

Supplementary Material

Genome-wide association study of wood anatomical and morphological traits in *Populus trichocarpa*

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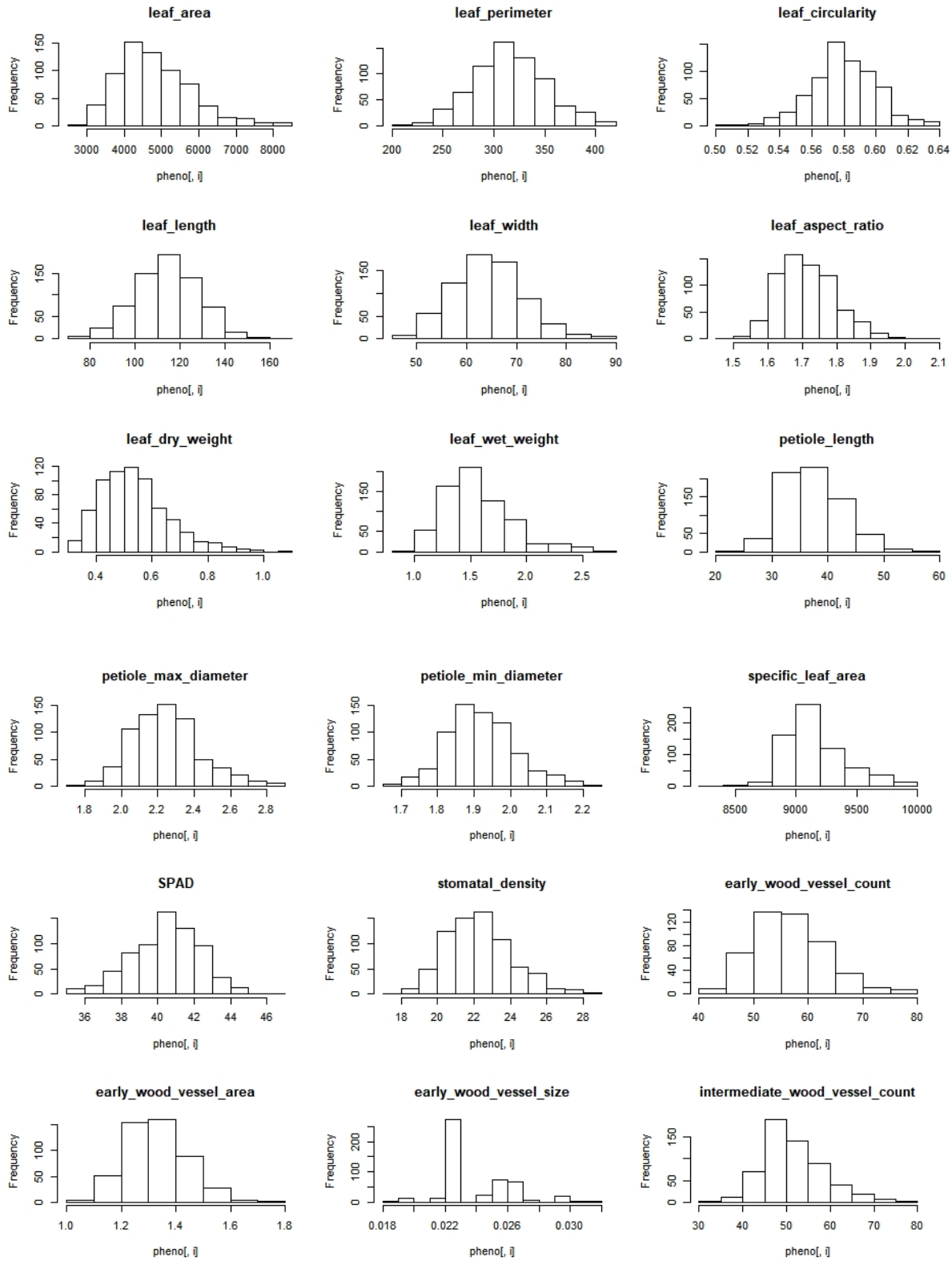
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1 Supplementary Figures



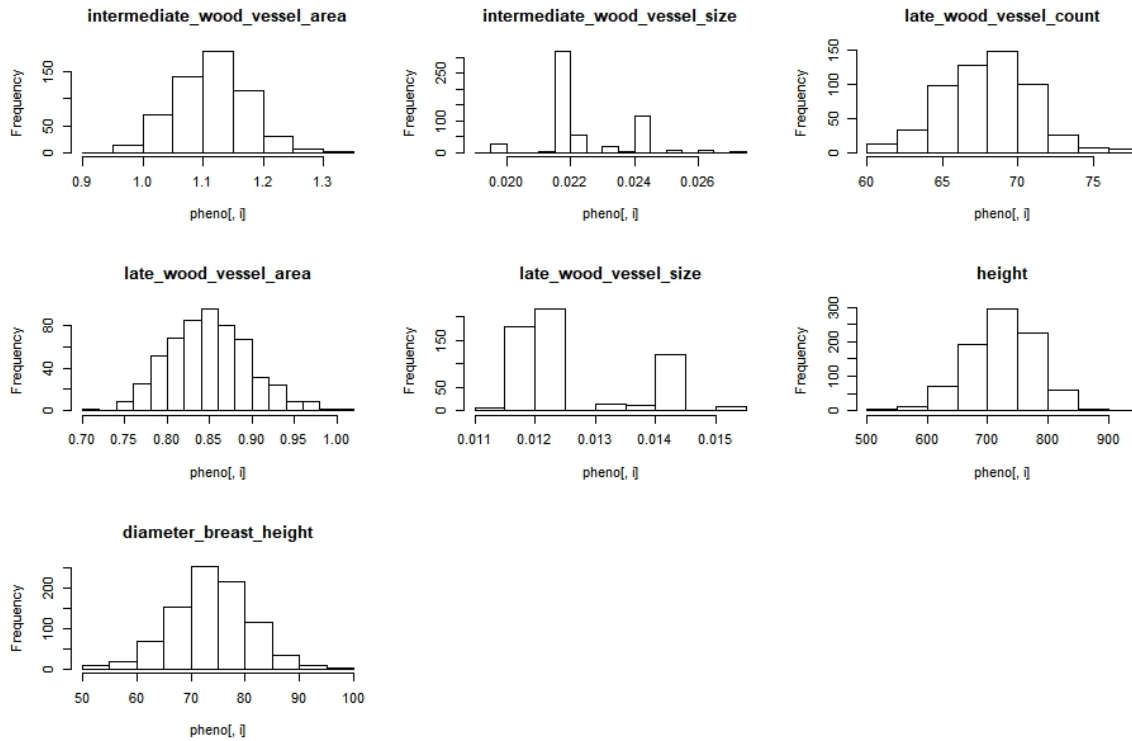


Figure S1. Histograms showing distribution of BLUP adjusted phenotypic values (BLUPs added to the mean phenotypic value) for each of the 25 morphological and anatomical traits used in GWAS study.

Trait																														
Diameter (breast height)	Diameter (breast height)																													
Height	Height																													
Leaf area	Leaf area																													
Leaf perimeter	Leaf perimeter																													
Leaf circularity	Leaf circularity																													
Leaf length	Leaf length																													
Leaf width	Leaf width																													
Leaf aspect ratio	Leaf aspect ratio																													
Leaf dry weight	Leaf dry weight																													
Leaf wet weight	Leaf wet weight																													
Petiole length	Petiole length																													
Petiole diameter (max)	Petiole diameter (max)																													
Petiole diameter (min)	Petiole diameter (min)																													
Specific leaf area	Specific leaf area																													
SPAD	SPAD																													
Stomatal density	Stomatal density																													
Early wood vessel count	Early wood vessel count																													
Early wood vessel area	Early wood vessel area																													
Early wood vessel size	Early wood vessel size																													
Intermediate wood vessel count	Intermediate wood vessel count																													
Intermediate wood vessel area	Intermediate wood vessel area																													
Intermediate wood vessel size	Intermediate wood vessel size																													
Late wood vessel count	Late wood vessel count																													
Late wood vessel area	Late wood vessel area																													
Late wood vessel size	Late wood vessel size																													

Figure S2. Pairwise correlation (r) of *P. trichocarpa* wood anatomical and morphological traits in Clatskanie, Oregon. Shaded values greater than 0.15 or less than -0.15 are significant based on the Bonferroni correction criteria at 5% significance level.

