

RELIGIOUS DIFFERENCES AFFECT ORCHID DIVERSITY OF ALBANIAN GRAVEYARDS

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Abstract

Graveyards are unique habitats and well-known as refugia for many organisms, as traditional habitat management of graveyards lends them serious conservational value. However, the impact of religious affiliation to the natural values of graveyards has not been evaluated yet, although religion can have an impact on them through different habits and management. To test this hypothesis, we collected comprehensive field data of orchids and environmental variables in 166 Albanian graveyards. We found that Muslim graveyards were significantly larger and contained a smaller proportion of area covered by graves than Christian ones. Altogether 29 orchid taxa were found in 88 graveyards with different religious affiliation (Muslim, Christian or mixed). Muslim graveyards contained more orchid taxa compared to Christian ones. Orchid abundance was also significantly positively related to elevation. Based on this study, Albanian graveyards can be considered as significant refugia for orchids in the Mediterranean, and the long-term graveyard management influenced by the religious affiliation may have a significant impact on the natural values of these graveyards.

Key words: Balkan Peninsula, cemetery, flora of Albania, Orchidaceae, refuges, vascular plants

Introduction

Albania hosts a significantly diverse flora with a remarkable proportion of endemics. The four volumes of Albanian Flora (Paparisto *et al.*, 1988) report the presence of 3250 vascular plant species (including 175 cultivated species); of these 450 (13.9%) taxa are endemic to the Balkans, 46 (1.4%) are local endemic taxa, and 190 (5.8%) are sub-endemics. The flora of Albania is one of the least explored in Europe, though it is currently in the focus of floristic research (e.g. Barina & Pifkó, 2008a, 2008b, 2011; Barina *et al.*, 2009, 2010, 2011, 2013; Mullaj *et al.*, 2010) and several natural values of the country have recently been discovered. The intensive techniques of forestry and agriculture are progressing rapidly in Albania, while the volume of both pastoral economy and husbandry is also growing rapidly, and these cause landscape degradation and depletion of natural resources in many regions of the country (Jansen *et al.*, 2006; Papanastasis, 2003).

Overgrazing is a general conservation problem worldwide (Homewood & Rodgers, 1987; Podwojewski *et al.*, 2002) and in Europe in particular (Mysterud, 2006; Petit & Elbersen, 2006); this is one of the most important threatening factors on the biodiversity of Mediterranean ecosystems (Paton *et al.*, 1997; Papanastasis *et al.*, 2002). Livestock enclosures and natural refuges inaccessible to grazing animals (e.g. rocky outcrops, cliffs, areas surrounded by spiny or toxic vegetation) have crucial importance in the maintenance of biodiversity in intensively grazed landscapes via the preservation of organisms sensitive to grazing (Callaway *et al.*, 2000; Milchunas & Noy-Meir, 2002).

According to Vangjeli *et al.* (2000), 83 orchid taxa (68 species and 15 subspecies) are present in Albania. Orchids frequently serve as focus of research interest, since they are mostly valuable species often found in sensitive habitats, and the family contains pronouncedly decorative species. Commercial collection and trading with orchids is prohibited (except for artificially propagated hybrids). Besides intensive grazing, tuber collecting for salep production is a serious threatening factor, especially in CITES-listed orchids (UNEP-WCMC, 2011). Salep harvesting is a traditional activity in Turkey (Özhatay *et al.*, 1997; Kasperek & Grimm, 1999; Sezik, 2002; Tamer *et al.*, 2006; Löki *et al.*, 2015), Iran (Ghorbani *et al.*, 2014) and also in Albania (Pieroni *et al.*, 2014a, 2014b; Kreziou *et al.*, 2015). Based on recent studies, salep harvesting seems unsustainable in Turkey and in Iran, but collecting and commercial habits are insufficiently known in Albania. Nonetheless, collecting activity can obviously influence orchid diversity and occurrences in the country.

As Gilbert (1991) points out, urban habitats are able to accommodate and preserve elements of the natural vegetation, but taxonomically different groups are not equally capable of benefiting from these habitats (Hodgson, 1986). According to Barrett & Barrett (2001), graveyards are model systems in which it is possible to study the relationship between biotic and cultural diversity; also the conservational and cultural importance of graveyards is well known and discussed by several studies from all around the world (Laske, 1994; Dafni *et al.*, 2006; Rahman *et al.*, 2008; Jordan, 2010; Hadi *et al.*, 2014). Muslim graveyards are considered as highly untouched, protected places (Champion *et al.*, 1965), although the role of Muslim graveyards in conserving

plants is known from only a few areas, such as Pakistan (Rahman *et al.*, 2008; Hadi *et al.*, 2014; Chaghtai, 1978, 1983; Ahmad, 2010), where rare aromatic and medicinal plants also regularly appear in Muslim graveyards. The tree species *Olea ferruginea*, a species threatened by human activities, has stable populations in Muslim graveyards of Pakistan (Ahmed *et al.*, 2009). Yet, only very scarce information is available on the flora of graveyards from the rest of the world; we are only aware of a single study from North-Africa (Brandes, 2011).

Based on former experiences in Turkey (Löki *et al.*, 2015), we assumed that graveyards can be important habitats for orchids in Albania as well. Although the importance of graveyards in several aspects is well known, the role of religious affinity of graveyards – according to our knowledge – has not yet been evaluated. Human population of Balkan states is religiously heterogeneous; the official Albanian census in 2011 indicated Muslim majority (58.79%), but the proportion of Christianity is also significant (incl. both Roman Catholicism and Orthodoxy, 10.03% and 6.75%, respectively); whereas 10.37% of the population belongs to other religions. Differences in religious affiliation imply different burial traditions, and these may imply very different and mixed land-use in

graveyards (e.g. removal of tree cover, regular mowing/reaping, creating concrete footpaths and modern, concrete-covered graves, herbicide usage, etc.). The diversity and intermixture of religions makes Albania a promising study ground for gaining insight into the conservational value of graveyards belonging to different religions. To test the conservational importance of graveyards via the example of terrestrial orchids, we carried out an extensive field survey of Albanian graveyards. The aims of present study are: (i) to assess plant biodiversity in Albanian graveyards and (ii) to compare Muslim and Christian ones as orchid habitats.

Materials and Methods

We studied burial grounds (Albanian: varrezë, hereafter graveyards) regardless of their religious affiliation, spatial dimension or geographic location within settlements. After preliminary studies between 2007 and 2011, 166 graveyards with different religious affiliation were studied in 21 districts from 2nd May to 3rd July 2015. All graveyards were visited once. We surveyed 1–26 (mean \pm SD = 7.8 \pm 6.0) graveyards in the studied districts (Fig. 1).

