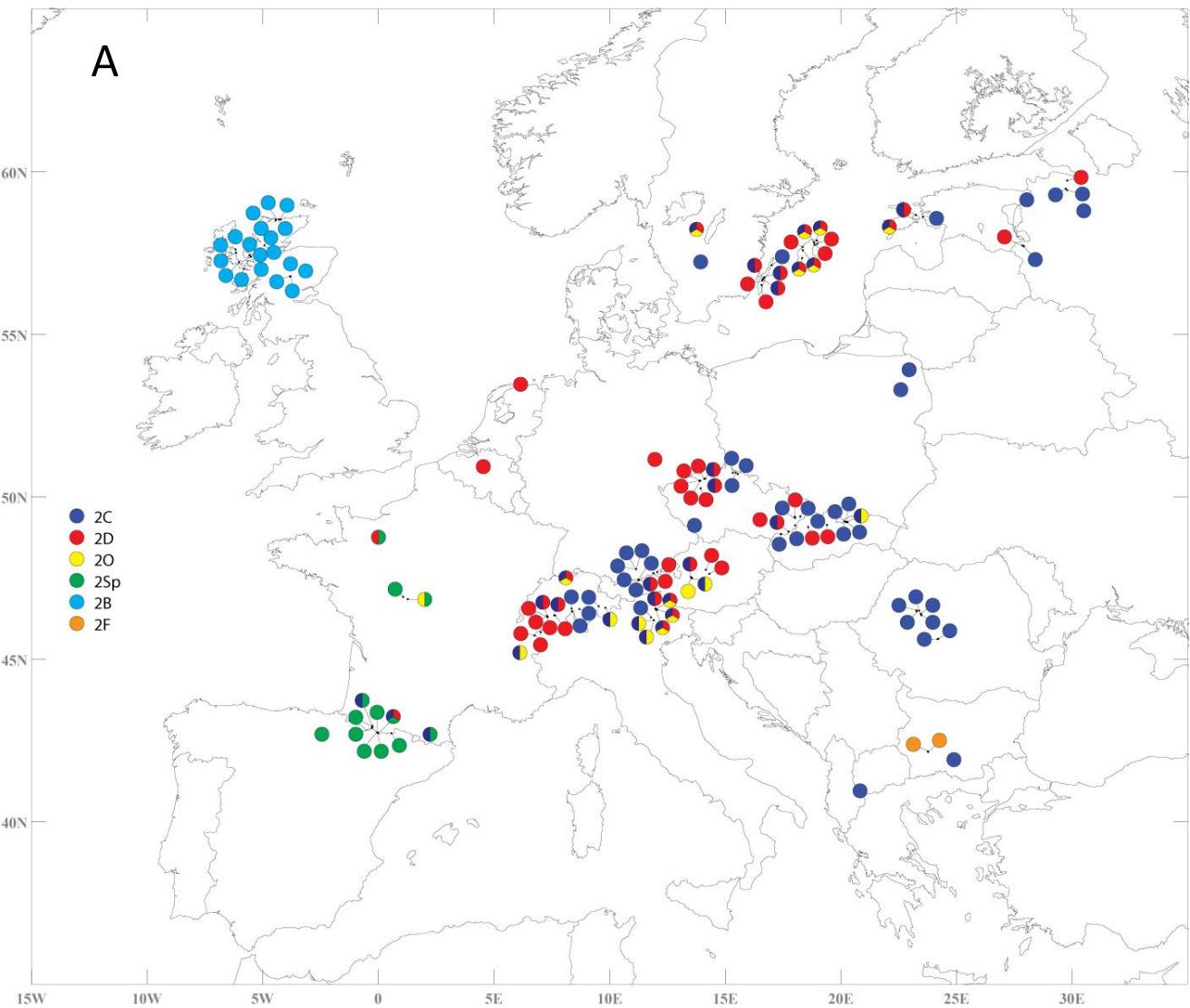
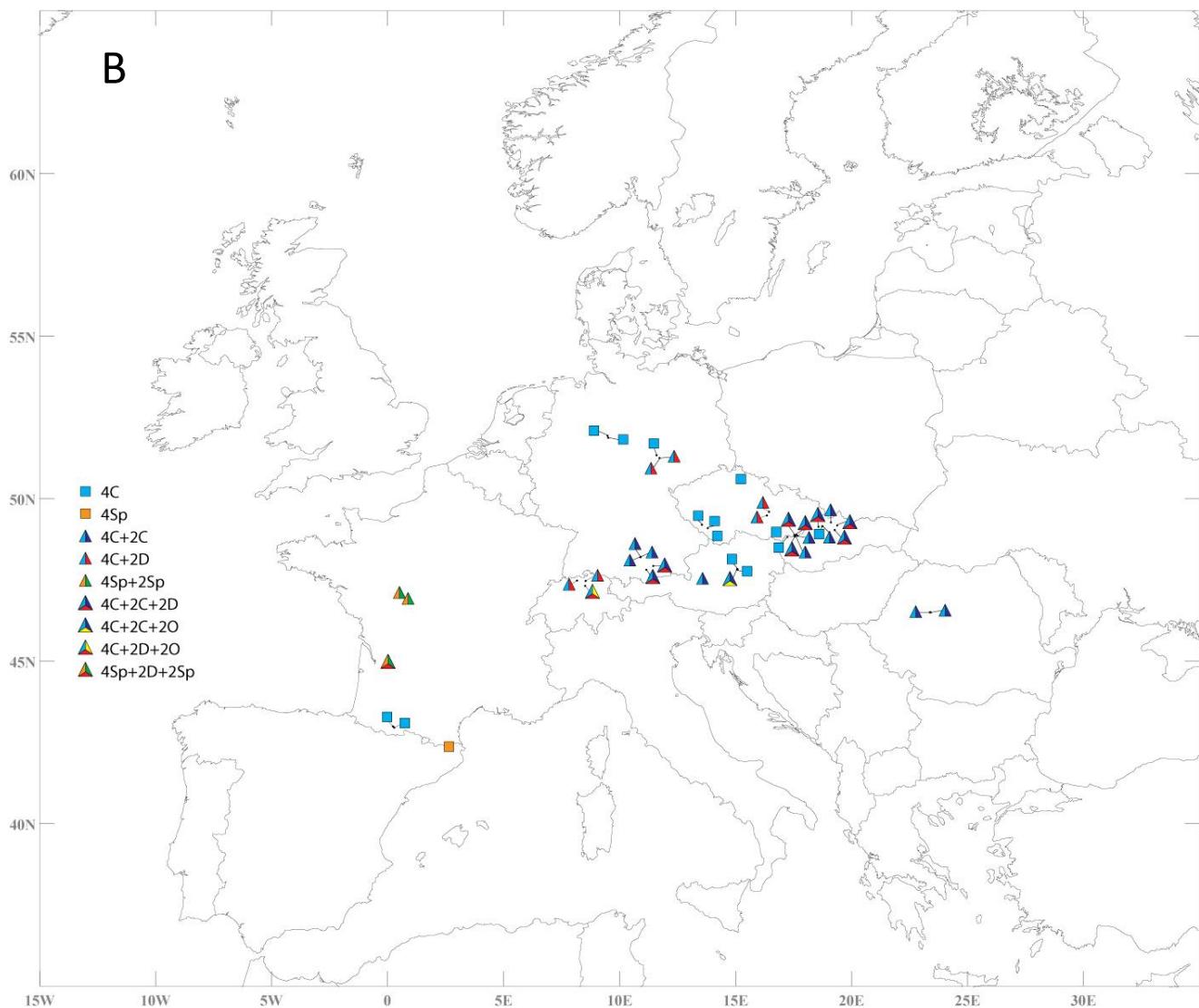