CLATSKANIE	CORVALLIS																	
		Water potential	Stomatal density	SPAD	Petiole length	Petiole diameter (max)	Specific leaf area	Leaf area	Leaf perimeter	Leaf length	Leaf width	Leaf feret ratio	Leaf aspect ratio	Leaf dry weight	Carbon isotope	Bud flush	Bud set	Height
	Traits																	
CLATSKANIE	Diameter (breast height)	0.09	-0.09	-0.07	0.21	0.17	0.15	0.26	0.28	0.26	0.24	0.25	-0.09	0.18	-0.01	0.23	-0.42	0.38
	Height	0.13	-0.06	-0.05	0.23	0.15	0.14	0.25	0.25	0.22	0.26	0.22	-0.15	0.17	0.00	0.25	-0.45	0.44
	Leaf area	-0.01	-0.12	0.04	0.05	0.09	-0.17	0.10	0.08	0.10	0.07	0.09	0.02	0.14	0.03	-0.15	0.26	-0.15
	Leaf perimeter	-0.01	-0.12	0.07	0.08	0.11	-0.18	0.12	0.11	0.14	0.08	0.13	0.05	0.16	0.05	-0.12	0.26	-0.13
	Leaf circularity	0.01	0.04	-0.06	-0.10	-0.08	0.04	-0.05	-0.09	-0.10	-0.02	-0.10	-0.05	-0.05	-0.04	-0.13	0.03	-0.09
	Leaf length	-0.03	-0.12	0.07	0.07	0.11	-0.18	0.11	0.11	0.15	0.06	0.14	0.07	0.15	0.05	-0.12	0.26	-0.12
	Leaf width	0.00	-0.08	0.04	0.01	0.06	-0.15	0.06	0.04	0.05	0.05	0.04	0.00	0.11	0.02	-0.18	0.29	-0.19
	Leaf aspect ratio	-0.02	-0.07	0.06	0.08	0.09	-0.01	0.09	0.13	0.17	0.03	0.17	0.11	0.06	0.05	0.15	-0.12	0.16
	Leaf dry weight	-0.05	-0.10	0.05	0.02	0.10	-0.23	0.10	0.08	0.10	0.07	0.08	0.01	0.15	0.03	-0.14	0.30	-0.15
	Leaf wet weight	-0.02	-0.14	0.05	0.07	0.15	-0.20	0.17	0.15	0.16	0.13	0.15	-0.02	0.20	0.04	-0.10	0.23	-0.12
	Petiole length	-0.03	-0.02	0.10	0.02	0.01	-0.20	-0.05	-0.05	-0.03	-0.06	-0.04	0.07	0.01	0.01	-0.19	0.40	-0.26
	Petiole diameter (max)	-0.02	-0.12	0.03	0.02	0.13	-0.19	0.12	0.10	0.11	0.11	0.10	-0.03	0.15	0.05	-0.08	0.26	-0.12
	Petiole diameter (min)	-0.01	-0.13	0.04	0.03	0.15	-0.17	0.14	0.13	0.13	0.12	0.12	-0.02	0.16	0.05	-0.05	0.20	-0.10
	Specific leaf area	0.00	-0.03	-0.09	0.02	-0.04	0.09	0.01	0.01	0.02	-0.01	0.02	0.03	-0.02	0.02	-0.02	-0.10	-0.01
	SPAD	-0.05	-0.08	0.20	-0.03	0.01	-0.15	-0.05	-0.05	-0.04	-0.04	-0.04	0.02	-0.01	0.08	0.00	0.20	-0.05
	Stomatal density	-0.02	0.35	-0.09	-0.09	-0.10	0.17	-0.16	-0.16	-0.18	-0.11	-0.18	-0.03	-0.18	-0.09	0.06	-0.01	-0.04
	Early wood vessel count	0.07	-0.03	-0.03	0.03	0.04	0.06	0.04	0.03	0.01	0.05	0.02	-0.03	0.05	-0.01	0.09	-0.13	0.12
	Early wood vessel area	0.08	-0.09	-0.08	0.09	0.09	0.09	0.13	0.13	0.11	0.13	0.11	-0.06	0.13	-0.09	0.07	-0.16	0.15
	Early wood vessel size	-0.02	-0.06	-0.06	0.05	0.04	0.04	0.05	0.07	0.07	0.05	0.06	-0.01	0.05	-0.01	-0.04	-0.03	0.03
	Intermediate wood vessel count	0.06	0.07	0.02	-0.01	-0.01	0.00	0.02	0.00	-0.02	0.01	-0.01	-0.03	0.03	0.01	0.07	-0.05	0.06
	Intermediate wood vessel area	0.06	-0.03	0.01	0.02	0.03	-0.02	0.09	0.09	0.06	0.09	0.07	-0.05	0.09	-0.02	0.10	-0.10	0.12
	Intermediate wood vessel size	-0.06	-0.10	-0.02	0.03	0.06	-0.01	0.09	0.10	0.10	0.09	0.10	-0.01	0.05	-0.02	0.03	-0.11	0.05
	Late wood vessel count	0.05	-0.03	-0.07	0.03	-0.01	0.04	0.02	0.01	0.00	0.02	0.01	-0.01	0.04	0.01	0.06	0.01	0.05
	Late wood vessel area	0.05	-0.05	0.00	0.14	0.10	-0.01	0.13	0.13	0.11	0.13	0.11	-0.06	0.14	-0.05	0.15	-0.16	0.19
	Late wood vessel size	-0.05	-0.02	0.06	0.06	0.04	-0.03	0.06	0.09	0.07	0.06	0.06	-0.04	0.04	-0.02	0.09	-0.16	0.11

Figure S3. Pearson correlation (r) of *P. trichocarpa* wood anatomical and morphological traits in Clatskanie, Oregon with morphological and physiological traits in Corvallis, OR. Shaded values greater than 0.15 or less than -0.15 are significant based on the Bonferroni correction criteria at 5% significance level.