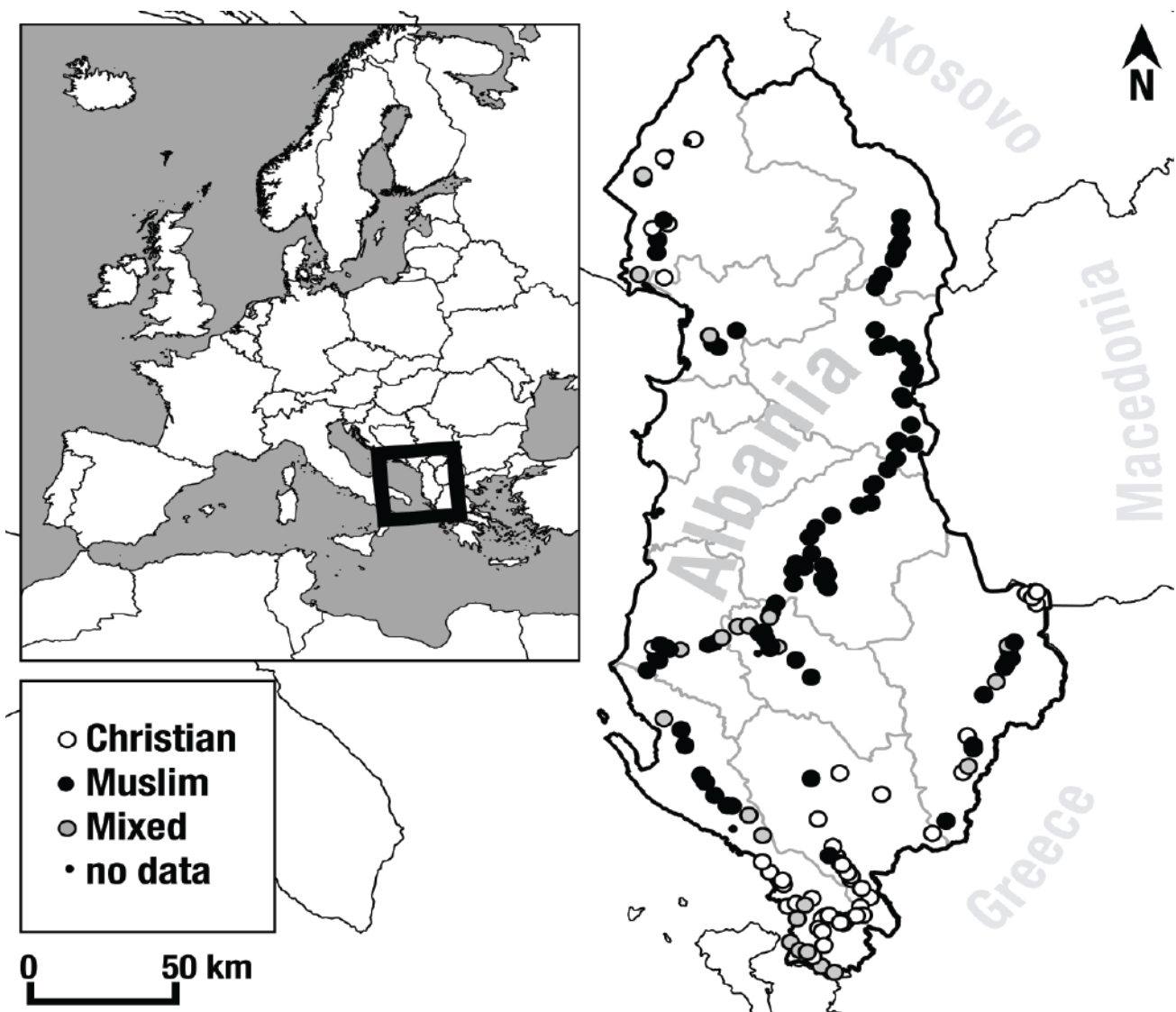


Fig. 1. Map of surveyed graveyards in Albania.

Table 1. Descriptive statistics of orchid taxa recorded in Albanian graveyards.

Taxon	Number of graveyards	Number of districts	Total number of observed individuals
<i>Serapias parviflora</i> Parl.	44	12	5873
<i>Orchis morio</i> L.	30	9	13367
<i>Orchis fragrans</i> Ten.	13	5	1737
<i>Ophrys crassicornis</i> (Renz) J. Devillers-Tersshuren & P. Devillers	13	5	377
<i>Serapias vomeracea</i> (Burm.f.) Briq.	12	5	166
<i>Ophrys sicula</i> Todaro	11	5	455
<i>Ophrys apifera</i> Huds.	10	6	260
<i>Anacamptis pyramidalis</i> (L.) Rich.	10	8	179
<i>Ophrys mammosa</i> Desf.	8	3	34
<i>Himantoglossum jankae</i> Somlyay <i>et al.</i>	6	5	106
<i>Epipactis microphylla</i> (Ehrh.) Sw.	6	5	77
<i>Ophrys</i> sp.	6	5	26
<i>Neotinea tridentata</i> Scop.	6	4	12
<i>Anacamptis laxiflora</i> (Lam.) Bateman <i>et al.</i>	5	4	2011
<i>Platanthera chlorantha</i> (Custer) Rchb.	5	4	77
<i>Limodorum abortivum</i> (L.) Sw.	5	3	16
<i>Ophrys ferrum-equinum</i> Desf.	4	2	35
<i>Epipactis helleborine</i> (L.) Crantz	4	3	8
<i>Ophrys bombyliflora</i> Link	3	2	32
<i>Orchis purpurea</i> Hudson	2	1	16
<i>Ophrys sphegodes</i> Miller	2	1	2
<i>Cephalanthera rubra</i> (L.) Rich.	1	1	50
<i>Ophrys epirotica</i> (Renz) J.Devillers-Tersshuren & P. Devillers	1	1	20
<i>Ophrys attica</i> (Boiss. & Orphanides) B.D. Jackson	1	1	8
<i>Cephalanthera longifolia</i> (L.) Fristch	1	1	3
<i>Ophrys speculum</i> Link	1	1	2
<i>Orchis intacta</i> Link	1	1	1
<i>Neottia ovata</i> (L.) Bluff & Fingerhuth	1	1	1
<i>Dactylorhiza sambucina</i> (L.) Soó	1	1	1

All orchid taxa and the number of individuals were counted or extrapolated in each graveyard. Taxa were identified based on Delforge (2006). In this paper we followed the nomenclature of Delforge (2006) except in the case of the genus *Himantoglossum* s. l. (incl. *Barlia*), where we followed the nomenclature of Sramkó *et al.* (2014). Authors of plant names are listed in Table 1. The geo-coordinates and the elevation of the visited graveyards were determined by a Garmin Trex Legend GPS handheld device and recorded in WGS84 format. Religious affiliation (Christian, Muslim or mixed) were determined based on religious symbols found on graves (cross or crescent). Altogether 85 Muslim, 50 Christian and 21 mixed graveyards were studied; in case of 10 graveyards, religious affiliation could not be categorized. The total area, proportional coverage of arboreal or grass dominated vegetation, graves, and the distance of graveyards from settlement margins were measured in Google Earth Pro software.