## SUPPLEMENTARY DATA

FIG. S1. Ploidy variation and taxonomic composition of *Gymnadenia conopsea* s.l. populations studied in the present study and by Trávníček *et al.* (2011); the distributional maps are based on nearly 10,000 cytotyped individuals. (A) Diploid populations (either ploidy-uniform or with the presence of minority cytotypes). Intrapopulation taxonomic heterogeneity is indicated by mixed colours. (B) Tetraploid (squares) and mixed 2x–4x (triangles) populations. Intrapopulation taxonomic heterogeneity is indicated by mixed colours. (C) Populations harbouring minority cytotypes (3x, blue; 5x, yellow; 6x, red). The presence of both majority ploidies (2x, 4x) is illustrated by a circle while triangles illustrate otherwise exclusive di- or tetraploid populations. Co-occurrence of different minority cytotypes is indicated by mixed colours. Arrows designate populations in which additional cytotype (most likely diploid) is expected (sympathy of 3x+4x or 4x+5x). Taxa abbreviation in (A) and (B): 2B, 2x *G. borealis*; 2C, 2x *G. conopsea*; 2D, 2x *G. densiflora*; 2F, 2x *G. frivaldii*; 2O, 2x *G. odoratissima*; 2Sp, undetermined diploid from France; 4C, 4x *G. conopsea*; 4Sp, undetermined tetraploid from France.