	Trait/Climate	Longitude	Latitude	Elevation	MAT	MWMT	MCT	TD	MAP	MSP	AHM	SHM	DD-0	DD-5	DD-10	DD-15	DD-20	DD-25	DD-30	DD-35	DD-40	DD-45	DD-50	DD-55	DD-60	DD-65	DD-70	DD-75	DD-80	DD-85	DD-90	DD-95	DD-100	DD-105	DD-110	DD-115	DD-120	DD-125	DD-130	DD-135	DD-140	DD-145	DD-150	DD-155	DD-160	DD-165	DD-170	DD-175	DD-180	DD-185	DD-190	DD-195	DD-200	DD-205	DD-210	DD-215	DD-220	DD-225	DD-230	DD-235	DD-240	DD-245	DD-250	DD-255	DD-260	DD-265	DD-270	DD-275	DD-280	DD-285	DD-290	DD-295	DD-300	DD-305	DD-310	DD-315	DD-320	DD-325	DD-330	DD-335	DD-340	DD-345	DD-350	DD-355	DD-360	DD-365	DD-370	DD-375	DD-380	DD-385	DD-390	DD-395	DD-400	DD-405	DD-410	DD-415	DD-420	DD-425	DD-430	DD-435	DD-440	DD-445	DD-450	DD-455	DD-460	DD-465	DD-470	DD-475	DD-480	DD-485	DD-490	DD-495	DD-500	DD-505	DD-510	DD-515	DD-520	DD-525	DD-530	DD-535	DD-540	DD-545	DD-550	DD-555	DD-560	DD-565	DD-570	DD-575	DD-580	DD-585	DD-590	DD-595	DD-600	DD-605	DD-610	DD-615	DD-620	DD-625	DD-630	DD-635	DD-640	DD-645	DD-650	DD-655	DD-660	DD-665	DD-670	DD-675	DD-680	DD-685	DD-690	DD-695	DD-700	DD-705	DD-710	DD-715	DD-720	DD-725	DD-730	DD-735	DD-740	DD-745	DD-750	DD-755	DD-760	DD-765	DD-770	DD-775	DD-780	DD-785	DD-790	DD-795	DD-800	DD-805	DD-810	DD-815	DD-820	DD-825	DD-830	DD-835	DD-840	DD-845	DD-850	DD-855	DD-860	DD-865	DD-870	DD-875	DD-880	DD-885	DD-890	DD-895	DD-900	DD-905	DD-910	DD-915	DD-920	DD-925	DD-930	DD-935	DD-940	DD-945	DD-950	DD-955	DD-960	DD-965	DD-970	DD-975	DD-980	DD-985	DD-990	DD-995	DD-1000	DD-1005	DD-1010	DD-1015	DD-1020	DD-1025	DD-1030	DD-1035	DD-1040	DD-1045	DD-1050	DD-1055	DD-1060	DD-1065	DD-1070	DD-1075	DD-1080	DD-1085	DD-1090	DD-1095	DD-1100	DD-1105	DD-1110	DD-1115	DD-1120	DD-1125	DD-1130	DD-1135	DD-1140	DD-1145	DD-1150	DD-1155	DD-1160	DD-1165	DD-1170	DD-1175	DD-1180	DD-1185	DD-1190	DD-1195	DD-1200	DD-1205	DD-1210	DD-1215	DD-1220	DD-1225	DD-1230	DD-1235	DD-1240	DD-1245	DD-1250	DD-1255	DD-1260	DD-1265	DD-1270	DD-1275	DD-1280	DD-1285	DD-1290	DD-1295	DD-1300	DD-1305	DD-1310	DD-1315	DD-1320	DD-1325	DD-1330	DD-1335	DD-1340	DD-1345	DD-1350	DD-1355	DD-1360	DD-1365	DD-1370	DD-1375	DD-1380	DD-1385	DD-1390	DD-1395	DD-1400	DD-1405	DD-1410	DD-1415	DD-1420	DD-1425	DD-1430	DD-1435	DD-1440	DD-1445	DD-1450	DD-1455	DD-1460	DD-1465	DD-1470	DD-1475	DD-1480	DD-1485	DD-1490	DD-1495	DD-1500	DD-1505	DD-1510	DD-1515	DD-1520	DD-1525	DD-1530	DD-1535	DD-1540	DD-1545	DD-1550	DD-1555	DD-1560	DD-1565	DD-1570	DD-1575	DD-1580	DD-1585	DD-1590	DD-1595	DD-1600	DD-1605	DD-1610	DD-1615	DD-1620	DD-1625	DD-1630	DD-1635	DD-1640	DD-1645	DD-1650	DD-1655	DD-1660	DD-1665	DD-1670	DD-1675	DD-1680	DD-1685	DD-1690	DD-1695	DD-1700	DD-1705	DD-1710	DD-1715	DD-1720	DD-1725	DD-1730	DD-1735	DD-1740	DD-1745	DD-1750	DD-1755	DD-1760	DD-1765	DD-1770	DD-1775	DD-1780	DD-1785	DD-1790	DD-1795	DD-1800	DD-1805	DD-1810	DD-1815	DD-1820	DD-1825	DD-1830	DD-1835	DD-1840	DD-1845	DD-1850	DD-1855	DD-1860	DD-1865	DD-1870	DD-1875	DD-1880	DD-1885	DD-1890	DD-1895	DD-1900	DD-1905	DD-1910	DD-1915	DD-1920	DD-1925	DD-1930	DD-1935	DD-1940	DD-1945	DD-1950	DD-1955	DD-1960	DD-1965	DD-1970	DD-1975	DD-1980	DD-1985	DD-1990	DD-1995	DD-2000	DD-2005	DD-2010	DD-2015	DD-2020	DD-2025	DD-2030	DD-2035	DD-2040	DD-2045	DD-2050	DD-2055	DD-2060	DD-2065	DD-2070	DD-2075	DD-2080	DD-2085	DD-2090	DD-2095	DD-2100	DD-2105	DD-2110	DD-2115	DD-2120	DD-2125	DD-2130	DD-2135	DD-2140	DD-2145	DD-2150	DD-2155	DD-2160	DD-2165	DD-2170	DD-2175	DD-2180	DD-2185	DD-2190	DD-2195	DD-2200	DD-2205	DD-2210	DD-2215	DD-2220	DD-2225	DD-2230	DD-2235	DD-2240	DD-2245	DD-2250	DD-2255	DD-2260	DD-2265	DD-2270	DD-2275	DD-2280	DD-2285	DD-2290	DD-2295	DD-2300	DD-2305	DD-2310	DD-2315	DD-2320	DD-2325	DD-2330	DD-2335	DD-2340	DD-2345	DD-2350	DD-2355	DD-2360	DD-2365	DD-2370	DD-2375	DD-2380	DD-2385	DD-2390	DD-2395	DD-2400	DD-2405	DD-2410	DD-2415	DD-2420	DD-2425	DD-2430	DD-2435	DD-2440	DD-2445	DD-2450	DD-2455	DD-2460	DD-2465	DD-2470	DD-2475	DD-2480	DD-2485	DD-2490	DD-2495	DD-2500	DD-2505	DD-2510	DD-2515	DD-2520	DD-2525	DD-2530	DD-2535	DD-2540	DD-2545	DD-2550	DD-2555	DD-2560	DD-2565	DD-2570	DD-2575	DD-2580	DD-2585	DD-2590	DD-2595	DD-2600	DD-2605	DD-2610	DD-2615	DD-2620	DD-2625	DD-2630	DD-2635	DD-2640	DD-2645	DD-2650	DD-2655	DD-2660	DD-2665	DD-2670	DD-2675	DD-2680	DD-2685	DD-2690	DD-2695	DD-2700	DD-2705	DD-2710	DD-2715	DD-2720	DD-2725	DD-2730	DD-2735	DD-2740	DD-2745	DD-2750	DD-2755	DD-2760	DD-2765	DD-2770	DD-2775	DD-2780	DD-2785	DD-2790	DD-2795	DD-2800	DD-2805	DD-2810	DD-2815	DD-2820	DD-2825	DD-2830	DD-2835	DD-2840	DD-2845	DD-2850	DD-2855	DD-2860	DD-2865	DD-2870	DD-2875	DD-2880	DD-2885	DD-2890	DD-2895	DD-2900	DD-2905	DD-2910	DD-2915	