To understand the role of geographic factors in determining variation in species richness and abundance of orchids across Albania, statistical models were built with the above characters, plus elevation, longitude, latitude and religious affiliation as dependent variables, the interaction between latitude and longitude as explanatory variables. Both the number of individuals and the number of species were count variables with over dispersion; therefore, we used Generalised Linear Models (GLMs) with quasipoisson distribution in the R statistical environment (R Core Team, 2015). The full models were simplified by backward elimination of non-significant

predictors, until we obtained the minimal models (all parameters had $p < 0.05$).

To compare graveyard types in terms of abiotic/geographic conditions, we used Kruskal-Wallis non-parametric ANOVA, since variables did not follow a normal distribution. Significant differences were further analyzed by post-hoc tests (pairwise Wilcoxon-tests with Bonferroni correction).

Results and Discussion

Muslim graveyards were significantly larger and contained a smaller proportion of area covered by graves than Christian ones (Table 3, Fig. 6G, Fig. 6D). Mixed graveyards were larger than the other two types and contained a larger proportion of area covered by grasslands (and less forested area; Table 3, Fig. 6G, 6F).

Twenty-nine orchid taxa were found in total; substantial differences could be observed in the number of individual specimens, range, and frequency of taxa. Orchids were found in 1–18 provinces (mean \pm SD = 3.3 ± 3.3), and in 1–42 graveyards (mean \pm SD = 6.8 ± 8.7). Eight taxa were only detected in a single graveyard, whereas six taxa were found in more than 10 graveyards. In graveyards with at least one orchid species, one to 5000 specimens were recorded (mean \pm SD = 152 ± 625). Only one specimen was found in case of three taxa, more than 1000 specimens were found in case of four taxa (Table 1). The list of orchid taxa found and the visited localities are detailed in Table 5.

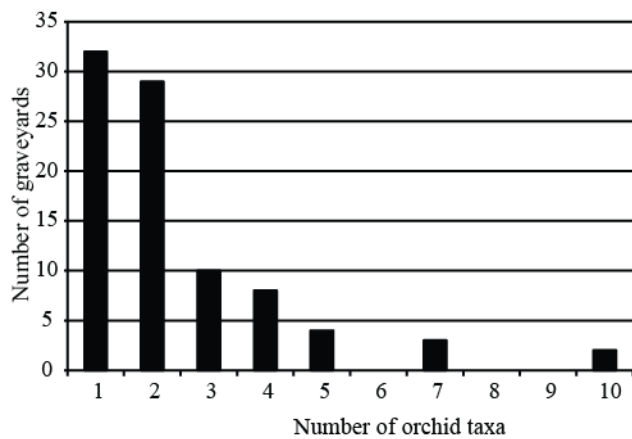


Fig. 2. Distribution of number of taxa in the 88 graveyards with orchids.

The mean number (\pm SD) of orchid species found in graveyards was 1.3 ± 1.8 . The highest number of species in a given graveyard was 10, but only one or two species occurred in most cases (32 and 27 graveyards, respectively). Those graveyards which are habitats for more than five species are very rare (5–3%) (Fig. 2). These most species-rich graveyards were found in district Vlorë (graveyard no.158, 163, 164, and 166) and in Bulqizë (graveyard no.11).

The mean number of individuals per graveyard was 152 ± 625 ; the majority (61 graveyards) harboured orchid individuals between 1 and 100 specimens, and we only detected >1000 individuals at six sites (3.7%) (Fig. 3).

We found at least one orchid species in 88 (53%) of the evaluated 166 graveyards. The 29 recorded orchid taxa represent 39.7% of the total orchid flora of Albania (as referred to Delforge, 2006).

The number of orchid taxa found in graveyards was significantly affected by religious identity both in the full and the minimal model (Table 2); significantly more taxa were found in Muslim graveyards and those with a mixed religious identity compared to purely Christian graveyards. In addition, species richness was significantly related to longitude in the reduced model (species richness decreasing towards the east, Fig. 4). Similar results were obtained for orchid abundance, which was higher in Muslim and mixed graveyards, and decreased towards the east (Table 2, Fig. 5). In addition, orchid abundance was also significantly positively related to elevation (Table 2). The quantity of orchid taxa, number of individuals and proportions in religiously different graveyards are summarized in Table 4.

The conservational importance of graveyards in different regions of Albania may be considerably different. More than 80% of the graveyards of districts Kolonjë, Vlorë, Bulqizë, Malësi e Madhe and Elbasan harboured orchids. Based on our dataset (the mean number of orchid taxa per graveyard), Vlorë district is the most outstanding area in Albania; in 12 graveyards, 16 different orchid taxa were found in this district. These findings are significant in light of the overall low proportion of common species recorded in the Orchidaceae family, where the percentage of common species is among the smallest, and percentage of rare species is significantly higher than in other plant families (Hodgson, 1986).

Although more orchid taxa (86) appear in Turkish graveyards (Löki *et al.*, 2015) than in Albanian ones (29), this number is still significant, particularly if taking the

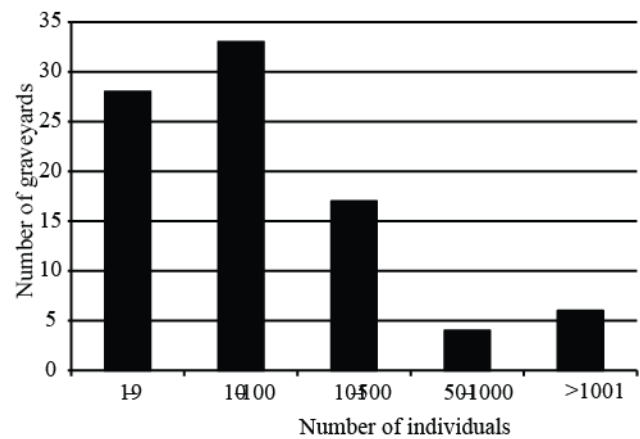


Fig. 3. Distribution of number of individuals in graveyards with orchids.

number of orchid species hosted, and the difference in total area of Albania and Turkey into consideration. This can be demonstrated by the proportion of the total area of the country, and the summarized area of the evaluated graveyards; while the complete area of Albania is 28 748 km², and the total area of our studied graveyards is only ca 200.98 hectares, almost 35% of the recorded Albanian orchid flora can be found in a mere 0.0005% of the total area of the country.