**B**

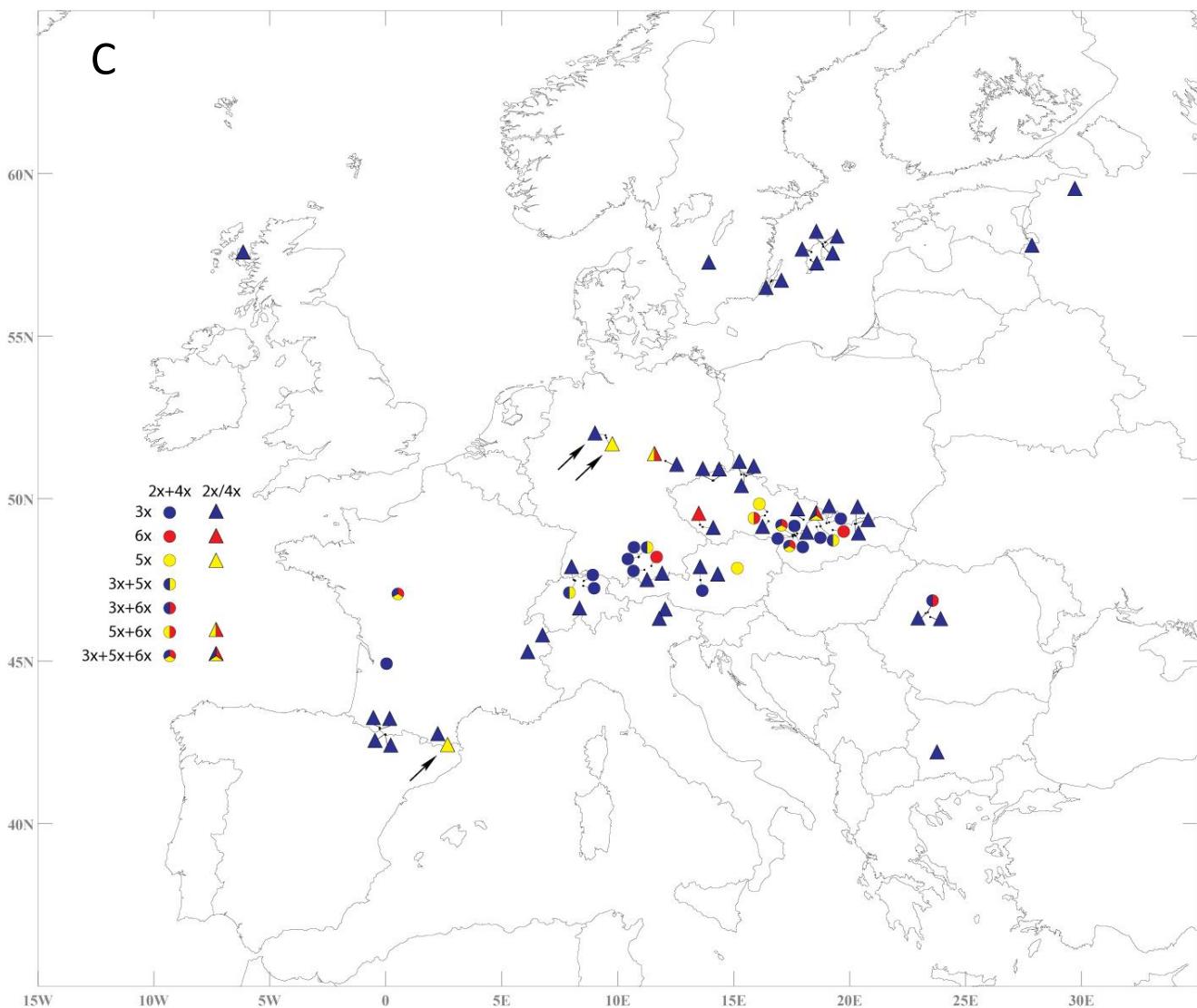
**C**

FIG. S2. Images of the *Gymnadenia* taxa investigated (habitus and inflorescence detail). Pictures from sites where morphometric analysis of 20 plants was undertaken are accompanied by mean  $\pm$  s.d. of plant height and inflorescence length (in cm). Flower detail is provided for taxa in which the spur length is of taxonomic value.

**2x *G. conopsea* – loc. DE08:** Kranzberg, Upper Bavaria, Germany, 1080 m a.s.l., 28.6.2010 (V. Čurn)



4x *G. conopsea* – loc. FR06: pass Col de Jau, Quillan, France, 1265 m a.s.l., 4.7.2011 (P. Trávníček)



4x *G. conopsea* – loc. DE12: Prittiching, Upper Bavaria, Germany, 550 m a.s.l., 20.6.2011 (V. Čurn)



*G. densiflora* – loc. SE12: wetland Torpmossen, Öland, Sweden, 20 m a.s.l., 26.5.2011 (J. Jersáková)



**52.7 ± 8.2**



**10.4 ± 1.9**

*G. densiflora* – loc. AT09: Warscheneck, Totes Gebirge, Austria, 930 m a.s.l., 21.7.2008 (V. Čurn)



**49.3 ± 15.5**



**12.9 ± 3.2**

*G. borealis* – loc. GB03: Inverdruie, Highland, Scotland, 310 m a.s.l., 23.6.2010 (J. Suda)



**18.8 ± 4.2**



**3.1 ± 0.7**

*G. frivaldii* – loc. BG02: Belmeken Reservoir, Rila Mts., Bulgaria, 2100 m a.s.l., 25.7.2010 (P. Hájková, M. Štech)



**17.8 ± 3.6**



**2.5 ± 0.6**

*G. odoratissima* - loc. SE04: Hoburgsmyr mire, Gotland, Sweden, 30 m a.s.l., 11.7.2010 (J. Jersáková)