DD-2920	DD-2925	DD-2930	DD-2935	DD-2940	DD-2945	DD-2950	DD-2955	DD-2960	DD-2965	DD-2970	DD-2975	DD-2980	DD-2985	DD-2990	DD-2995	DD-3000	DD-3005	DD-3010	DD-3015	DD-3020	DD-3025	DD-3030	DD-3035	DD-3040	DD-3045	DD-3050	DD-3055	DD-3060	DD-3065	DD-3070	DD-3075	DD-3080	DD-3085	DD-3090	DD-3095	DD-3100	DD-3105	DD-3110	DD-3115	DD-3120	DD-3125	DD-3130	DD-3135	DD-3140	DD-3145	DD-3150	DD-3155	DD-3160	DD-3165	DD-3170	DD-3175	DD-3180	DD-3185	DD-3190	DD-3195	DD-3200	DD-3205	DD-3210	DD-3215	DD-3220	DD-3225	DD-3230	DD-3235	DD-3240	DD-3245	DD-3250	DD-3255	DD-3260	DD-3265	DD-3270	DD-3275	DD-3280	DD-3285	DD-3290	DD-3295	DD-3300	DD-3305	DD-3310	DD-3315	DD-3320	DD-3325	DD-3330	DD-3335	DD-3340	DD-3345	DD-3350	DD-3355	DD-3360	DD-3365	DD-3370	DD-3375	DD-3380	DD-3385	DD-3390	DD-3395	DD-3400	DD-3405	DD-3410	DD-3415	DD-3420	DD-3425	DD-3430	DD-3435	DD-3440	DD-3445	DD-3450	DD-3455	DD-3460	DD-3465	DD-3470	DD-3475	DD-3480	DD-3485	DD-3490	DD-3495	DD-3500	DD-3505	DD-3510	DD-3515	DD-3520	DD-3525	DD-3530	DD-3535	DD-3540	DD-3545	DD-3550	DD-3555	DD-3560	DD-3565	DD-3570	DD-3575	DD-3580	DD-3585	DD-3590	DD-3595	DD-3600	DD-3605	DD-3610	DD-3615	DD-3620	DD-3625	DD-3630	DD-3635	DD-3640	DD-3645	DD-3650	DD-3655	DD-3660	DD-3665	DD-3670	DD-3675	DD-3680	DD-3685	DD-3690	DD-3695	DD-3700	DD-3705	DD-3710	DD-3715	DD-3720	DD-3725	DD-3730	DD-3735	DD-3740	DD-3745	DD-3750	DD-3755	DD-3760	DD-3765	DD-3770	DD-3775	DD-3780	DD-3785	DD-3790	DD-3795	DD-3800	DD-3805	DD-3810	DD-3815	DD-3820	DD-3825	DD-3830	DD-3835	DD-3840	DD-3845	DD-3850	DD-3855	DD-3860	DD-3865	DD-3870	DD-3875	DD-3880	DD-3885	DD-3890	DD-3895	DD-3900	DD-3905	DD-3910	DD-3915	DD-3920	DD-3925	DD-3930	DD-3935	DD-3940	DD-3945	DD-3950	DD-3955	DD-3960	DD-3965	DD-3970	DD-3975	DD-3980	DD-3985	DD-3990	DD-3995	DD-4000	DD-4005	DD-4010	DD-4015	DD-4020	DD-4025	DD-4030	DD-4035	DD-4040	DD-4045	DD-4050	DD-4055	DD-4060	DD-4065	DD-4070	DD-4075	DD-4080	DD-4085	DD-4090	DD-4095	DD-4100	DD-4105	DD-4110	DD-4115	DD-4120	DD-4125	DD-4130	DD-4135	DD-4140	DD-4145	DD-4150	DD-4155	DD-4160	DD-4165	DD-4170	DD-4175	DD-4180	DD-4185	DD-4190	DD-4195	DD-4200	DD-4205	DD-4210	DD-4215	DD-4220	DD-4225	DD-4230	DD-4235	DD-4240	DD-4245	DD-4250	DD-4255	DD-4260	DD-4265	DD-4270	DD-4275	DD-4280	DD-4285	DD-4290	DD-4295	DD-4300	DD-4305	DD-4310	DD-4315	DD-4320	DD-4325	DD-4330	DD-4335	DD-4340	DD-4345	DD-4350	DD-4355	DD-4360	DD-4365	DD-4370	DD-4375	DD-4380	DD-4385	DD-4390	DD-4395	DD-4400	DD-4405	DD-4410	DD-4415	DD-4420	DD-4425	DD-4430	DD-4435	DD-4440	DD-4445	DD-4450	DD-4455	DD-4460	DD-4465	DD-4470	DD-4475	DD-4480	DD-4485	DD-4490	DD-4495	DD-4500	DD-4505	DD-4510	DD-4515	DD-4520	DD-4525	DD-4530	DD-4535	DD-4540	DD-4545	DD-4550	DD-4555	DD-4560	DD-4565	DD-4570	DD-4575	DD-4580	DD-4585	DD-4590	DD-4595	DD-4600	DD-4605	DD-4610	DD-4615	DD-4620	DD-4625	DD-4630	DD-4635	DD-4640	DD-4645	DD-4650	DD-4655	DD-4660	DD-4665	DD-4670	DD-4675	DD-4680	DD-4685	DD-4690	DD-4695	DD-4700	DD-4705	DD-4710	DD-4715	DD-4720	DD-4725	DD-4730	DD-4735	DD-4740	DD-4745	DD-4750	DD-4755	DD-4760	DD-4765	DD-4770	DD-4775	DD-4780	DD-4785	DD-4790	DD-4795	DD-4800	DD-4805	DD-4810	DD-4815	DD-4820	DD-4825	DD-4830	DD-4835	DD-4840	DD-4845	DD-4850	DD-4855	DD-4860	DD-4865	DD-4870	DD-4875	DD-4880	DD-4885	DD-4890	DD-4895	DD-4900	DD-4905	DD-4910	DD-4915	DD-4920	DD-4925	DD-4930	DD-4935	DD-4940	DD-4945	DD-4950	DD-4955	DD-4960	DD-4965	DD-4970	DD-4975	DD-4980	DD-4985	DD-4990	DD-4995	DD-5000	DD-5005	DD-5010	DD-5015	DD-5020	DD-5025	DD-5030	DD-5035	DD-5040	DD-5045	DD-5050	DD-5055	DD-5060	DD-5065	DD-5070	DD-5075	DD-5080	DD-5085	DD-5090	DD-5095	DD-5100	DD-5105	DD-5110	DD-5115	DD-5120	DD-5125	DD-5130	DD-5135	DD-5140	DD-5145	DD-5150	DD-5155	DD-5160	DD-5165	DD-5170	DD-5175	DD-5180	DD-5185	DD-5190	DD-5195	DD-5200	DD-5205	DD-5210	DD-5215	DD-5220	DD-5225	DD-5230	DD-5235	DD-5240	DD-5245	DD-5250	DD-5255	DD-5260	DD-5265	DD-5270	DD-5275	DD-5280	DD-5285	DD-5290	DD-5295	DD-5300	DD-5305	DD-5310	DD-5315	DD-5320	DD-5325	DD-5330	DD-5335	DD-5340	DD-5345	DD-5350	DD-5355	DD-5360	DD-5365	DD-5370	DD-5375	DD-5380	DD-5385	DD-5390	DD-5395	DD-5400	DD-5405	DD-5410	DD-5415	DD-5420	DD-5425	DD-5430	DD-5435	DD-5440	DD-5445	DD-5450	DD-5455	DD-5460	DD-5465	DD-5470	DD-5475	DD-5480	DD-5485	DD-5490	DD-5495	DD-5500	DD-5505	DD-5510	DD-5515	DD-5520	DD-5525	DD-5530	DD-5535	DD-5540	DD-5545	DD-5550	DD-5555	DD-5560	DD-5565	DD-5570	DD-5575	DD-5580	DD-5585	DD-5590	DD-5595	DD-5600	DD-5605	DD-5610	DD-5615	DD-5620	DD-5625	DD-5630	DD-5635	DD-5640	DD-5645	DD-5650	DD-5655	DD-5660	DD-5665	DD-5670	DD-5675	DD-5680	DD-5685	DD-
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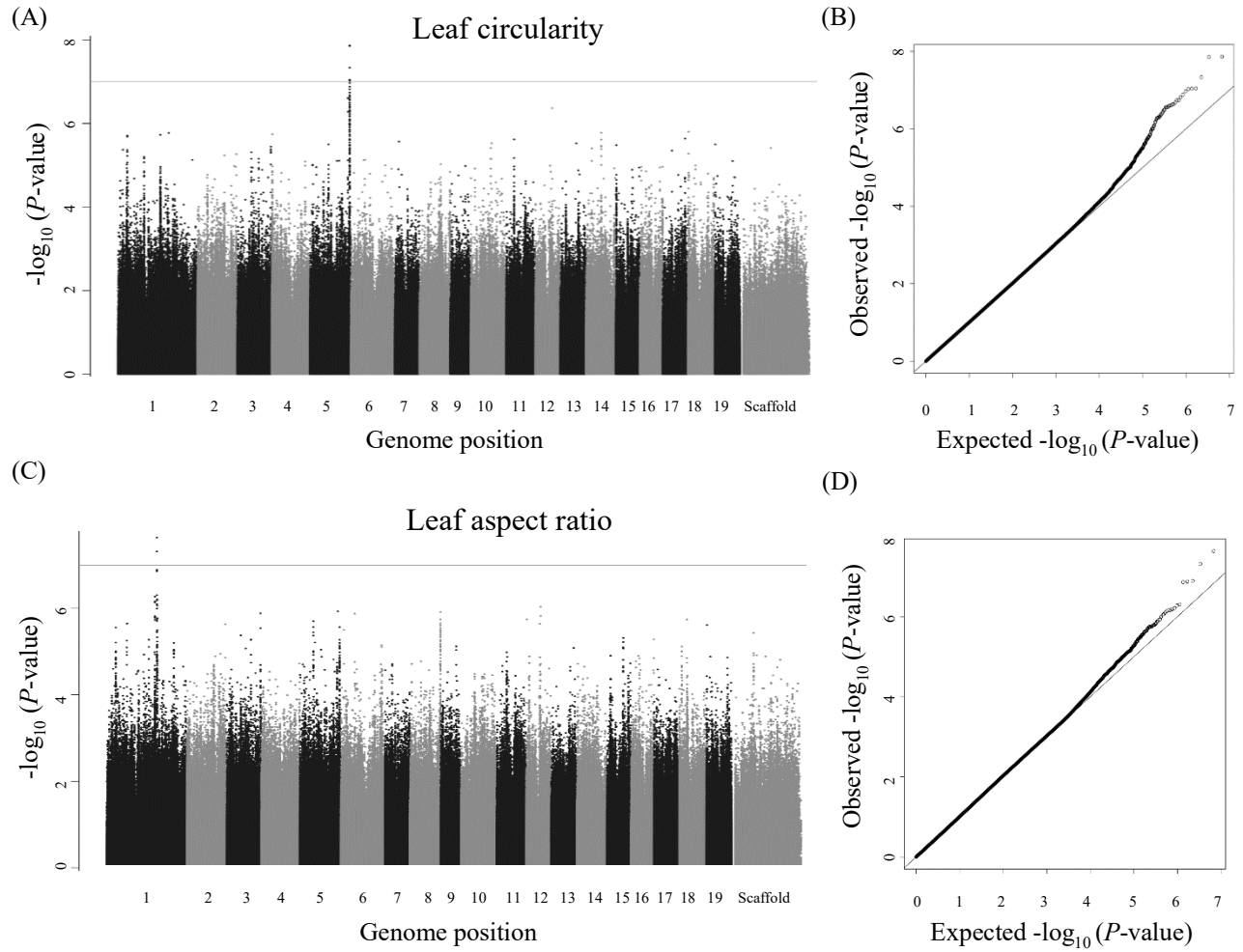


