

ON-LINE SUPPLEMENTARY MATERIAL

Vidaković, A., Matijašević, S., Tumpa, K., Poljak, I.: Leaf phenotypic plasticity of European ash (*Fraxinus excelsior*) at its northern range in Dinaric Alps. Acta Botanica Croatica, DOI: 10.37427/botcro-2025-001.

On-line Suppl. Tab. 1. Geographic coordinates, altitudes, and bioclimatic variables for seven observed *Fraxinus excelsior* populations. Bioclimatic variables: BIO1 (annual mean temperature); BIO2 (mean diurnal range (mean of monthly (max. temp – min. temp))); BIO3 (isothermality (BIO2/BIO7) (×100)); BIO4 (temperature seasonality (standard deviation ×100)); BIO5 (max temperature of warmest month); BIO6 (min temperature of coldest month); BIO7 (temperature annual range (BIO5-BIO6)); BIO8 (mean temperature of wettest quarter); BIO9 (mean temperature of driest quarter); BIO10 (mean temperature of warmest quarter); BIO11 (mean temperature of coldest quarter); BIO12 (annual precipitation); BIO13 (precipitation of wettest month); BIO14 (precipitation of driest month); BIO15 (precipitation seasonality (coefficient of variation)); BIO16 (precipitation of wettest quarter); BIO17 (precipitation of driest quarter); BIO18 (precipitation of warmest quarter); BIO19 (precipitation of coldest quarter). Population acronyms: P1–Žumberak; P2–Crni Lug; P3–Delnice; P4–Vrbovsko; P5–Brinje; P6–Prozor; P7–Perušić.

Pop. ID	Latitude	Longitude	Alt.	Bioclimatic variables (BIO)																		
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
P1	45.806397	15.498413	735	8.28	8.98	32.55	686.85	21.2	–6.4	27.6	16.75	1.12	16.75	–0.12	1261	136	62	20.84	366	223	366	228
P2	45.427192	14.707854	699	7.65	8.99	33.18	683.55	20.7	–6.4	27.1	8.52	0.32	16.17	–0.65	1492	175	93	20.69	475	300	349	318
P3	45.399978	14.821221	727	7.28	9.21	34.62	660.63	20.1	–6.5	26.6	7.95	0.18	15.53	–0.68	1518	177	95	20.40	481	307	350	326
P4	45.380998	15.042382	554	8.37	9.92	35.67	668.38	21.6	–6.2	27.8	8.72	1.28	16.72	0.32	1467	166	86	20.19	464	284	351	304
P5	45.012709	15.152317	535	8.78	10.69	35.64	722.37	23.0	–7.0	30.0	9.22	17.72	17.72	–0.18	1382	169	78	23.92	462	282	282	320
P6	44.846530	15.267748	476	9.48	10.27	33.77	737.65	23.6	–6.8	30.4	9.80	18.70	18.70	0.37	1293	159	69	25.00	438	251	251	307
P7	44.654396	15.420334	554	8.85	11.14	35.94	733.50	23.6	–7.4	31.0	4.38	18.02	18.02	–0.15	1239	160	60	27.53	428	227	227	310

On-line Suppl. Tab. 2. Pearson's correlation coefficients between analysed leaf traits. TL–terminal leaflet; LL–lateral leaflet. Morphometric traits: LA–leaflet area; LL–leaflet length; MLW–maximum leaflet width; PMLW–leaflet length, measured from its base to the point of maximum width; LW1–leaflet width at 50% of its length; LW2–leaflet width at 90% of its length; LA1–angle enclosed by the main leaflet vein and point on its edge, at 10% of its length; LA2–angle enclosed by the main leaflet vein and point on its edge, at 25% of its length; PL–petiole length; RL–rachis length. Statistically significant correlations are highlighted in red ($P < 0.05$).