Our dataset proves that graveyards can play a significant role in conserving orchids in this country as well, and reveals an interesting characteristic of the conservational value of graveyards. Muslim graveyards seem to be more suitable for orchids than the graveyards with other religions in this country. Although Albania has several religions, the country is considered to be a less religious region (e.g. it was declared to be atheist between 1950 and 2000). This study revealed that religious affiliation may influence the occurrence of orchids, but the exact nature of abiotic and biotic conditions determining the conservational value of graveyards is yet to be uncovered, and the actual reasons why Muslim graveyards are more suitable for orchids in Albania is still to be explained. Despite atheism and apparent piety both exist in the country, we detected significant difference of the orchid hosting ability of different religious graveyards, thus this further strengthens that religious confession must determine the natural value of the habitat in different ways, even in a country which is considered as barely religious. Several studies suggested that vegetation and floristic composition of Muslim graveyards are more natural than those of the surrounding area (Champion *et al.*, 1965; Chaghtai, 1978; Ahmad *et al.*, 2010). This phenomenon can be explained by the less intensive land use activities (grazing, mowing, harvesting of medicinal herbs, etc.), since these are sacred places (Rahman *et al.*, 2008; Ahmad *et al.*, 2010; Hadi *et al.*, 2014), where several land use activities are restricted (Fig. 7A). This is generally true also for Christian graveyards, however, the examples of western European countries suggest that the maintenance practices may probably be more intensive (Plumwood, 2007). Systematic studies on this topic have not yet been conducted.

Our results show that Mediterranean graveyards can hold a highly significant conservational value as refuges of sensitive plants. This phenomenon probably holds for other (especially mainly Muslim) countries in this region, but may also be true in a wider geographical and cultural aspect.

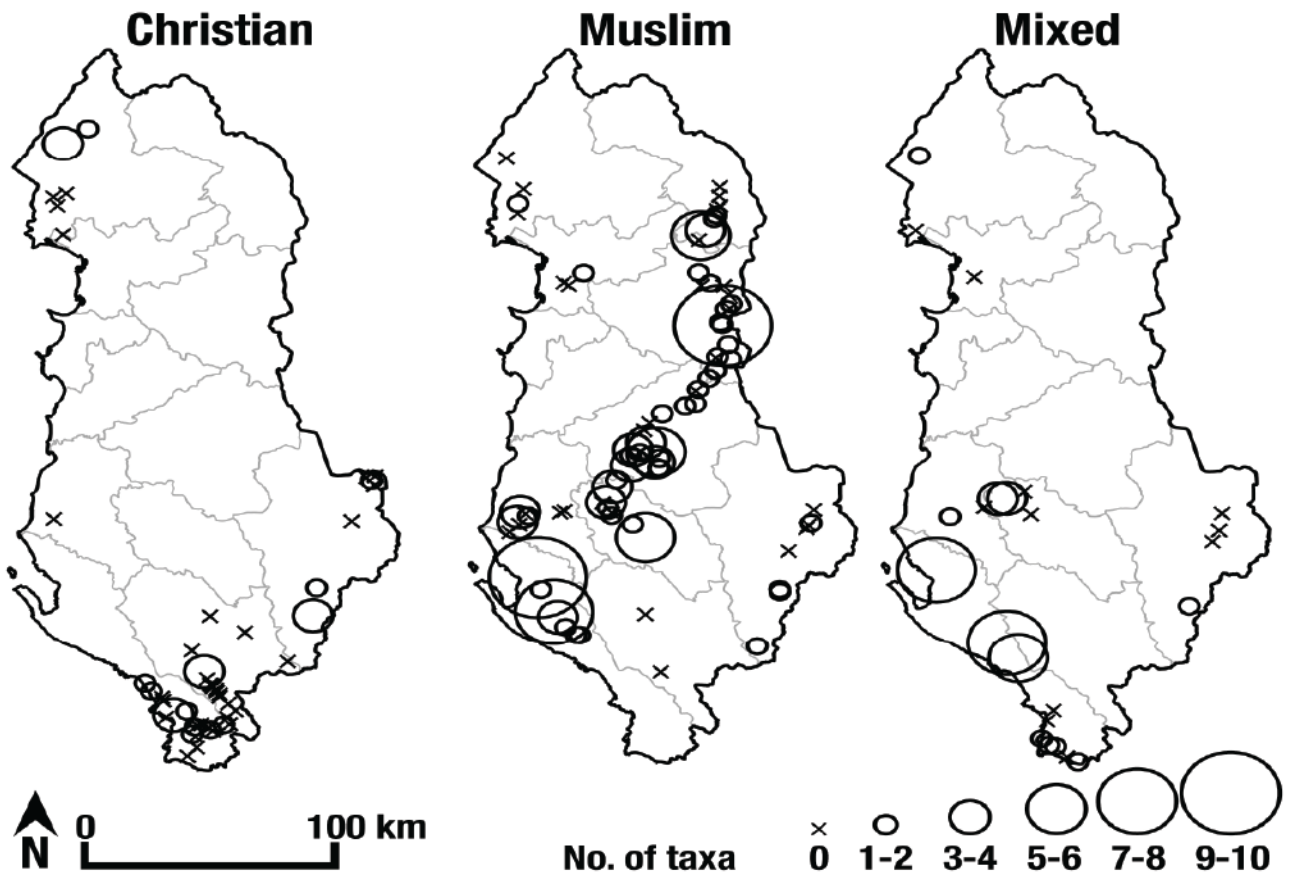


Fig. 4. Distribution of number of orchid taxa in graveyards studied.