Figure S5. Single trait GWAS – Manhattan (left) and QQ plots (right). Numbers 1 to 19 represent chromosomes; scaffolds are the reads that did not align to any of the 19 chromosomes. (A) and (B) Leaf circularity; (C) and (D) Leaf aspect ratio. SNPs above gray line have $p < 1 \times 10^{-7}$, which is roughly equivalent to $FDR \leq 0.1$ and SNPs above black line (the top line) have $p < 7.417 \times 10^{-9}$ (the Bonferroni correction threshold), which is roughly equivalent to $FDR \leq 0.05$ in this study.

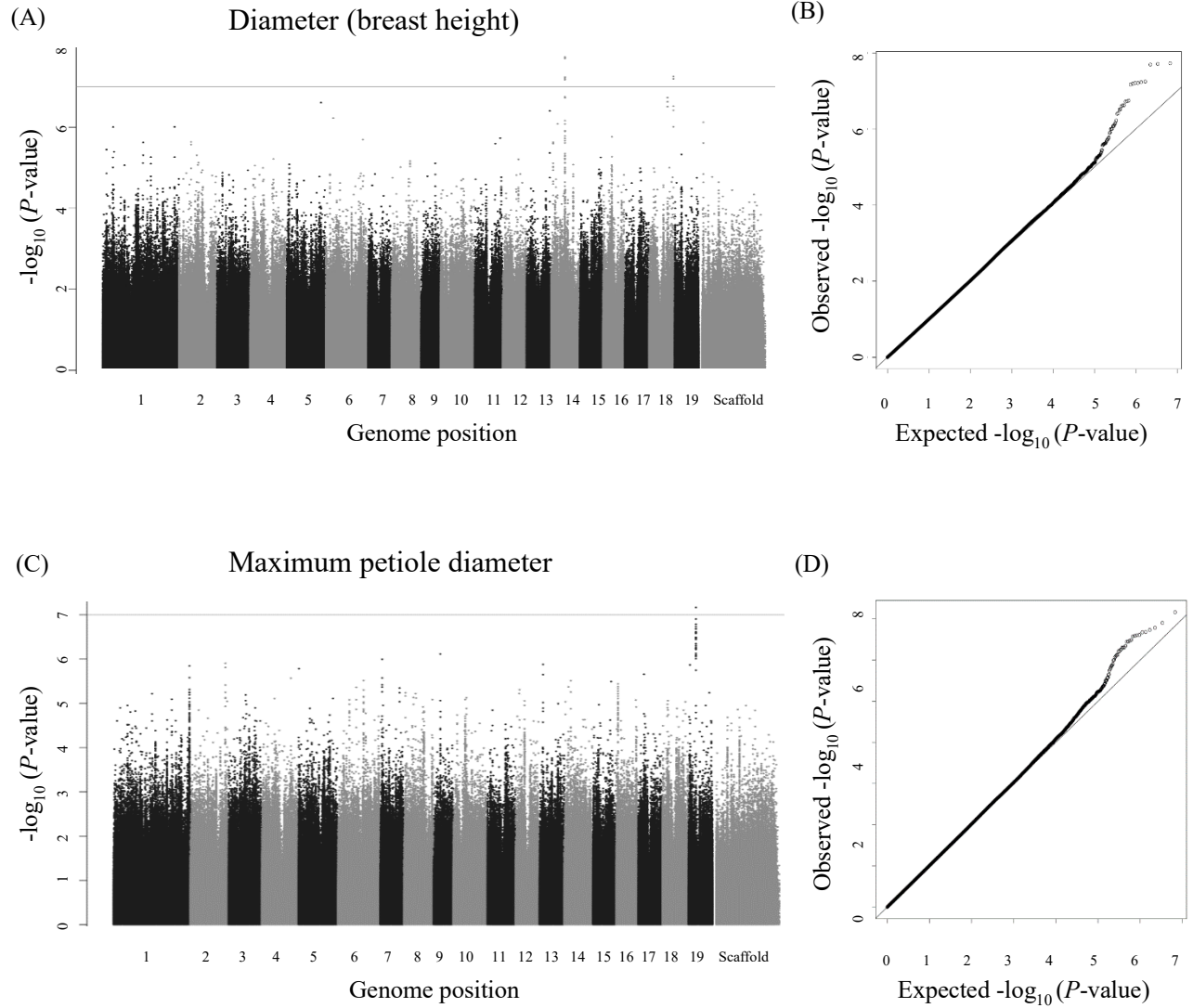


Figure S6. Single trait GWAS – Manhattan (left) and QQ plots (right). Numbers 1 to 19 represent chromosomes; scaffolds are the reads that did not align to any of the 19 chromosomes. (A) and (B) Diameter (breast height); (C) and (D) Maximum petiole diameter. SNPs above gray line have $p < 1 \times 10^{-7}$, which is roughly equivalent to $FDR \leq 0.1$ and SNPs above black line (the top line) have $p < 7.417 \times 10^{-9}$ (the Bonferroni correction threshold), which is roughly equivalent to $FDR \leq 0.05$ in this study.

(A) Vessel area (early wood), leaf area and stomatal density (B)

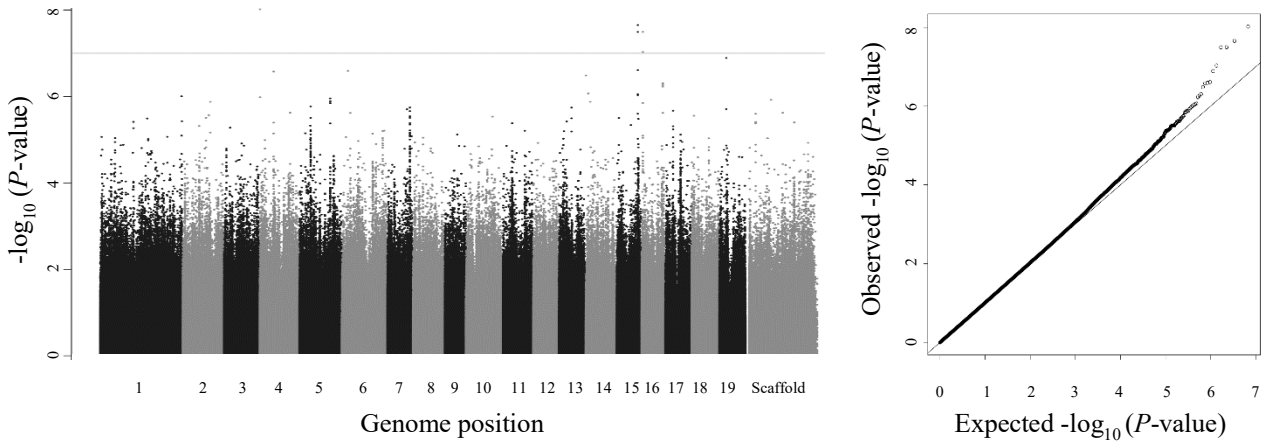


Figure S7. Multitrait GWAS – Manhattan (left) and QQ plots (right). Numbers 1 to 19 represent chromosomes; scaffolds are the reads that did not align to any of the 19 chromosomes. (A) and (B) Vessel area (early wood), leaf area and stomatal density. SNPs above gray line have $p < 1 \times 10^{-7}$, which is roughly equivalent to $FDR \leq 0.1$ and SNPs above black line (the top line) have $p < 7.417 \times 10^{-9}$ (the Bonferroni correction threshold), which is roughly equivalent to $FDR \leq 0.05$ in this study.

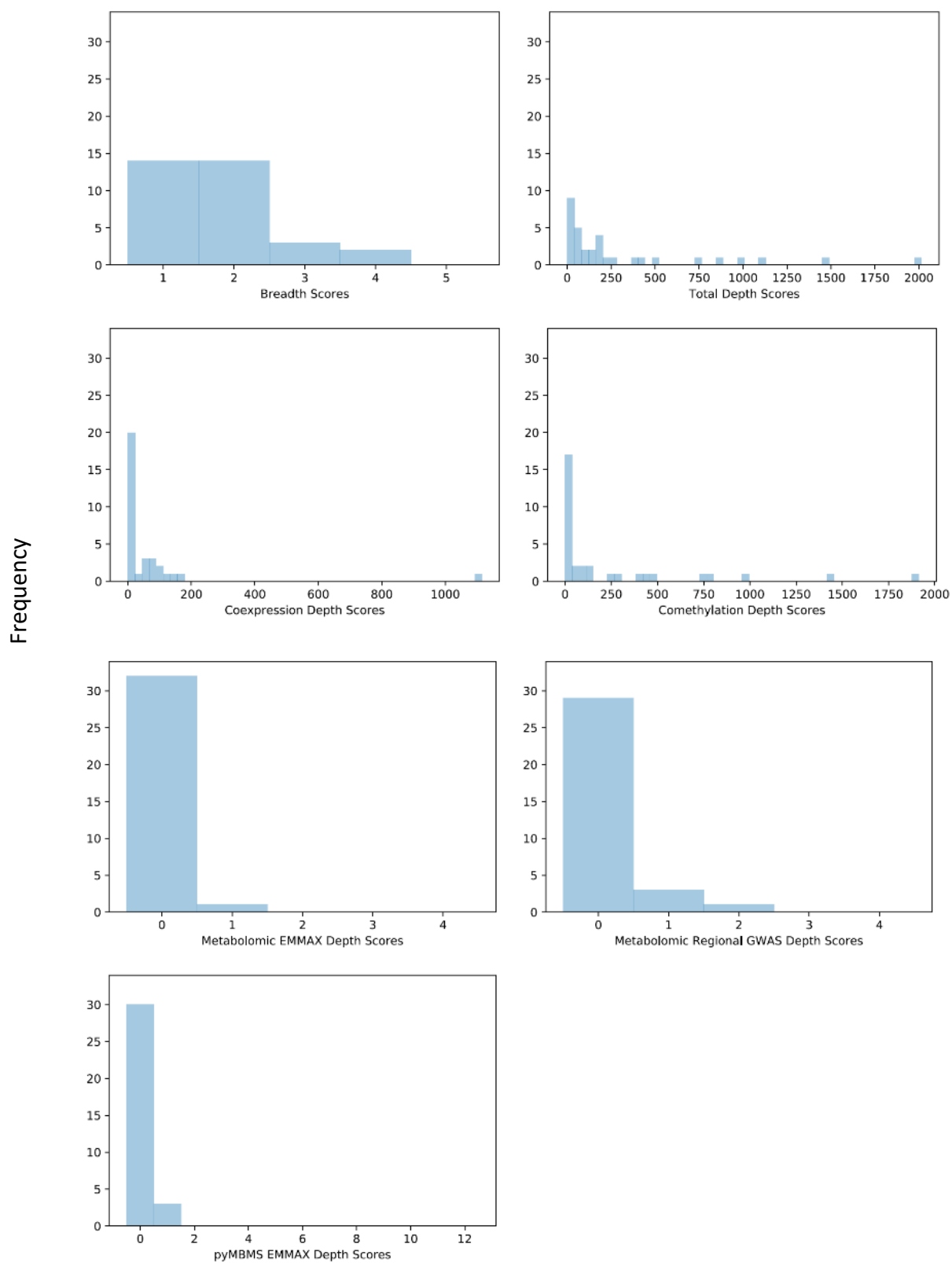


Figure S8. Distributions of LOE scores for all single trait and multitrait anchor (GWAS) genes.