	LL- LA	LL- LL	LL- MLW	LL- PMLW	LL- LW1	LL- LW2	LL- LA1	LL- LA2	TL- LA	TL- LL	TL- MLW	TL- PMLW	TL- LW1	TL- LW2	TL- LA1	TL- LA2	TL- PL	RL	PL
LL-LA	1.00	0.82	0.92	0.74	0.89	0.46	0.07	0.16	0.79	0.67	0.70	0.70	0.70	0.30	0.22	0.21	0.39	0.30	0.17
LL-LL	0.82	1.00	0.57	0.83	0.52	0.10	-0.30	-0.38	0.61	0.84	0.38	0.76	0.38	-0.01	-0.12	-0.20	0.20	0.20	0.27
LL-MLW	0.92	0.57	1.00	0.57	0.99	0.56	0.27	0.50	0.77	0.45	0.81	0.55	0.81	0.44	0.40	0.45	0.48	0.32	0.09
LL-PMLW	0.74	0.83	0.57	1.00	0.60	0.34	-0.49	-0.36	0.58	0.69	0.40	0.78	0.39	0.24	-0.21	-0.20	0.25	0.11	0.11
LL-LW1	0.89	0.52	0.99	0.60	1.00	0.64	0.21	0.50	0.74	0.40	0.80	0.55	0.80	0.50	0.35	0.43	0.47	0.31	0.07
LL-LW2	0.46	0.10	0.56	0.34	0.64	1.00	0.12	0.44	0.44	0.11	0.51	0.35	0.49	0.71	0.16	0.26	0.27	0.25	0.06
LL-LA1	0.07	-0.30	0.27	-0.49	0.21	0.12	1.00	0.78	0.09	-0.26	0.24	-0.28	0.26	0.03	0.75	0.57	0.24	0.26	0.02
LL-LA2	0.16	-0.38	0.50	-0.36	0.50	0.44	0.78	1.00	0.22	-0.33	0.50	-0.22	0.50	0.40	0.66	0.74	0.32	0.22	-0.07
TL-LA	0.79	0.61	0.77	0.58	0.74	0.44	0.09	0.22	1.00	0.78	0.92	0.76	0.91	0.55	0.41	0.45	0.63	0.08	0.09
TL-LL	0.67	0.84	0.45	0.69	0.40	0.11	-0.26	-0.33	0.78	1.00	0.51	0.89	0.51	0.16	-0.02	-0.10	0.32	0.02	0.20
TL-MLW	0.70	0.38	0.81	0.40	0.80	0.51	0.24	0.50	0.92	0.51	1.00	0.55	1.00	0.62	0.53	0.66	0.66	0.17	0.02
TL-PMLW	0.70	0.76	0.55	0.78	0.55	0.35	-0.28	-0.22	0.76	0.89	0.55	1.00	0.53	0.37	-0.09	-0.16	0.34	0.07	0.15
TL-LW1	0.70	0.38	0.81	0.39	0.80	0.49	0.26	0.50	0.91	0.51	1.00	0.53	1.00	0.59	0.54	0.67	0.66	0.18	0.04
TL-LW2	0.30	-0.01	0.44	0.24	0.50	0.71	0.03	0.40	0.55	0.16	0.62	0.37	0.59	1.00	0.14	0.38	0.39	-0.04	0.02
TL-LA1	0.22	-0.12	0.40	-0.21	0.35	0.16	0.75	0.66	0.41	-0.02	0.53	-0.09	0.54	0.14	1.00	0.84	0.60	0.17	-0.07
TL-LA2	0.21	-0.20	0.45	-0.20	0.43	0.26	0.57	0.74	0.45	-0.10	0.66	-0.16	0.67	0.38	0.84	1.00	0.57	0.06	-0.10
TL-PL	0.39	0.20	0.48	0.25	0.47	0.27	0.24	0.32	0.63	0.32	0.66	0.34	0.66	0.39	0.60	0.57	1.00	0.10	-0.03
RL	0.30	0.20	0.32	0.11	0.31	0.25	0.26	0.22	0.08	0.02	0.17	0.07	0.18	-0.04	0.17	0.06	0.10	1.00	0.21
PL	0.17	0.27	0.09	0.11	0.07	0.06	0.02	-0.07	0.09	0.20	0.02	0.15	0.04	0.02	-0.07	-0.10	-0.03	0.21	1.00