**32.0 ± 7.1**



**6.7 ± 2.1**

*G. odoratissima* – loc. IT09: Falzarego Pass, Dolomites, Italy, 2170 m a.s.l., 20.7.2009 (V. Čurn)



**27.2 ± 4.9**



**7.2 ± 2.0**

Plants corresponding to *G. conopsea* var. *alpina* (not distinguished from the nominate variety in our study) – loc. IT07:  
Paneveggio Pale di San Martino NP, Trentino, Italy, 2000 m a.s.l., 3.7.2011 (V. Čurn)



Plants corresponding to *G. conopsea* var. *alpina* (not distinguished from the nominate variety in our study) – loc. DE10: St. Anton, Mittenwald, Upper Bavaria, Germany, 1230 m a.s.l., 18.7.2010 (C.A.J. Kreutz)



**French diploid – loc. FR05:** Chaumussay, Indre-et-Loire, Central France, 100 m a.s.l., 1.6.2007 (O. Marchand)



**French diploid – loc. FR10:** Bagnères-de-Bigorre, Midi-Pyrénées, France, 1260 m a.s.l., 4.7.2011 (P. Trávníček)

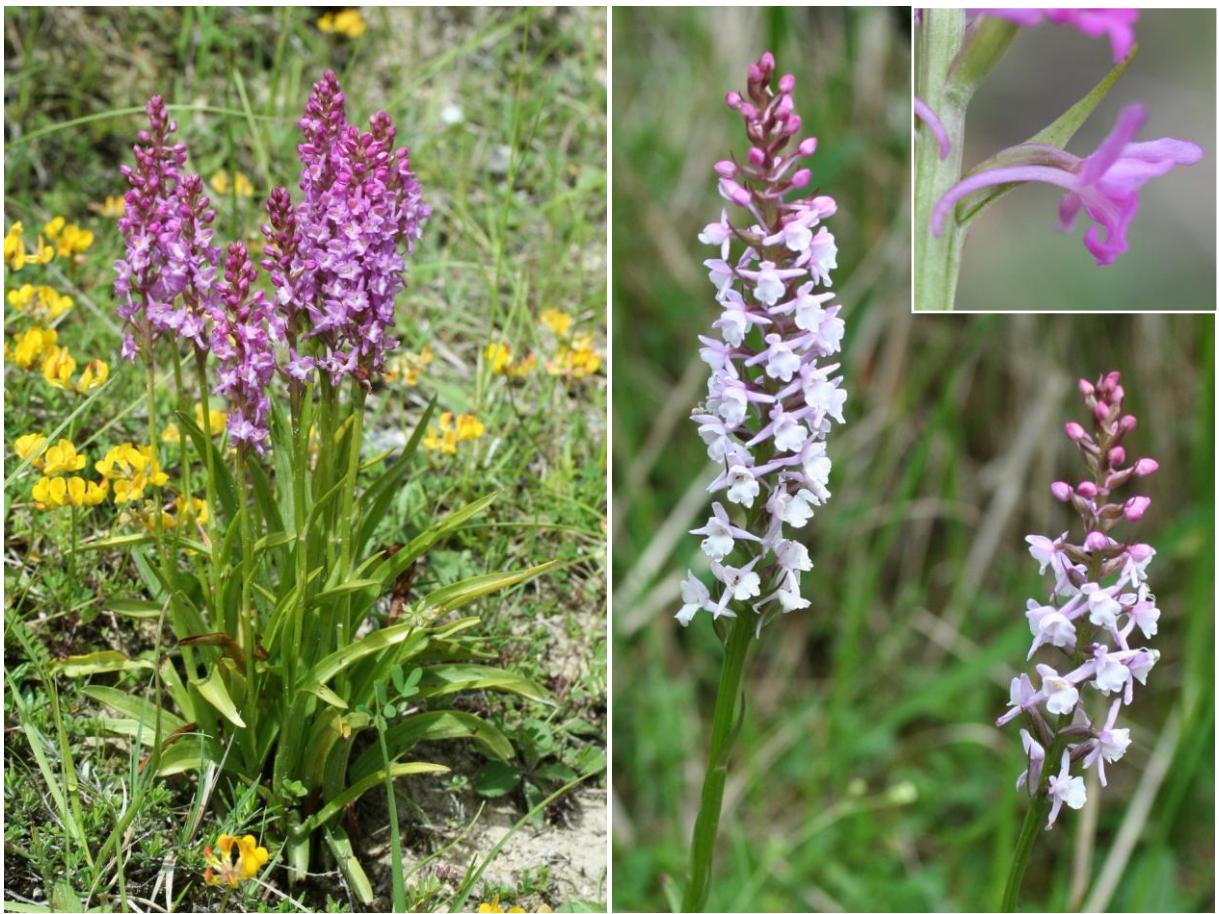


**$23.2 \pm 4.7$**



**$5.8 \pm 1.6$**

French tetraploid – loc. FR05: Chaumussay, Indre-et-Loire, Central France, 100 m a.s.l., 24.5.2008 (O. Marchand)