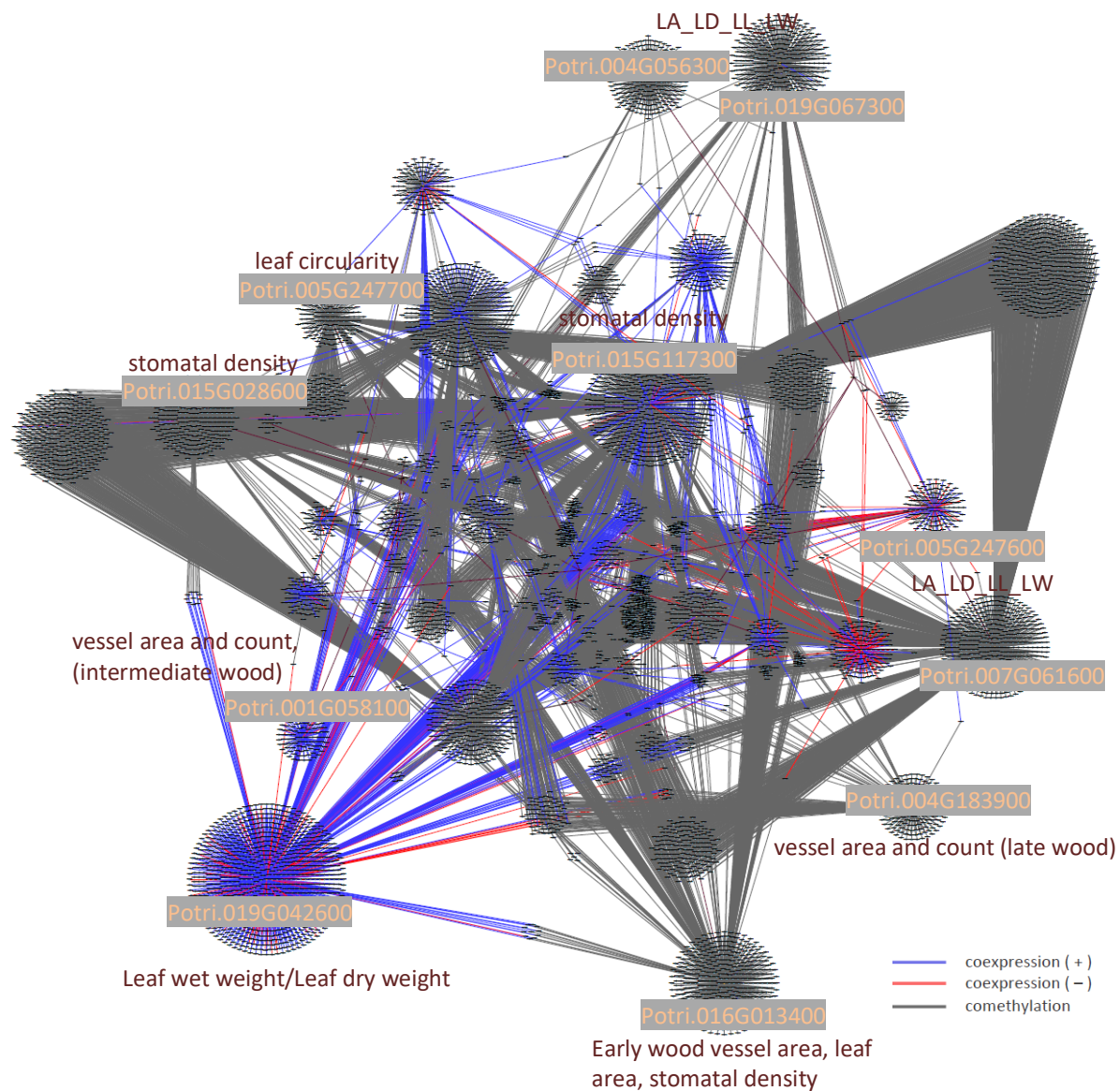


Figure S9. One-hop multi-omic network for all single and multitrait GWAS (anchor) genes with major anchor genes highlighted. LA_LD_LL_LW = leaf area, leaf dry weight, leaf length and leaf width. For GWAS edges, solid maroon indicates “traditional” GWAS and dashed maroon indicates RV metabolite GWAS.

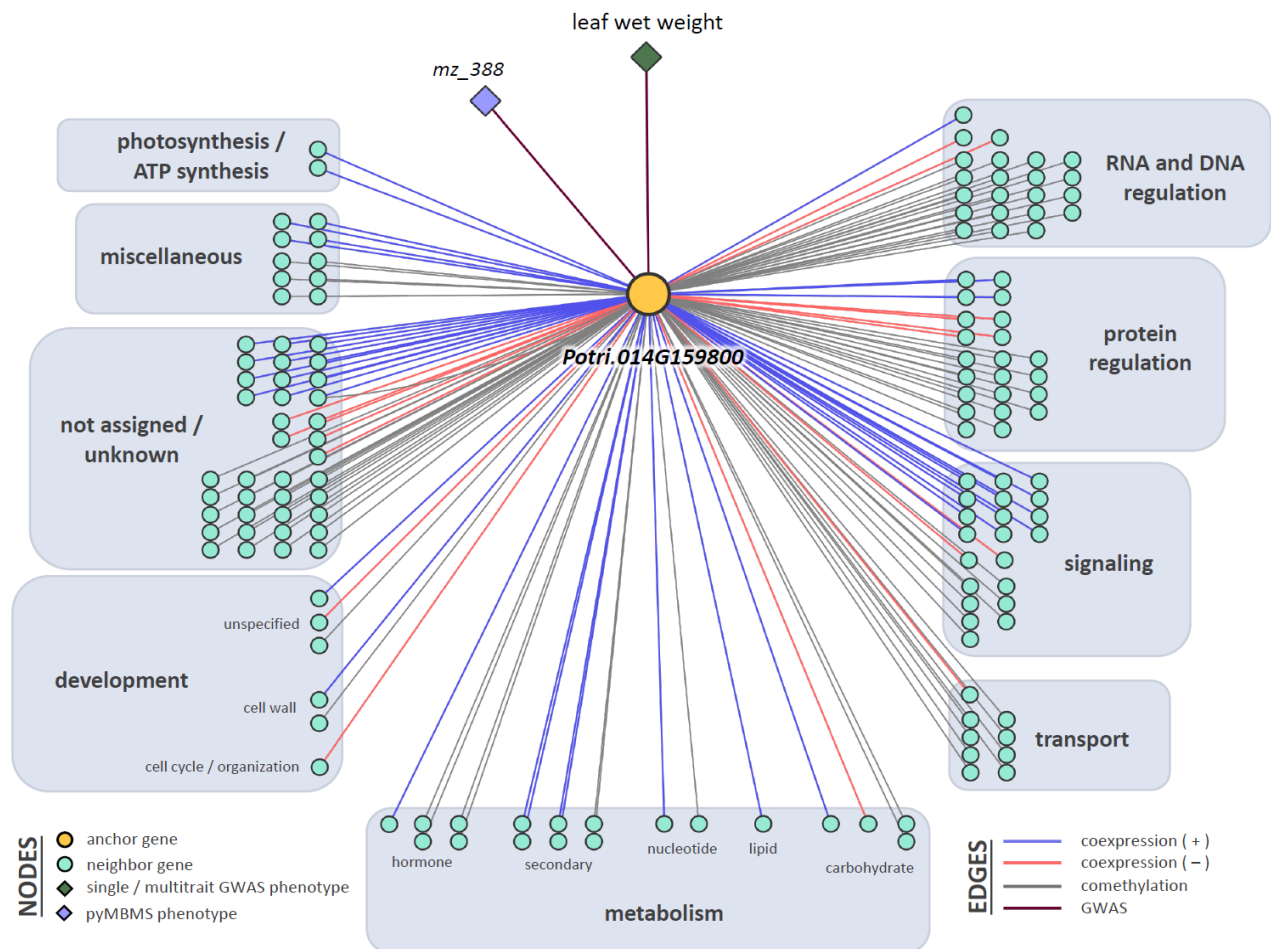


Figure S10. One-hop multi-omic network for the gene *Potri.014G159800*, which was associated with leaf wet weight.