On-line Suppl. Tab. 3. Results of the Fisher's LSD test. Acronyms of populations: P1–Žumberak; P2–Crni Lug; P3–Delnice; P4–Vrbovsko; P5–Brinje; P6–Prozor; P7–Perušić. TL–terminal leaflet; LL–lateral leaflet. Morphometric traits: LA–leaflet area; LL–leaflet length; MLW–maximum leaflet width; PMLW–leaflet length, measured from its base to the point of maximum width; LW1–leaflet width at 50% of its length; LW2–leaflet width at 90% of its length; LA1–angle enclosed by the main leaflet vein and point on its edge, at 10% of its length; LA2–angle enclosed by the main leaflet vein and point on its edge, at 25% of its length; PL–petiole length; RL–rachis length.

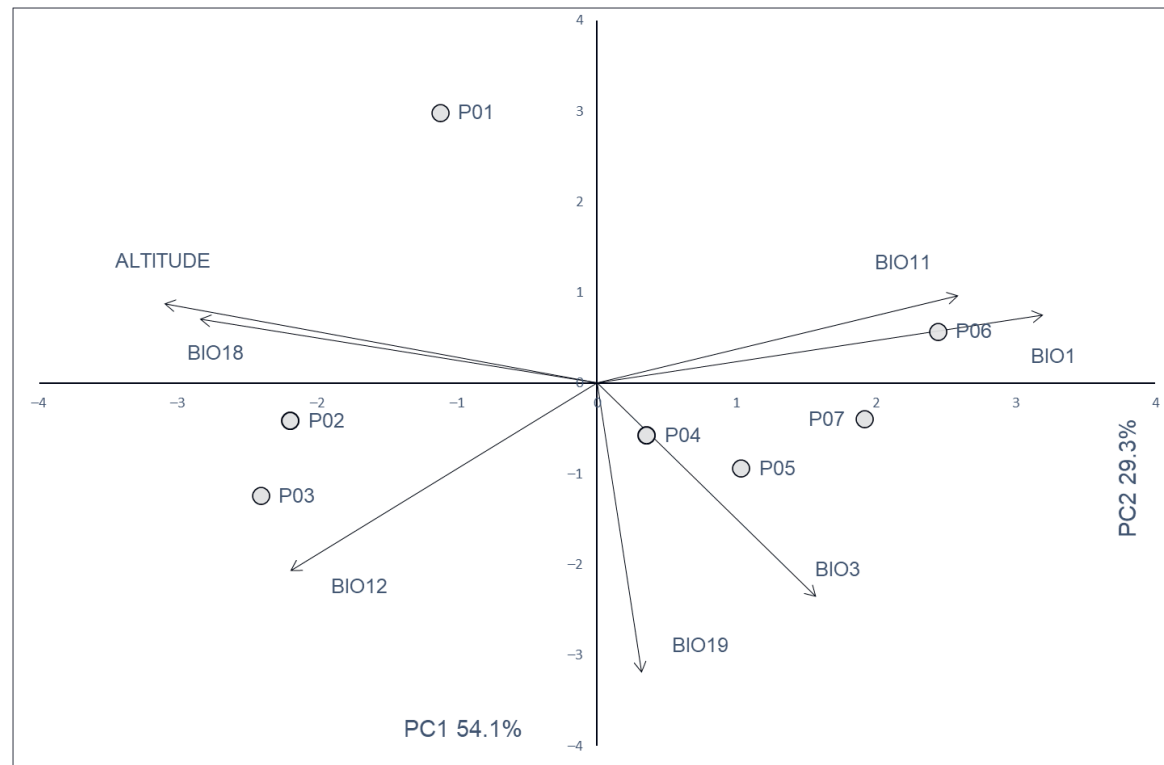
	P1	P2	P3	P4	P5	P6
P2	LL-LA10; TL-LA10; TL-PL					
P3	LL-LA10; LL-LA25; TL-LA10; TL-LA25; TL-PL					
P4	LL-LA10; TL-LA; TL-MPW; TL-LW50; TL-LA10; TL-LA25; TL-PL	TL-MPW; TL-LW50; TL-PL	TL-PL			
P5	LL-LA25; RL; TL-LL	LL-MPW; LL-LW50; LL-LA10; LL-LA25; RL; TL-LA10; TL-LA25	LL-MPW; LL-LW50; LL-LA10; LL-LA25; RL; TL-MPW; TL-LW50; TL-LA10; TL-LA25; TL-PL	LL-MPW; LL-LW50; LL-LA10; LL-LA25; RL; TL-MPW; TL-LW50; TL-LA10; TL-LA25; TL-PL		
P6	LL-LA10	LL-MPW; LL-LW50; LL-LA10; TL-LA; TL-MPW; TL-LW50; TL-LA10; TL-LA25; TL-PL	LL-MPW; LL-LW50; LL-LA10; TL-LA; TL-MPW; TL-LW50; TL-LA10; TL-LA25; TL-PL	LL-MPW; LL-LW50; TL-LA; TL-LL; TL-MPW; TL-LW50; TL-LA10; TL-LA25; TL-PL	LL-LA10; LL-LA25; RL; TL-LL;	
P7	RL; TL-PL	LL-LA10; RL; TL-LA10	LL-LA10; RL; TL-LA10	LL-LA10; RL; TL-LA10; TL-PL	LL-LA25; TL-LA25	LL-LA10; TL-LA; TL-MPW; TL-LW50; TL-LA25; TL-PL