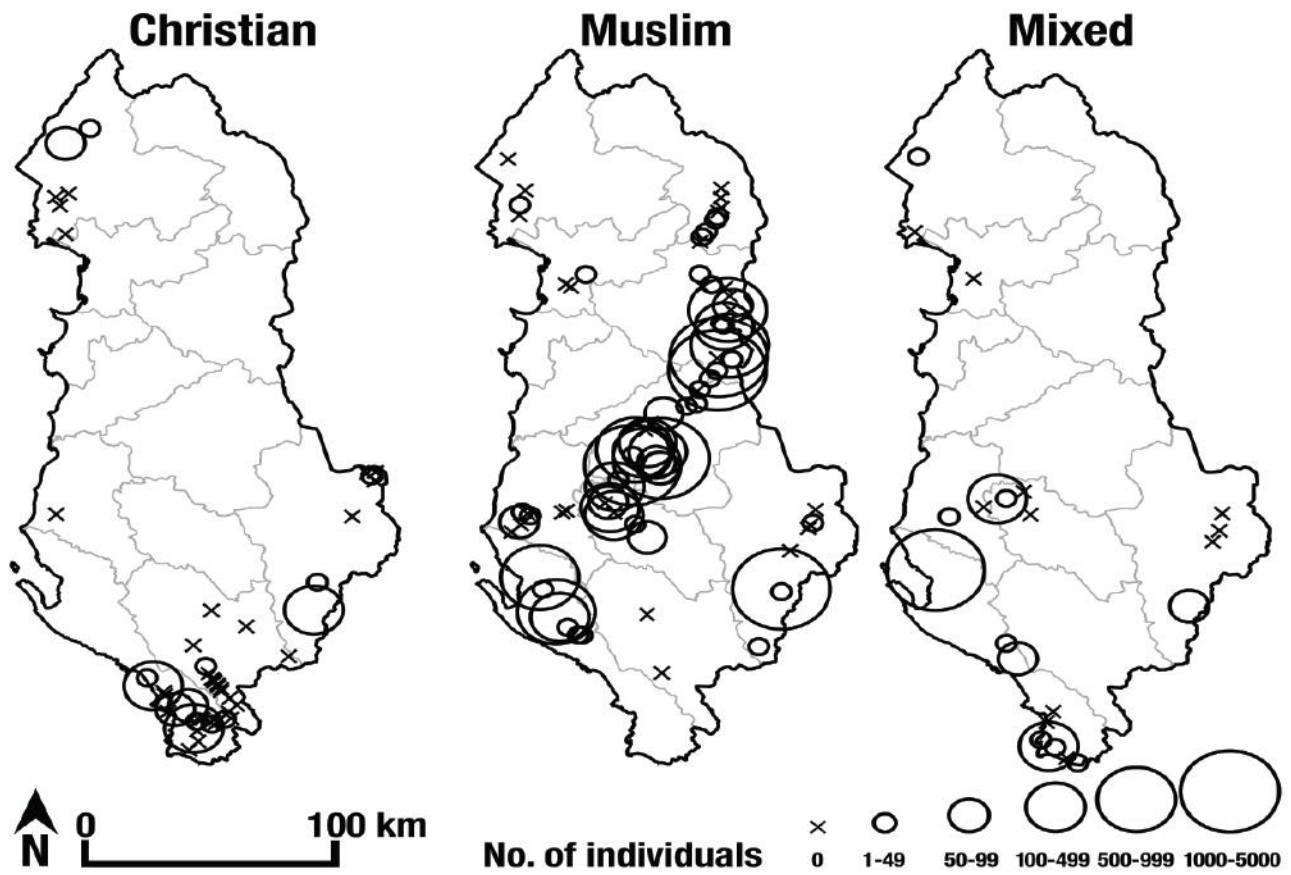


Fig. 5. Distribution of number of orchid individuals in graveyards studied.

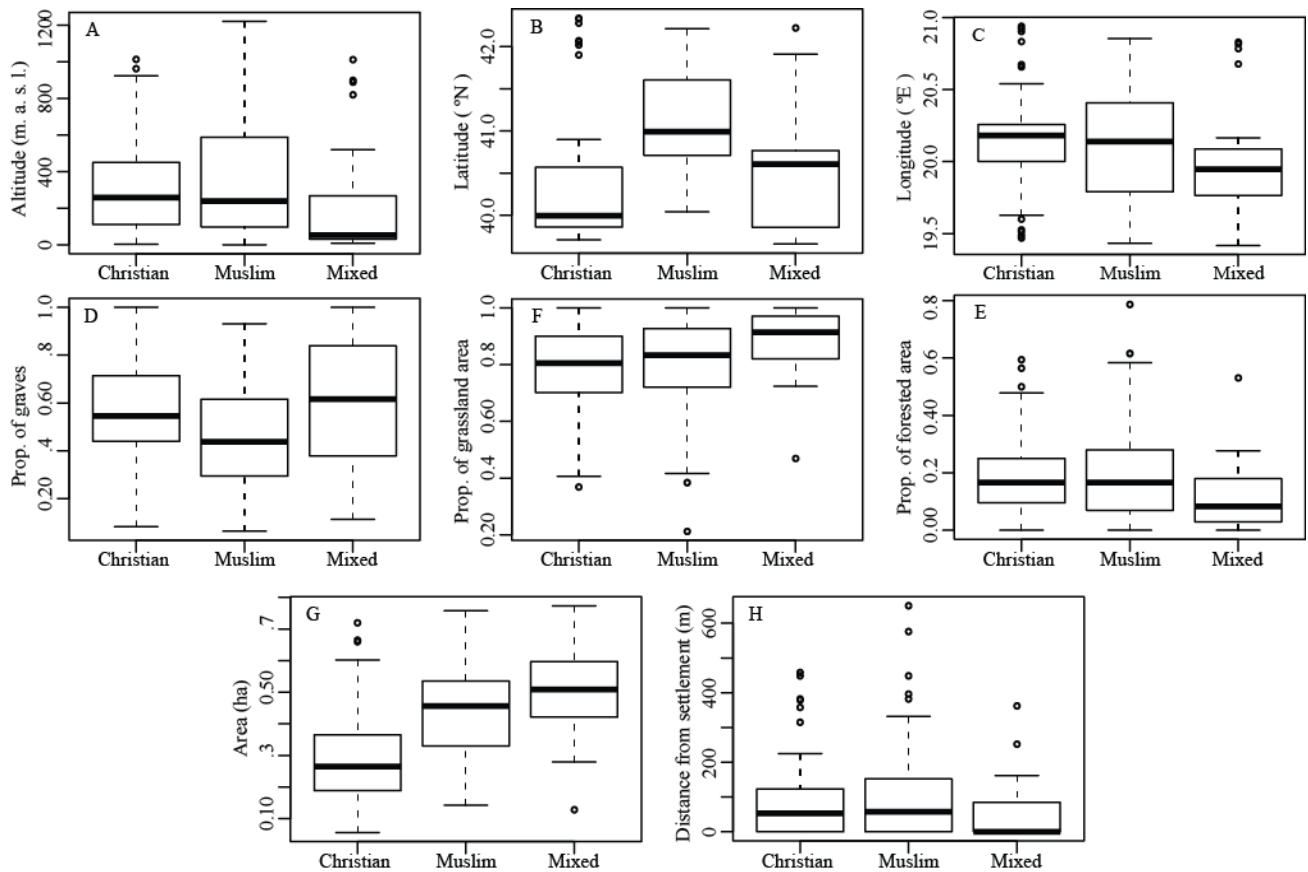


Fig. 6. Comparison of some characteristics of the studied graveyards. A. Elevation about see level (m), B. Geographic latitude ($^{\circ}$), Geographic longitude ($^{\circ}$), D. proportion of territory covered by graves, E. proportion of forested area, F. proportion of grassland area, G. Total area, H. Graveyard distance from settlement.