French tetraploid – loc. FR04: Marcilly-sur-Vienne, Indre-et-Loire, Central France, 70 m a.s.l., 14.6.2009 (J.-P. Amardeilh)



Plants corresponding to *G. conopsea* var. *friesica* (synonymized with *G. densiflora* in our study) – loc. NL01:  
Schiermonnikoog, Netherlands, 1 m a.s.l., 8.8.2010 (C.A.J. Kreutz)



$28.9 \pm 5.8$



$6.8 \pm 1.9$

Plants corresponding to *G. vernalis* (synonymized with *G. conopsea* in our study) – loc. DE17: Huglfing, Upper Bavaria, Germany, 610 m a.s.l., 26.5.2011 (V. Čurn)



$25.1 \pm 5.3$



$5.2 \pm 1.1$

Plants corresponding to *G. conopsea* var. *serotina* (synonymized with *G. densiflora* in our study) – loc. BE01: NR Torfbroek, Berg, Belgium, 20 m a.s.l., 13.7.2010 (C.A.J. Kreutz)



Plants corresponding to *G. conopsea* var. *serotina* (synonymized with *G. densiflora* in our study) – loc. DE19: Spitsingsee, Upper Bavaria, Germany, 1030 m a.s.l., 19.7.2010 (C.A.J. Kreutz)



Plants corresponding to *G. odoratissima* subsp. *longicalcarata* (likely identical with the French diploid) – loc. ES01: Izkiz Natural Park, N Spain, 685 m a.s.l., 1.7.2007 (C. Hermosilla)



TABLE S1. Locality details (including geographic co-ordinates and altitude) and species/ploidy composition of 141 *Gymnadenia* populations from 17 European countries. Asterisks denote localities where herbarium vouchers (stored in PRC or CBFS) were collected. Taxa abbreviation: 2B, 2x *G. borealis*; 2C, 2x *G. conopsea*; 2D, 2x *G. densiflora*; 2F, 2x *G. frivaldii*; 2O, 2x *G. odoratissima*; 2Sp, undetermined diploid from France; 4C, 4x *G. conopsea*; 4Sp, undetermined tetraploid from France.

Pop.	Locality Description	Geographical co-ordinates	Altitude (m a.s.l.)	No. of plants	2B	2C	2D	2F	2O	2Sp	3x	4C	4Sp	5x	6x	Note
AT01	AT - Lower Austria, Mostviertel, Ybbstaler Alpen, Durrenstein - grassland on skeletal soil on slopes in the Seetal valley, between Klausee and Ludwigfall, 5 km S of Lunz am See	N47.8090 E15.0773	1080	10												10
AT02	AT - Lower Austria, Mostviertel, Ybbstaler Alpen, Durrenstein - mesophytic grassland and roadsides between Seehof and Mittersee, 3 km S of Lunz am See	N47.8353 E15.0729	740	17												17
AT03	AT - Lower Austria, Mostviertel, Ybbstaler Alpen, Durrenstein - mesophytic grassland and skeletal slopes above Seebach, 4 km S of Lunz am See	N47.8178 E15.0788	880	33	2				3			27		1		
AT04	AT - Upper Austria, Traunkreis, Dachstein, Am Hohen Riedel - alpine grassland on skeletal soil on the plateau 750 W of the Adamek Hütte	N47.4949 E13.5738	2020	55		53					1	1				<i>G. conopsea</i> var. <i>alpina</i>
AT05	AT - Upper Austria, Traunkreis, Dachstein, Grobgestein Hütte - grassland and spring area 1 km SE of Hintere See Alm	N47.4959 E13.5628	1640	63		60			2	1						<i>G. conopsea</i> var. <i>alpina</i>
AT06	AT - Upper Austria, Traunkreis, Dachstein, Kreidenbach - spring area and subalpine meadows 750 m SE of Hintere See Alm	N47.4959 E13.5574	1550	11					11							
AT07	AT - Upper Austria, Traunkreis, Dachstein - moist grassland on the NE side of Vorderer Gosausee 500 m E of the Gosausee hotel	N47.5311 E13.5064	940	11		1	10									
AT08	AT - Upper Austria, Traunkreis, Totes Gebirge, Laaberg - grassy forest margin ca 5 km N of Hinterstoder	N47.7504 E14.1639	550	25			25									
AT09	AT - Upper Austria, Traunkreis, Totes Gebirge, Warscheneck - spring area and moist meadow ca 4.5 km SW of Spital am Pyhrn	N47.6294 E14.3140	930	65			63				2					
BE01	BE - Flemish Brabant, Kampenhout, Berg - nature reserve Torfbroek, rich fen ca 15 km NE of Brussels	N50.9274 E4.5381	20	26			26									putative occurrence of <i>G. conopsea</i> subsp. <i>serotina</i> sensu Dworschak (2002)
BG01	BG - Blagoevgrad, Yakoruda, Rila mts. - spring along the road 350 m W of the south-western dam of the	N42.1493 E23.7733	1920	11				10			1					