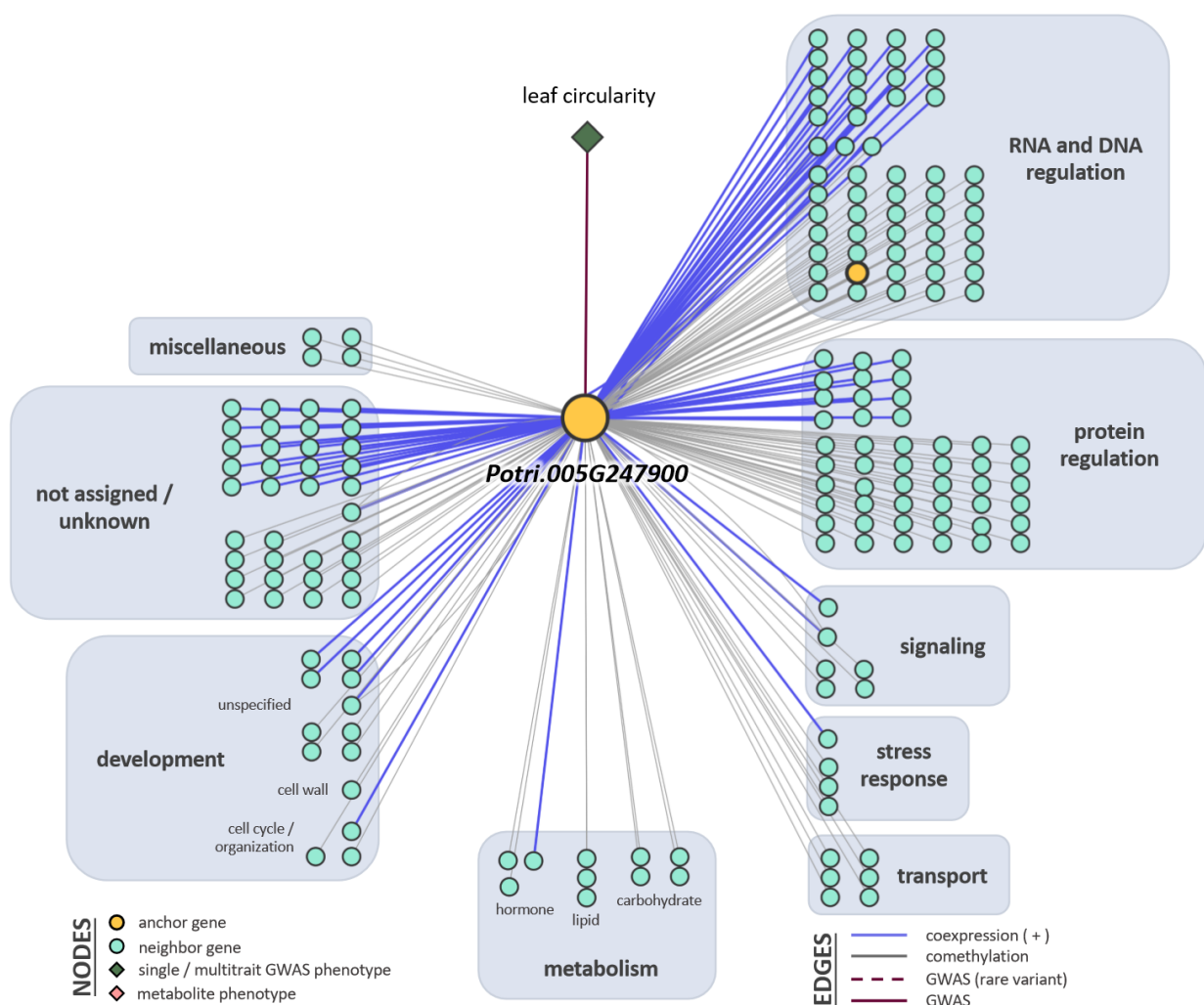


Figure S11. One-hop multi-omic network for the gene *Potri.005G247900*, which was associated with leaf circularity.

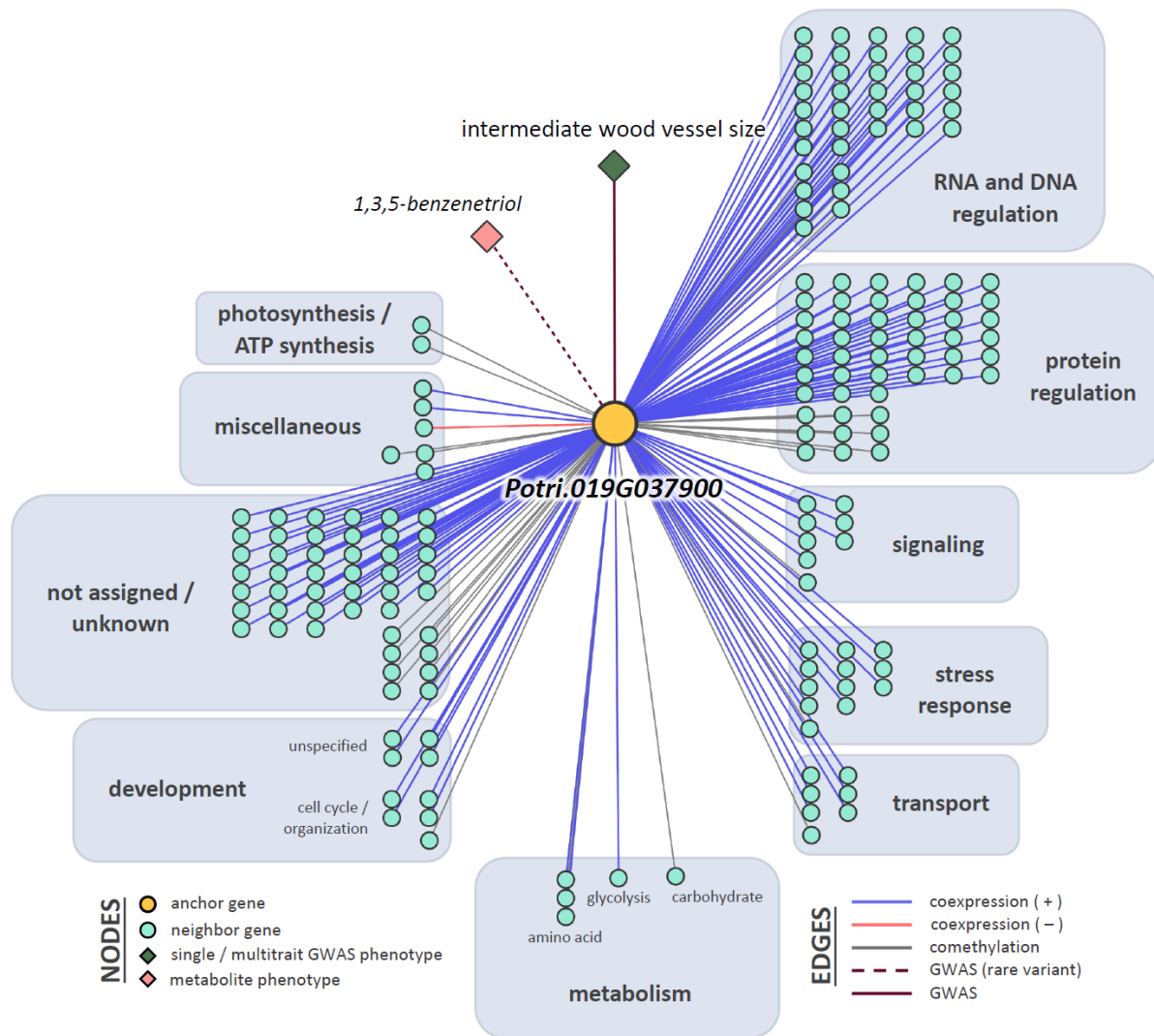


Figure S12. One-hop multi-omic network for the gene Potri.019G037900, which was associated with intermediate wood vessel size.