Table 2. Effect of abiotic / geographic factors on number of orchid taxa and number of orchid individuals per graveyard, as identified from Generalized Linear Models with quasipoisson distribution. Parameter estimates, their standard errors (SE), associated t-values (t) and significance levels (p) from the full and minimal models are presented

Number of taxa	Full model				Minimal model			
	Estimate	SD	t	P-value	Estimate	SD	t	P-value
Area	-0.977	0.759	-1.287	0.201				
Proportion of graves	0.085	0.494	0.171	0.864				
Proportion of forested area	1.104	5.576	0.198	0.843				
Proportion of grassland	1.143	5.503	0.208	0.836				
Latitude	-18.501	11.101	-1.667	0.098				
Longitude	-38.944	22.818	-1.707	0.090	-0.628	0.287	-2.189	0.030
Elevation	0.001	0.001	2.763	0.007				
Type (Muslim)	0.886	0.365	2.426	0.017				
Type (Mixed)	0.931	0.406	2.292	0.024	0.816	0.295	2.762	0.006
Latitude: Longitude	0.905	0.557	1.624	0.107	0.757	0.370	2.049	0.042
Number of individuals	Full model				Minimal model			
	Estimate	SD	t	P-value	Estimate	SD	t	P-value
Area	-2.654	1.391	-1.908	0.059				
Proportion of graves	1.996	1.180	1.692	0.093				
Proportion of forested area	0.200	20.901	0.010	0.992				
Proportion of grassland	0.314	20.830	0.015	0.988				
Latitude	-18.465	21.786	-0.848	0.398				
Longitude	-39.434	44.051	-0.895	0.372	-2.354	0.828	-2.843	0.005
Elevation	0.005	0.001	5.136	0.000	0.004	0.001	4.825	<0.001
Type (Muslim)	3.370	1.370	2.459	0.015	2.517	1.053	2.391	0.018
Type (Mixed)	2.907	1.480	1.964	0.052	2.411	1.156	2.085	0.039
Latitude: Longitude	0.888	1.083	0.820	0.414				

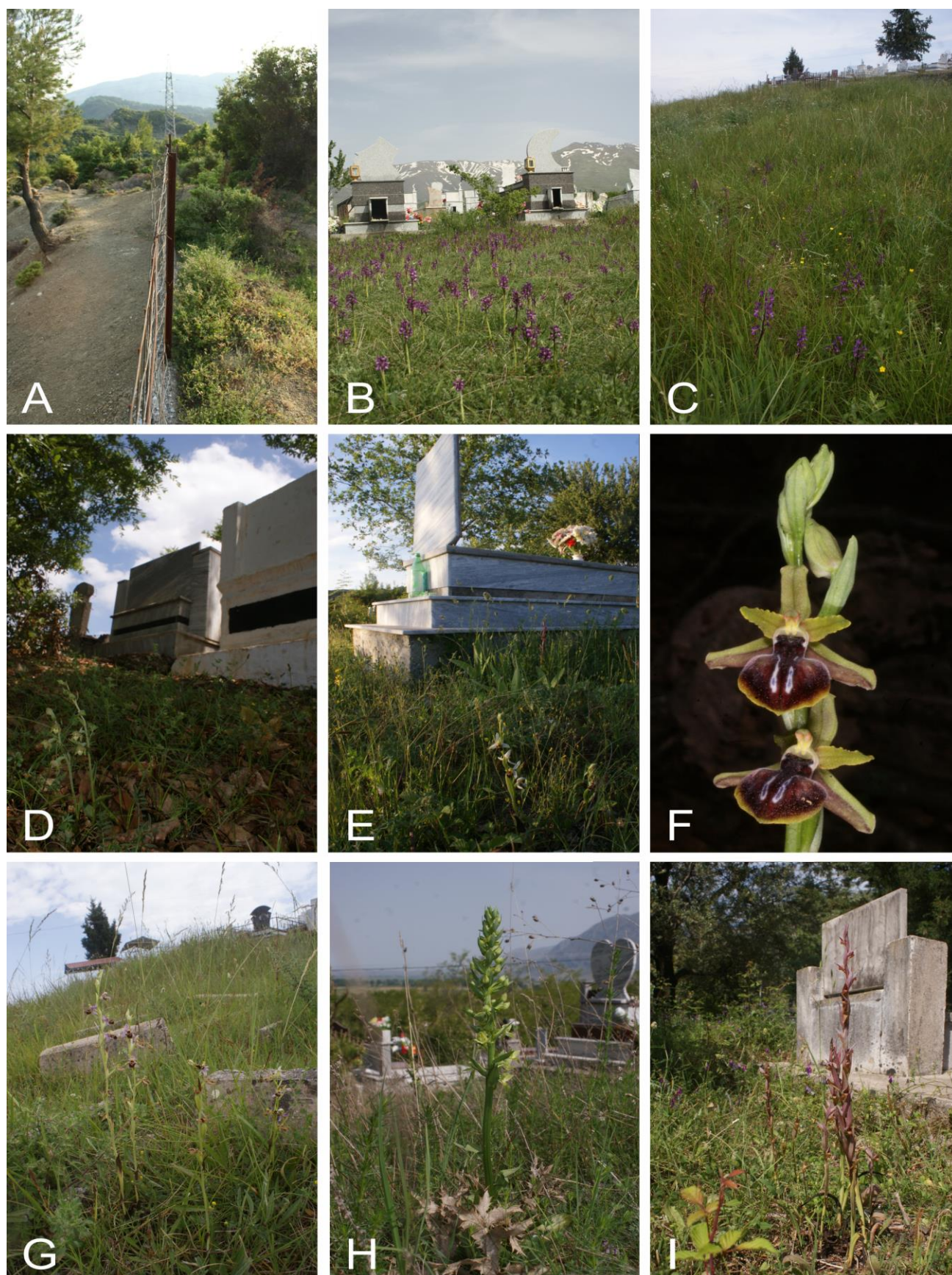


Fig. 7. A: Effect of fence of graveyards on grazing: plant cover is considerable lower outside (left) and inside (right) of graveyard [Drashovicë no. 158] Vlorë]; B: *Anacamptis morio* [Qinam no. 77] Kolonjë]; C: *Anacamptis laxiflora* [Vlorë no. 166] Vlorë]; D: *Epipactis microphylla* [Zgosht no. 108] Librazhd]; E: *Ophrys apifera* [Shtrazë no. 44] Elbasan]; F: *Ophrys epirotica* [Cereneç i Eperm no. 11] Bulqizë]; G: *Ophrys crassicornis* [Vlorë no. 166] Vlorë]; H: *Platanthera chlorantha* [Plasë no. 88] Korçë]; I: *Serapias parviflora* [Fterë no. 159] Delvinë]. – Photographs: A by A. Takács; B – I by A. Molnár V.

Table 3. Comparison of three graveyard types in terms of abiotic / geographic conditions. Overall comparison was performed with Kruskal-Wallis non-parametric ANOVA; statistically significant differences were further investigated with post-hoc tests (pairwise Wilcoxon tests with Bonferroni correction).