Pop.	Locality Description	Geographical co-ordinates	Altitude (m a.s.l.)	No. of plants	2B	2C	2D	2F	2O	2Sp	3x	4C	4Sp	5x	6x	Note
Belmeken Reservoir																
BG02	BG - Blagoevgrad, Yakoruda, Rila mts. - spring on the left bank of the stream 2.3 km of the south-western dam of the Belmeken Reservoir	N42.1614 E23.7571	2100	22					22							
BG03	BG - Plovdiv, Asenovgrad, Rodopi mts. - open forest in the valley ca 4.5 km E of Dobrostan	N41.9124 E24.8727	1130	3		3										
CH01	CH - Aargau, Brugg, Effingen - southern slope of Jurassic mountain, calcareous, dry meadow, poor in nutrients	N47.4987 E8.1023	485	71		15	29		26		1					
CH02	CH - Aargau, Brugg, Villnachern - southern slope of Jurassic mountain, calcareous, dry meadow, poor in nutrients (former vineyard)	N47.4751 E8.1618	460	190			76			7	103		4			
CH03	CH - Bern, Oberhasli, Oberwald - moist meadow 0.5 km E of Gletsch	N46.5620 E8.3562	1845	29		28					1					
CH04	CH - Graubünden, Albula District, Tiefencastel - dry alpine-subalpine meadow, calcareous soil	N46.6286 E9.5214	2100	47		47										<i>G. conopsea</i> var. <i>alpina</i>
CH05	CH - Ticino, Leventina, Airolo - dry alpine-subalpine meadow on the bank of lake Lago Ritom, calcareous soil	N46.5473 E8.6917	2115	14		14										<i>G. conopsea</i> var. <i>alpina</i>
CH06	CH - Valais, Goms - Tessiner Alpen - moist meadows along stream 1 km W of the Nufenen Pass	N46.4785 E8.3772	2215	1		1										<i>G. conopsea</i> var. <i>alpina</i>
CH07	CH - Valais, Leuk - Bernese Alps - moist meadows and marshes along stream in Lirschigrabu, ca 5 km N of Leuk	N46.3456 E7.6366	1420	18			18									
CH08	CH - Valais, Leuk, Varen - grassy roadsides in open forest 1 km NW of Inden	N46.3493 E7.6076	1365	42		36	6									
CH09	CH - Valais, Sion, Bernese Alps, Sanetch - meadows and pastures above the timberline ca 10 km NW of Sion	N46.3329 E7.2866	2240	8		1	7									<i>G. conopsea</i> var. <i>alpina</i> + 2D
CH10	CH - Valais, Sion, Bernese Alps, Sanetch - moist meadows and pastures above the timberline ca 8 km NW of Sion	N46.3100 E7.3197	1960	15			15									
CH11	CH - Valais, Sion, Bernese Alps, Sanetch - moist meadows and spring area above the timberline ca 9 km NW of Sion	N46.3094 E7.3262	1820	14			14									
CH12	CH - Valais, Sion, Bernese Alps, Saviese - moist meadows and forest margins ca 7 km NW of Sion	N46.2992 E7.3208	1420	14			14									
CH13	CH - Zurich, Dielsdorf, Niederhasli - moist meadow close to the Zurich airport	N47.4668 E8.5374	420	51			20			4	27					
CH14	CH - Zurich, Meilen, Adliswil - meadow, poor in nutrients close to Felsenegg	N47.3112 E8.5117	630	20		9		3		1	7					