On-line Suppl. Tab. 4. Results of the stepwise discriminant analyses for studied morphometric traits. TL–terminal leaflet; LL–lateral leaflet. LA1–angle enclosed by the main leaflet vein and point on its edge, at 10% of its length; LA2–angle enclosed by the main leaflet vein and point on its edge, at 25% of its length; PL–petiole length; RL–rachis length; LL–leaflet length; LA–leaflet area.

Trait	Wilks'	Partial	F-remove	P-value
TL-LA1	0.053	0.559	7.358	0.000
TL-LA2	0.053	0.564	7.225	0.000
TL-PL	0.052	0.566	7.171	0.000
LL-LA1	0.045	0.657	4.881	0.000
RL	0.038	0.779	2.646	0.025
TL-LL	0.033	0.897	1.072	0.390
TL-LA	0.033	0.909	0.935	0.477
LL-LA2	0.032	0.913	0.885	0.512

On-line Suppl. Tab. 5. Pearson correlation coefficients between altitude and six bioclimatic variables and scores of the first four principal components. Bioclimatic variables: BIO1–annual mean temperature; BIO3–isothermality (BIO2/BIO7) (×100); BIO11–mean temperature of coldest quarter; BIO12–annual precipitation; BIO18–precipitation of warmest quarter; BIO19–precipitation of coldest quarter.

Environmental variable	PC-principal component		
	PC1	PC2	PC3
Altitude	-0.932	0.264	-0.194
BIO1	0.959	0.226	0.019
BIO3	0.471	-0.706	0.076
BIO11	0.776	0.289	0.550
BIO12	-0.660	-0.620	0.388
BIO18	-0.854	0.213	0.464
BIO19	0.095	-0.958	-0.087
Eigenvalue	3.79	2.05	0.72
% Total	54.09	29.28	10.28
% Cumulative	54.09	83.37	93.65



On-line Suppl. Fig. 1. Biplot of the principal component analysis based on seven environmental variables. Acronyms of populations: P1–Žumberak; P2–Crni Lug; P3–Delnice; P4–Vrbovsko; P5–Brinje; P6–Prozor; P7–Perušić. Bioclimatic variables: BIO1–annual mean temperature; BIO3–isothermality (BIO2/BIO7) ($\times 100$); BIO11–mean temperature of coldest quarter; BIO12–annual precipitation; BIO18–precipitation of warmest quarter; BIO19–precipitation of coldest quarter.