

SUPPLEMENTARY MATERIAL

Table S1. Location and habitat description of the selected populations of four *P. nigra* taxa from the Balkan Peninsula and Southern Carpathians.

<i>P. nigra</i> taxa	Locality	Mountain system	Latitude (N)	Longitude (E)	Altitude (m a.s.l.)	Substratum	Number of individuals analyzed	Date of collection	Vaucher
subsp. <i>nigra</i> ¹ (Black pine or Austrian pine)	Croatia: Mt. Lička Plješevica	Dinaric	44°39'25.80"	15°46'7.22"	937	Limestone	10	July, 2015	13095 HMN
	Bosnia and Herzegovina: Mt. Bijela Gora, Arandelovo	Dinaric	42°41'59.27"	18°31'57.65"	379	Limestone	10	August, 2013	7032 HMN
	Serbia: Mt. Tara, Zmajevački potok	Dinaric	43°51'33.68"	19°24'57.76"	869	Serpentine	10	June, 2013	6942 HMN
	Serbia: Kremna, Tarabići	Dinaric	43°52'25.01"	19°34'50.39"	800	Serpentine	10	May, 2013	6935 HMN
	Serbia: Mt. Zlatibor, Tornik	Dinaric	43°39'59.88"	19°37'33.38"	1173	Serpentine	10	May, 2013	6918 HMN
	Serbia: Prijepolje, Mileševka Canyon	Dinaric	43°21'23.72"	19°45'13.62"	853	Limestone	10	July, 2013	6920 HMN
	Serbia: Goč Mt., Gvozdačka reka	Dinaric	43°32'19.41"	20°41'41.02"	1162	Serpentine	10	June, 2013	7030 HMN
subsp. <i>dalmatica</i> ¹ (Dalmatian black pine)	Croatia: Brač, Vidova Gora	Dinaric	43°16'47.78"	16°37'4.33"	764	Limestone	11	August, 2016	13096 HMN
subsp. <i>banatica</i> ² (Banat black pine)	Romania: Mt. Domogled, the Cerna Valley	Carpathian-Balkan	44°52'52.68"	22°25'39.32"	670	Limestone	10	July, 2013	17089 BEOU
	Romania: Svinita, the Danube Valley	Carpathian-Balkan	44°29'00.16"	22°08'35.58"	180	Limestone	10	July, 2013	17090 BEOU
	Serbia: Lazareva Reka Canyon, Kovej	Carpathian-Balkan	44°0'47.05"	21°55'15.27"	698	Limestone	10	July, 2013	7031 HMN
	Serbia: Jerma Canyon, Tikva	Carpathian-Balkan	42°58'35.14"	22°37'22.63"	694	Limestone	10	July, 2013	7029 HMN
subsp. <i>pallasiana</i> ¹ (Crimean black pine)	Bulgaria: Mt. Rhodopes, Dobrostan	Rhodopean	41°53'55.24"	24°55'49.91"	1158	Silicate	10	September, 2020	14392 HMN
	Bulgaria: Mt. Pirin, Dobrinishte	Rhodopean	41°47'58.55"	23°33'58.47"	1008	Silicate	10	September, 2020	14393 HMN

Serbia: Mt. Dukat, Jarešnik	Rhodopean	42°24'7.25"	22°23'25.12"	1440	Silicate	10	July, 2013	7027 HMN
Macedonia: Strumica, Tri Vodi	Rhodopean	41°24'36.00"	22°37'38.00"	320	Silicate	10	July, 2013	7028 HMN
Greece: Mt. Smolikas, Pades	Scardo- Pindic	40° 03'36.22"	20°54'26.74"	1564	Serpentine	20	July, 2017	13295 HMN
Greece: Zouzouli- Eptachori	Scardo- Pindic	40°20'82.40"	21°01'77.22"	1294	Limestone	10	September, 2015	11961 HMN
Greece: Mt. Olympus, Kalamaras	Scardo- Pindic	40°01'40.50"	22°41'61.30"	1536	Limestone	10	September, 2015	11960 HMN

¹Accepted subspecies according to Gaussen et al. [10], Euro+Med [11] and WFO [12]. ²Accepted subspecies according to Ciocârlan [18].

Table S2. Morpho-anatomical characteristics of the needles of studied *P. nigra* populations classified according to mountain systems: descriptive statistics, results of ANOVA, and *post-hoc* tests.