Variable	Comparison	P-value (Bonferroni-corrected)	Overall effect: Kruskal-Wallis χ^2 (P-value)
Elevation	Muslim-Christian	1.000	8.875 (0.012)
	Christian-Mixed	0.052	
	Muslim-Mixed	0.009	
Latitude	Muslim-Christian	<0.001	42.889 (<0.001)
	Christian-Mixed	1.000	
	Muslim-Mixed	0.001	
Longitude	Muslim-Christian	-	4.405 (0.111)
	Christian-Mixed	-	
	Muslim-Mixed	-	
Proportion of graves	Muslim-Christian	0.013	9.834 (0.007)
	Christian-Mixed	1.000	
	Muslim-Mixed	0.112	
Proportion of forested area	Muslim-Christian	1.000	7.167 (0.028)
	Christian-Mixed	0.026	
	Muslim-Mixed	0.053	
Proportion of grassland area	Muslim-Christian	1.000	8.648 (0.013)
	Christian-Mixed	0.009	
	Muslim-Mixed	0.051	
Area	Muslim-Christian	<0.001	33.071 (<0.001)
	Christian-Mixed	<0.001	
	Muslim-Mixed	0.08	
Distance from settlement	Muslim-Christian	-	2.098 (0.350)
	Christian-Mixed	-	
	Muslim-Mixed	-	

Table 4. Descriptive statistics of orchid taxa, individuals and proportions in religiously different graveyards of Albania.

Religious affiliation of graveyards	Number of orchid taxa (Mean \pm SD)	Number of orchid individuals (Mean \pm SD)	Percentage of graveyards with orchids
Christian	0.67 \pm 1.19	17 \pm 47	29.4%
Mixed	1.57 \pm 2.21	147 \pm 545	52.2%
Muslim	1.54 \pm 1.98	241 \pm 803	63.5%

Conclusions

The highly valuable biodiversity of Albania is deteriorating due to different reasons, and in the changing circumstances graveyards in the country are apparently suitable habitats for sensitive species, like orchids. A total of 29 orchid taxa was recorded in graveyards in this study, representing 35% of the total orchid flora of Albania; orchids represented in graveyards by tens of thousands of individuals. Based on our data, in this religiously multicoloured country, Muslim graveyards host more orchids than Christian or mixed ones. Since several studies suggested that the vegetation and floristic composition of Muslim graveyards are more natural than those of the surrounding areas, the phenomenon reported here for Albania is presumably not unique, and additional studies could probably reveal the conservation role of graveyards, especially those managed in the Muslim way, in different regions of the world.

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Table 5. Geographic location, elevation, area, and orchid taxa of the 166 graveyards studied. Localities are listed alphabetically, first by district, then by settlement. A dash “–” indicates that no orchid taxa were recorded.

No.	District	Settlement	Latitude, longitude	Area [ha]	Elevation a.s.l. [m]	Religious affiliation	Orchid taxa
1.	Berat	Berat	40.71994° N, 019.94755° E	3.44	62	C+M	–
2.	Berat	Kutalli	40.78687° N, 019.79543° E	0.64	55	C+M	<i>Ophrys mammosa</i> , <i>Serapias parviflora</i> , <i>Ophrys sicula</i>
3.	Berat	Lagjia e Shkallës	40.74577° N, 019.90177° E	0.18	106	M	<i>Serapias parviflora</i> , <i>Orchis fragrans</i>
4.	Berat	Moravë	40.76848° N, 019.89344° E	0.41	31	M	<i>Ophrys mammosa</i> , <i>Serapias parviflora</i> , <i>Orchis fragrans</i> , <i>Ophrys apifera</i>
5.	Berat	Paftal	40.69717° N, 19.872900° E	0.43	472	NA	<i>Ophrys mammosa</i> , <i>Ophrys sicula</i>
6.	Berat	Poshnjë	40.78852° N, 019.83691° E	1.06	41	C+M	<i>Anacamptis pyramidalis</i> , <i>Ophrys mammosa</i> , <i>Serapias parviflora</i> , <i>Neottinea tridentata</i>
7.	Berat	Remanicë	40.72441° N, 019.91999° E	0.17	47	M	–
8.	Berat	Starovë	40.71302° N, 019.91892° E	0.55	73	M	<i>Serapias parviflora</i> , <i>Orchis fragrans</i>
9.	Berat	Ure Vajgurorë	40.76592° N, 019.87805° E	1.12	67	M	–
10.	Berat	Vodicë	40.67568° N, 020.01707° E	1.57	107	M	<i>Ophrys apifera</i>
11.	Bulqizë	Cerenec i Eperm	41.51296° N, 020.43402° E	1.46	652	M	<i>Platanthera chlorantha</i> , <i>Epipactis microphylla</i> , <i>Ophrys oestriifera</i> , <i>Epipactis helleborine</i> , <i>Ophrys sp.</i> , <i>Cephalanthera rubra</i> , <i>Limodorum abortivum</i> , <i>Ophrys epirotica</i> , <i>Neottia ovata</i>
12.	Bulqizë	Cerenec i Poshtem	41.51610° N, 020.43066° E	1.43	588	M	<i>Epipactis helleborine</i>
13.	Bulqizë	Fushe Studë	41.32405° N, 020.39964° E	0.35	1123	M	–
14.	Bulqizë	Fushe Studë	41.32647° N, 020.40238° E	0.24	1135	M	–
15.	Bulqizë	Klenjë	41.37162° N, 020.46955° E	3.42	1222	M	<i>Dactylorhiza sambucina</i>
16.	Bulqizë	Llangë	41.29115° N, 020.36849° E	3.01	1024	M	–
17.	Bulqizë	Ostreni i Madh	41.43268° N, 020.45855° E	2.49	938	M	<i>Limodorum abortivum</i>
18.	Bulqizë	Sebisht	41.37690° N, 020.40133° E	NA	917	M	–
19.	Bulqizë	Sebisht	41.38227° N, 020.40876° E	0.82	825	M	–
20.	Bulqizë	Shupenzë	41.52638° N, 020.42202° E	1.47	530	M	–
21.	Delvinë	Çlirim	39.90269° N, 020.07909° E	0.14	45	C	<i>Anacamptis pyramidalis</i> , <i>Serapias parviflora</i>
22.	Dibër	Arras	41.73431° N, 020.32132° E	0.55	442	M	<i>Platanthera chlorantha</i>
23.	Dibër	Cernenë	41.58473° N, 020.46434° E	0.22	557	M	–
24.	Dibër	Maqellarë	41.60355° N, 020.47276° E	1.05	620	M	–
25.	Dibër	Muhur	41.68013° N, 020.33530° E	1.31	428	M	–
26.	Dibër	Peshkopi	41.67794° N, 020.43795° E	3.04	671	M	–
27.	Dibër	Staravec	41.691900° N, 20.435990° E	0.82	846	NA	<i>Epipactis microphylla</i> , <i>Limodorum abortivum</i>
28.	Dibër	Trepçë	41.64248° N, 020.45918° E	0.59	812	M	–
29.	Dibër	Vojnik	41.58190° N, 020.44958° E	1.31	555	M	–
30.	Dibër	Zall-Rec	41.86910° N, 020.32264° E	NA	420	M	–
31.	Dibër	Zdojan	41.68970° N, 020.37539° E	0.8	506	M	–
32.	Elbasan	Cikallesh	41.02106° N, 020.07783° E	0.59	225	M	<i>Serapias parviflora</i> , <i>Serapias vomeracea</i> , <i>Orchis fragrans</i>

Table 5. (Cont'd.).