Pop.	Locality Description	Geographical co-ordinates	Altitude (m a.s.l.)	No. of plants	2B	2C	2D	2O	2Sp	3x	4C	4Sp	5x	6x	Note
CH15	CH - Graubünden, Albula District, Bergün - dry alpine meadow, calcareous soil	N46.5817 E9.8137	2220	38	19		19								G. conopsea var. <i>alpina</i> + 2O
DE01	DE - Lower Saxony, Holzminden, Bevern - semidry grassland 1.1 km NW of Lobach	N51.8724 E9.5121		50						47		3			
DE02	DE - Lower Saxony, Holzminden, Hehlen - dry grassland 1.3 km WNW of Pegestorf	N51.9320 E9.4796	125	50						1	49				
DE03	DE - Saxony-Anhalt, Burgenlandkreis, Hohenmölsen - wet fen 2.2 km S of Hohenmölsen	N51.1359 E12.1088	185	43		42				1					
DE04	DE - Saxony-Anhalt, Saalekreis, Querfurt - dry grassland 1 km NE of Grockstädt	N51.3345 E11.5898	200	36						31		4	1		
DE05	DE - Saxony-Anhalt, Burgenlandkreis, Balgstädt - dry grassland 1.2 km E of Grössnitz	N51.1851 E11.7317	195	48		33				15					
DE06	DE - Saxony-Anhalt, Burgenlandkreis, Balgstädt - dry grassland 1.7 km S of Balgstädt	N51.1900 E11.7352	205	46		1				45					
DE07	DE - Upper Bavaria, Garmisch-Partenkirchen, Northern Limestone Alps, Wetterstein, Gertraudtafel - xerophytic and mesophytic grassland on skeletal slopes 250 m NW of the lower cableway station in Mittenwald	N47.4470 E11.2510	1105	41	38	2			1						putative occurrence of <i>G. graminea</i> and <i>G. splendida</i> sensu Dworschak (2002)
DE08	DE - Upper Bavaria, Garmisch-Partenkirchen, Northern Limestone Alps, Wetterstein, Kalvarienberg - spring area and meadow 100 m NW of the lower cableway station in Mittenwald	N47.4446 E11.2549	1080	48	48										
DE09	DE - Upper Bavaria, Garmisch-Partenkirchen, Northern Limestone Alps, Wetterstein, Korbinianhütte - grassy forest margin and meadow 500 m NW of the lower cableway station in Mittenwald	N47.4488 E11.2439	1180	72	72										
DE10	DE - Upper Bavaria, Garmisch-Partenkirchen, Northern Limestone Alps, Wetterstein, St. Anton - spring area and meadow 750 m NW of the lower cableway station in Mittenwald	N47.4496 E11.2404	1230	60	60										G. conopsea var. <i>alpina</i>
DE11	DE - Upper Bavaria, Landsberg, Bavarian Alpine Foreland, Donau, Lechtal - meadows around the water reservoirs along the river Lech, 2 km W of Prittriching	N48.2075 E10.9049	550	56	43				2	10	1				putative occurrence of <i>G. splendida</i> sensu Dworschak (2002)
DE12	DE - Upper Bavaria, Landsberg, Bavarian Alpine Foreland, Donau, Lechtal - meadows around the water reservoirs along the river Lech, 3 km W of Prittriching	N48.2018 E10.8991	550	45	1				10	34					putative occurrence of <i>G. conopsea</i> subsp. <i>serotina</i> sensu Dworschak (2002)
DE13	DE - Upper Bavaria, Landsberg, Bavarian Alpine Foreland, Donau, Lechtal - moist meadows and forest margins along the river Lech, 4 km SW of Prittriching	N48.1935 E10.8898	560	76	63				6	7					
DE14	DE - Upper Bavaria, Weilheim-Schongau, Bavarian Alpine Foreland - spring area, moist and peaty meadow between Polling and Etting, along the Ettinger Bach	N47.8049 E11.1548	590	59	5	14			3	37					putative occurrence of <i>G. splendida</i> and <i>G. conopsea</i> subsp. <i>serotina</i> sensu

Pop.	Locality Description	Geographical co-ordinates	Altitude (m a.s.l.)	No. of plants	2B	2C	2D	2F	2O	2Sp	3x	4C	4Sp	5x	6x	Note
Dworschak (2002)																
<b>DE15</b>	DE - Upper Bavaria, Weilheim-Schongau, Bavarian Alpine Foreland - moist and mesophytic meadow 200 m S-SE of the railway station Huglfing	N47.7748 E11.1420	595	4		4										
<b>DE16</b>	DE - Upper Bavaria, Weilheim-Schongau, Bavarian Alpine Foreland - moist meadows and forest margins 750 m S of Rechetsberg, ca 6 km SW of Huglfing	N47.7463 E11.0908	690	20		20										putative occurrence of <i>G. vernalis</i> sensu Dworschak (2002)
<b>DE17</b>	DE - Upper Bavaria, Weilheim-Schongau, Bavarian Alpine Foreland - moist meadows, pastures and spring areas between Deimenried and Grasleitenweg, 3 km SW of Huglfing	N47.7574 E11.1284	610	17		17										putative occurrence of <i>G. vernalis</i> sensu Dworschak (2002)
<b>DE18</b>	DE - Upper Bayern, Bad Tölz-Wolfratshausen, Bavarian Alpine Foreland - xerophytic and mesophytic grassland opening in pine forest along the river Isar 1 km E of Wolfratshausen	N47.9234 E11.4461	635	57	14	5					35		3			putative occurrence of <i>G. splendida</i> sensu Dworschak (2002)
<b>DE19</b>	DE - Upper Bayern, Miesbach, Northern Limestone Alps, Mangfall Alps - moist meadows and marshes 300 m SE of Albert-Link-Hutte, 1 km S of Spitsingsee	N47.6532 E11.8913	1030	43		42				1						putative occurrence of <i>G. conopsea</i> subsp. <i>serotina</i> sensu Dworschak (2002)
<b>DE20</b>	DE - Upper Bayern, Rosenheim, Northern Limestone Alps, Mangfall Alps - moist meadows and spring areas above Deutsche Alpenstrasse, 2 km E of Sudelfeld	N47.6853 E12.0545	1040	6		6										
<b>EE01</b>	EE - Lääne County, Hanila Parish, Hanila - Sillukse old airfield, flat alvar site	N58.6212 E23.5491	15	30	30											
<b>EE02</b>	EE - Saare County, Lümanda Parish, Lümanda - Viidumäe nature reserve, spring fen	N58.2989 E22.0756	15	24	20	2	2									
<b>EE03</b>	EE - Saare County, Muhu, Kallaste - Üügu - limestone cliff on the northern coast	N58.6719 E23.2373	5	37	26	11										
<b>ES01</b>	ES- Basque Country, Álava, Arraia-Maetzu, Izkiz Natural Park - grassy and juniper slopes, loamy soil	N42.6923 W2.4368	685	13					13							
<b>FR01</b>	FR - Aquitaine, Gironde, Les Salles de Castillon - dry grassland on calcareous soil	N44.9114 E0.0153	50	84		17			2	10		55				
<b>FR02</b>	FR - Centre, Indre, Châteauroux, Cléré-du-Bois - calcareous grassland 2.9 km SW of the village	N46.9160 E1.0769	120	21					21							
<b>FR03</b>	FR - Centre, Indre, Châteauroux, Saulnay - alkaline marshes 1.5 km SW of the village	N46.8503 E1.2757	100	50				24	26							
<b>FR04</b>	FR - Centre, Indre-et-Loire, Marcilly-sur-Vienne - grassland with junipers on chalk slopes	N47.0581 E0.5197	70	58					5	1	49	2	1			
<b>FR05</b>	FR - Centre, Indre-et-Loire, Preuilly-sur-Claise - grassland near the place called "La forge" 1.8 km SE of Chaumussay	N46.8650 E0.8770	100	30					18		12					