No.	Morpho-anatomical characteristics	F	p	Dinaric <i>n</i> =81	Carpathian-Balkan <i>n</i> =40	Rhodopean <i>n</i> =40	Scardo-Pindic <i>n</i> =40
				<i>X</i> ± <i>SD</i>	<i>X</i> ± <i>SD</i>	<i>X</i> ± <i>SD</i>	<i>X</i> ± <i>SD</i>
1.	Needle length (cm)	25.5	***	9.6±1.9 ^a	8.6±1.2 ^a	11.2±1.4 ^b	12.4±1.3 ^b
2.	Needle width (µm)	15.9	***	1681.6±227.6 ^a	1638.4±153.8 ^a	1705.5±147.4 ^a	1769.7±163.5 ^b
3.	Needle thickness (µm)	17.1	***	964.3±113.0 ^{bc}	850.4±116.0 ^a	958.0±90.9 ^b	1021.5±85.0 ^c
4.	Endodermis tube perimeter (µm)	26.7	***	2130.6±310.6 ^b	1839.7±203.2 ^a	2064.3±227.6 ^b	2367.5±199.8 ^c
5.	Number of resin ducts	19.6	***	5.5±2.5 ^a	4.4±2.1 ^a	4.7±2.2 ^a	8.0±2.1 ^b
6.	Resin duct diameter (µm)	6.8	***	115.4±15.2 ^b	115.1±10.5 ^b	105.3±9.3 ^a	110.5±9.9 ^{ab}
7.	Distance between resin duct and endodermis tube (µm)	10.6	***	102.0±14.4 ^a	99.7±15.1 ^a	99.5±18.0 ^a	118.0±22.0 ^b
8.	Epidermis+cuticle thickness (µm)	13.6	***	32.7±3.3 ^b	31.3±3.0 ^b	31.1±3.6 ^b	26.9±7.5 ^a
9.	Hypodermis thickness (µm)	10.0	***	75.4±14.1 ^a	68.6±11.0 ^a	73.4±20.8 ^a	87.1±13.5 ^b

F: ANOVA F-test. p: level of significance (***: p<0.001).
n: the number of analyzed individuals.
X: mean. *SD*: standard deviation. Means with different superscript letters within the same row (a, b, c) differ significantly (Tukey's HSD for unequal N *post-hoc* test).

Table S3. HS needle volatiles of studied *P. nigra* populations classified according to mountain systems: descriptive statistics, results of ANOVA, and *post-hoc* tests.

No.	Compounds	RI	LI	F	p	Dinaric <i>n</i> =81	Carpathian- Balkan <i>n</i> =40	Rhodopean <i>n</i> =40	Scardo-Pindic <i>n</i> =40
						<i>X</i> ± <i>SD</i>	<i>X</i> ± <i>SD</i>	<i>X</i> ± <i>SD</i>	<i>X</i> ± <i>SD</i>
1.	Tricyclene	921	921	0.4	ns	0.0±0.1	0.0±0.1	0.0±0.2	0.0±0.1
2.	α-Thujene	926	924	2.5	ns	1.1±1.0	0.8±0.9	0.7±0.8	1.0±0.6
3.	α-Pinene	934	932	4.0	**	74.7±10.9^{ab}	79.5±6.5^b	71.1±12.6^a	75.4±9.3^{ab}
4.	Camphene	949	946	5.4	**	1.1±0.4 ^{ab}	1.2±0.6 ^{ab}	0.9±0.5 ^a	1.4±0.5 ^b
5.	Sabinene	971	969	3.8	*	0.1±0.3 ^b	0.0±0.1 ^{ab}	0.0±0.0 ^a	0.0±0.0 ^{ab}
6.	β-Pinene	980	974	3.7	*	10.6±10.3^{ab}	8.0±6.6^a	15.7±14.9^b	8.3±9.6^{ab}
7.	Myrcene	990	988	2.3	ns	1.1±0.5	1.0±0.5	0.9±0.4	1.1±0.2
8.	Limonene+β- Phellandrene	1029	1024/1025	7.2	***	2.6±2.0 ^b	1.5±0.8 ^a	1.6±0.7 ^a	2.1±0.7 ^{ab}
9.	(<i>E</i>)-β-ocimene	1044	1044	4.2	**	0.3±0.4 ^a	0.3±0.5 ^a	0.4±0.5 ^a	0.7±0.6 ^b
10.	Terpinolene	1087	1086	1.9	ns	0.6±0.7	0.4±0.6	0.4±0.4	0.4±0.4
11.	(<i>E</i>)-Caryophyllene	1420	1417	3.7	*	2.2±1.3 ^a	2.1±1.4 ^a	2.1±1.6 ^a	2.9±1.2 ^b
12.	Germacrene D	1485	1484	1.7	ns	5.6±3.3	5.1±2.7	6.1±3.7	6.7±3.0
Total						100.0±0.6	99.9±0.3	99.9±0.3	100.0±0.1
Monoterpene hydrocarbons						92.1±4.0	92.8±3.4	91.7±4.7	90.4±3.5
Sesquiterpene hydrocarbons						7.8±3.9	7.2±3.4	8.2±4.7	9.6±3.5

RI: Experimental linear retention indices relative to C₈-C₂₀ alkanes. LI: Literature indices-Adams' retention indices.
F: ANOVA F-test. p: level of significance (ns: not significant; *: p<0.05; **: p<0.01; ***: p<0.001).
n: the number of analyzed individuals.
X: mean. *SD*: standard deviation. Means with different superscript letters within the same row (a, b, c) differ significantly (Tukey's HSD for unequal *N post-hoc* test).
The HS volatiles recorded in the average content >10% in at least one of the studied mountain systems are in boldface.