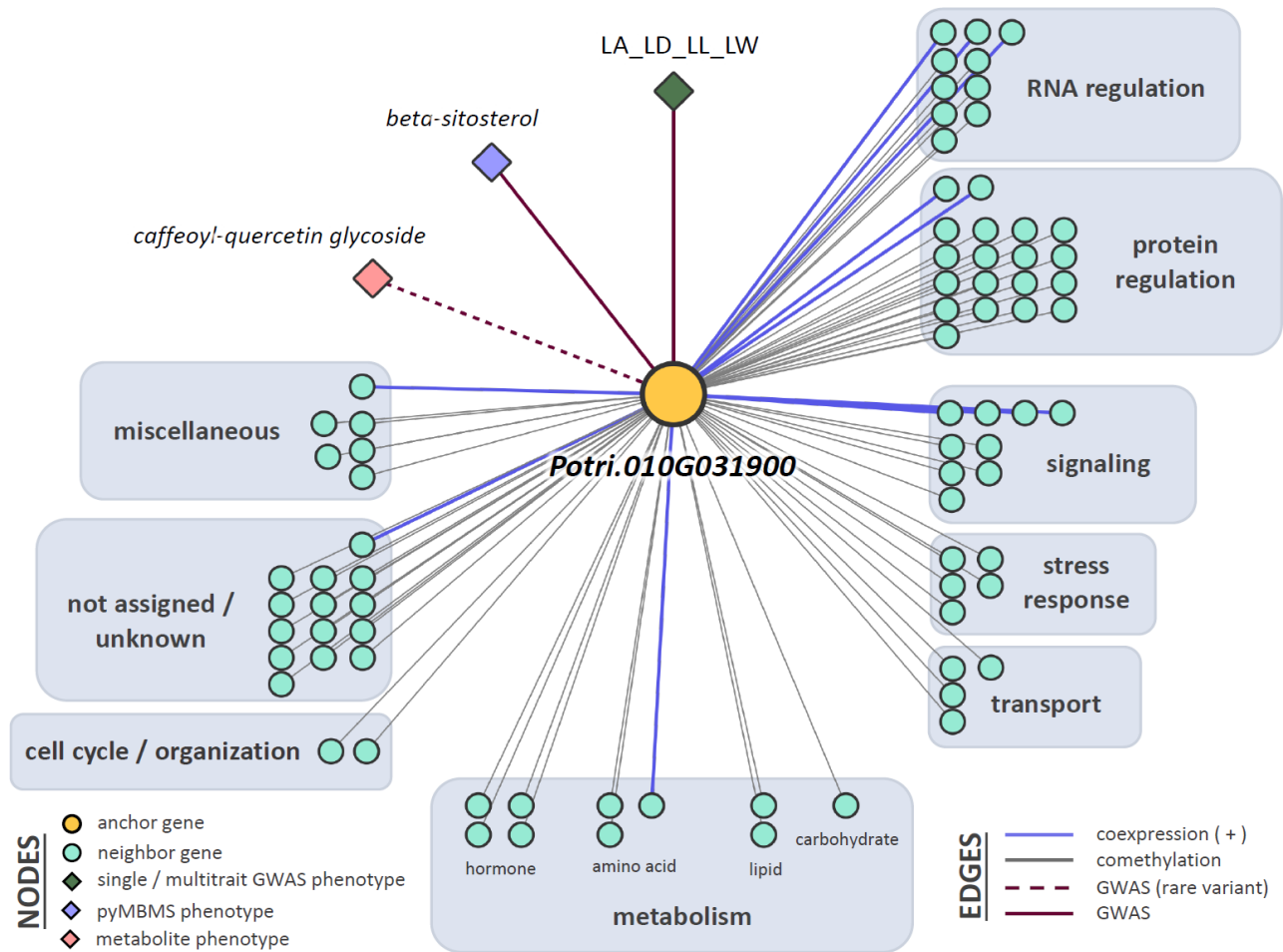


Figure S13. One-hop multi-omic network for the gene Potri.010G031900, which was associated with the multitrait phenotype leaf area, leaf dry weight, leaf length and leaf width.

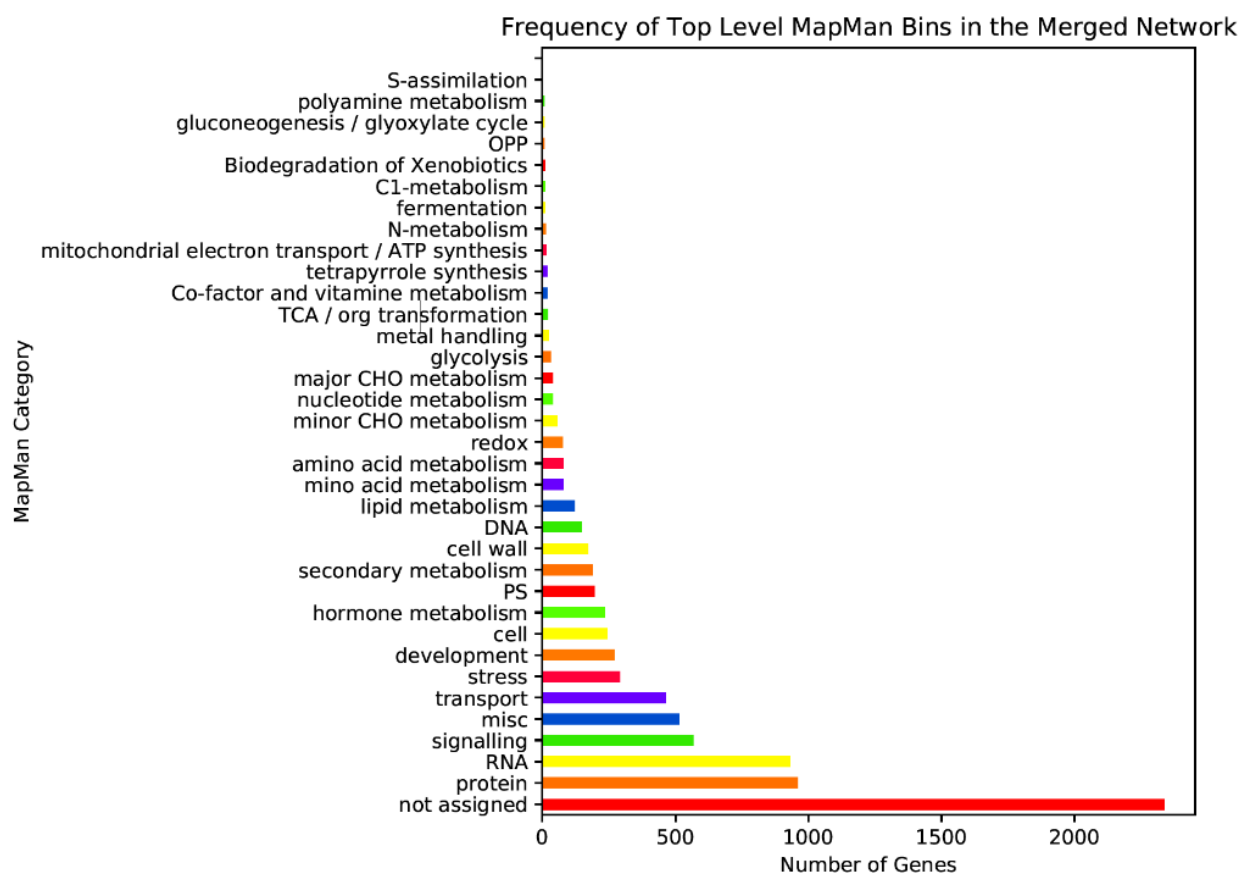


Figure S14. Mapman annotations for all single trait and multitrait GWAS (anchor) genes.

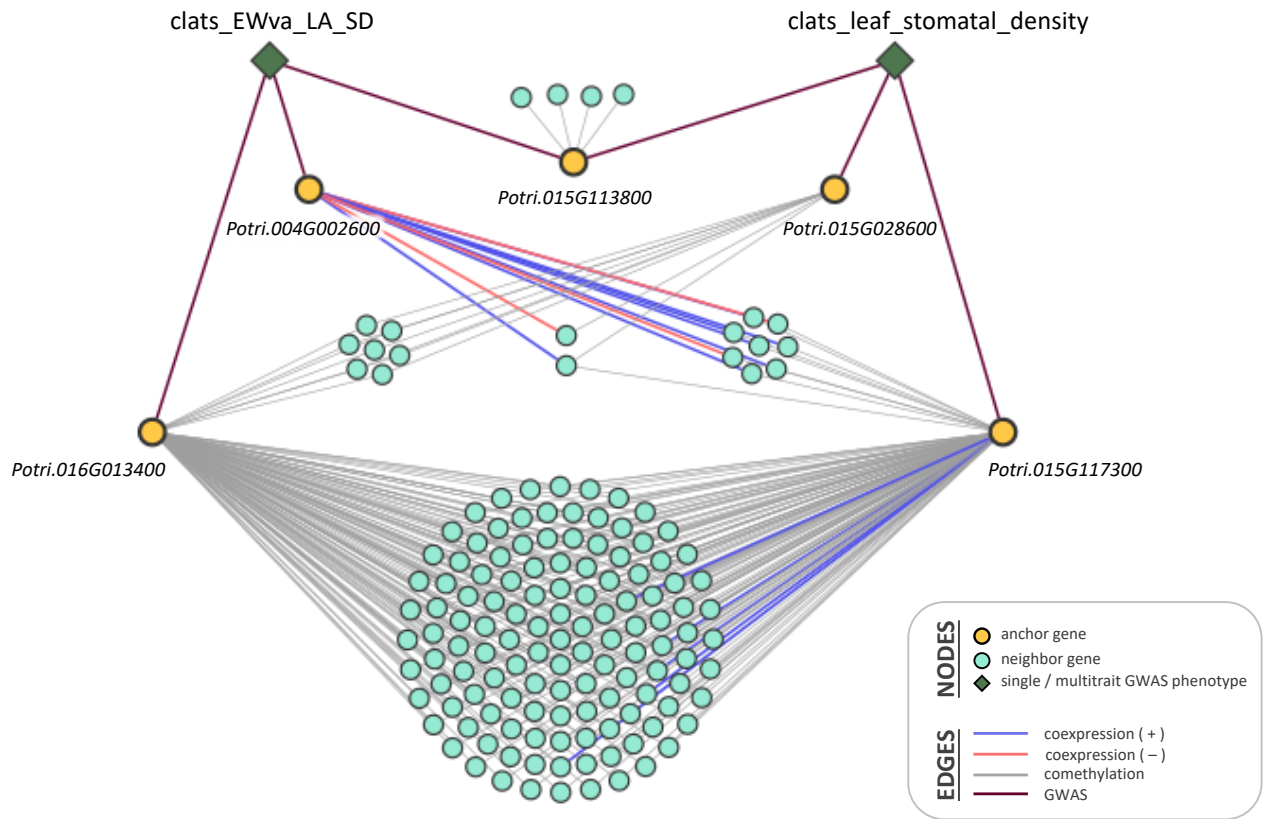


Figure S15. Intersections of subnetworks for single-trait GWAS for Stomatal density and multi-trait GWAS for Early Wood vessel area, Leaf Area, and Stomatal Density.