Pop.	Locality Description	Geographical co-ordinates	Altitude (m a.s.l.)	No. of plants	2B	2C	2D	2F	2O	2Sp	3x	4C	4Sp	5x	6x	Note
	Mountains - meadow E of the village Salciua	E23.4523														
<b>RO04</b>	RO – Northwest, Alba county, Alba Iulia, Trascau Mountains - meadow near the Valeas Poienii chalet	N46.3513 E23.4724	830	11		9					2					
<b>RO05</b>	RO – Northwest, Alba county, Turda - east slope of the Scarita peak, calcareous soil	N46.4967 E23.3839	1200	8		8										
<b>RO06</b>	RO – Northwest, Alba county, Turda - meadow above the Cheile Pociovalistei glen	N46.5003 E23.4137	750	5		3					2					
<b>RO07</b>	RO – Northwest, Alba county, Turda, Muntele Mare Massif - meadow near the La Crucea Margineanului chalet	N46.4736 E23.2808	1180	37		36					1					
<b>RO08</b>	RO – Northwest, Alba county, Turda, Muntele Mare Massif - meadow W of the Creasta Stancoasa peak	N46.5052 E23.2635	1600	2		2										
<b>RO09</b>	RO – Northwest, Cluj county, Gilau Massif, Scarita - Belioara nature reserve, meadow	N46.4969 E23.3750	1320	75		57				3	13		2			
<b>RU01</b>	RU - Leningrad Region, Lomonosov District, Glyadino - wet bottom of the old lime quarry 2 km N of the village	N59.7298 E29.7752	100	21			21									
<b>RU02</b>	RU - Leningrad Region, Luga District, Pozharishche - spring sphagnum bog around the Bezymyannoye lake, 1 km S of the village	N58.8075 E30.4944	65	3		3										
<b>RU03</b>	RU - Leningrad Region, Slantzy District, Kamenka - mesophytic meadow along the road ca 4 km NW of the village	N59.1407 E28.0326	50	47		47										
<b>RU04</b>	RU - Leningrad Region, Volosovo District, Arbyone - mesophytic meadow on limestone 2 km NE of the village	N59.4799 E29.7143	125	44		42					2					
<b>RU05</b>	RU - Leningrad Region, Volosovo District, Dontso reserve - mesophytic meadow on limestone 1 km E of Selo village	N59.4324 E29.7618	100	2		2										
<b>RU06</b>	RU - Pskov Region, Pechory District, Malye Mil'tsy - mesophytic meadow 1 km S of the village	N57.7126 E27.9050	70	3		3										
<b>RU07</b>	RU - Pskov Region, Pechory District, Staryi Izborsk village - spring bog on the slope of the Maly-Izborsk valley	N57.7307 E27.8463	45	10			9				1					
<b>SE01</b>	SE - Gotland, Fårösund - alvar 1 km SE of the Bästeträsk lake	N57.8822 E18.9460	15	163		35	61		65		2					
<b>SE02</b>	SE - Gotland, Husken - grassy roadside on the road ca 3 km from Husken to Vallevik	N57.7828 E18.9684	10	39			39									
<b>SE03</b>	SE - Gotland, Klintehamn - mire ca 8 km SE of Klintehamn, on the road to Lojsta	N57.3437 E18.3218	70	148		95	39		13		1					

