | 0.13 (0.01) | |
|  | Tracheid length | 0.31 (0.21) | 0.44 (0.18) | |
|  | Tracheid diameter | 0.12 (0.02) | | 0.24 (0.10) |
|  | Number of pits per tracheid | 0.35 (0.27) | 0.54 (0.28) | |
| Moderate | Specific conductivity | 0.05 (0.00) | 0.17 (0.07) | |
|  | Lumen diameter | 0.13 (0.06) | 0.22 (0.14) | |
|  | Tracheid length | 0.10 (0.02) | 0.23 (0.10) | |
|  | Tracheid diameter | 0.00 (0.00) | 0.29 (0.10) | |
|  | Number of pits per tracheid | 0.00 (0.00) | 0.15 (0.13) | |
| Severe | Specific conductivity | 0.08 (0.00) | 0.22 (0.02) | |
|  | Lumen diameter | 0.38 (0.20) | 0.42 (0.18) | |
|  | Tracheid length | 0.03 (0.01) | 0.31 (0.12) | |
|  | Tracheid diameter | 0.00 (0.00) | 0.28 (0.10) | |
|  | Number of pits per tracheid | 0.12 (0.03) | 0.17 (0.10) | |