No.	District	Settlement	Latitude, longitude	Area [ha]	Elevation a.s.l. [m]	Religious affiliation	Orchid taxa
33.	Elbasan	Cingari I Siperim	40.95470° N, 020.13982° E	0.52	440	M	<i>Serapias parviflora</i>
34.	Elbasan	Drizë	40.91499° N, 020.13499° E	0.3	185	M	<i>Serapias parviflora</i>
35.	Elbasan	Elbasan	41.10454° N, 020.09406° E	10.05	113	M	–
36.	Elbasan	Frashër	40.86237° N, 019.94051° E	0.24	83	M	<i>Serapias parviflora</i> , <i>Orchis fragrans</i>
37.	Elbasan	Gostimë	40.99046° N, 020.01798° E	2.43	97	M	<i>Serapias parviflora</i> , <i>Ophrys oestriifera</i> , <i>Orchis fragrans</i> , <i>Ophrys apifera</i>
38.	Elbasan	Labinot-Fushë	41.14317° N, 020.15363° E	0.43	153	M	<i>Serapias parviflora</i> , <i>Ophrys oestriifera</i>
39.	Elbasan	Lumas	40.96862° N, 020.00663° E	NA	81	M	<i>Serapias parviflora</i> , <i>Orchis fragrans</i>
40.	Elbasan	Mjekes	41.07414° N, 020.06874° E	0.48	135	M	–
41.	Elbasan	Mollas	40.92557° N, 020.00795° E	0.53	133	M	<i>Serapias parviflora</i> , <i>Ophrys oestriifera</i> , <i>Orchis fragrans</i>
42.	Elbasan	Plak	40.98190° N, 020.12470° E	0.8	321	M	<i>Anacamptis pyramidalis</i> , <i>Serapias parviflora</i> , <i>Himantoglossum jankae</i> , <i>Ophrys oestriifera</i> , <i>Orchis fragrans</i>
43.	Elbasan	Shpanja	40.97875° N, 020.04972° E	1.62	117	M	<i>Serapias parviflora</i> , <i>Orchis fragrans</i>
44.	Elbasan	Shtrazë	40.93850° N, 020.11905° E	0.25	239	M	<i>Serapias parviflora</i> , <i>Ophrys oestriifera</i> , <i>Ophrys apifera</i>
45.	Fier	Fier	40.71101° N, 019.57451° E	9.47	30	C+M	<i>Ophrys apifera</i>
46.	Fier	Jaru	40.68496° N, 019.48241° E	1.13	45	M	<i>Serapias parviflora</i> , <i>Serapias vomeracea</i> , <i>Ophrys sicula</i> , <i>Ophrys speculum</i>
47.	Fier	Kuman	40.72565° N, 019.68123° E	1.26	25	M	–
48.	Fier	Levan	40.67374° N, 019.49189° E	0.87	40	M	–
49.	Fier	Pojan	40.71835° N, 019.46988° E	1.16	50	C	–
50.	Fier	Radostinë	40.72810° N, 019.49659° E	1.19	40	M	<i>Serapias parviflora</i> , <i>Serapias vomeracea</i> , <i>Ophrys sp.</i>
51.	Fier	Roskovec	40.73232° N, 019.70151° E	2.7	36	M	–
52.	Fier	Strumë	40.75146° N, 019.73285° E	1.92	16	C+M	–
53.	Fier	Vadhizë	40.71951° N, 019.52137° E	2.83	50	M	–
54.	Fier	Zhupan	40.71124° N, 019.53391° E	1.37	59	M	<i>Serapias vomeracea</i>
55.	Gjirokastrë	Bodrishtë	39.90548° N, 020.30210° E	0.41	313	C	–
56.	Gjirokastrë	Dervican	40.03971° N, 020.17297° E	0.81	205	C	–
57.	Gjirokastrë	Farshtan	39.96391° N, 020.22970° E	0.27	343	C	–
58.	Gjirokastrë	Gjirokastra	40.07113° N, 020.15912° E	5.43	200	C	<i>Anacamptis pyramidalis</i> , <i>Ophrys attica</i> , <i>Serapias parviflora</i>
59.	Gjirokastrë	Goranxi	40.01672° N, 020.18722° E	0.31	265	C	–
60.	Gjirokastrë	Goricë	39.97516° N, 020.22953° E	0.15	297	C	–
61.	Gjirokastrë	Haskovë	40.00503° N, 020.19905° E	0.24	300	C	–
62.	Gjirokastrë	Jorgucat	39.93490° N, 020.26966° E	0.92	250	C	–
63.	Gjirokastrë	Kerrë	39.87500° N, 020.26458° E	0.26	760	C	–
64.	Gjirokastrë	Lazarat	40.04162° N, 020.14630° E	1.76	490	M	–
65.	Gjirokastrë	Palokaster	40.16059° N, 020.10219° E	0.36	189	C	–
66.	Gjirokastrë	Sofratikë	39.99458° N, 020.21276° E	0.32	235	C	–

Table 5. (Cont'd.).

No.	District	Settlement	Latitude, longitude	Area [ha]	Elevation a.s.l. [m]	Religious affiliation	Orchid taxa
67.	Gjirokaštër	Terihat	39.98531° N, 020.21593° E	0.23	340	C	–
68.	Gjirokaštër	Vanister	40.01193° N, 020.19543° E	0.31	216	C	–
69.	Gramsh	Cerujë	40.91256° N, 020.14081° E	0.65	198	M	<i>Serapias parviflora</i> , <i>Neotinea tridentata</i>
70.	Kavajë	Hallula	41.15751° N, 19.496860° E	0.93	38	NA	<i>Ophrys sphegodes</i>
71.	Kavajë	Peqinaj	41.14415° N, 19.475570° E	0.2	133	NA	<i>Ophrys sphegodes</i>
72.	Kolonjë	Borovë	40.31187° N, 020.65736° E	0.92	1013	C	<i>Himantoglossum jankae</i> , <i>Orchis purpurea</i>
73.	Kolonjë	Erseka	40.33160° N, 020.67847° E	1.49	1012	C+M	<i>Orchis purpurea</i>
74.	Kolonjë	Leskovik	40.15456° N, 020.59278° E	0.74	930	M	<i>Neotinea tridentata</i>
75.	Kolonjë	Mollas	40.43001° N, 020.67438° E	0.5	963	C	<i>Neotinea tridentata</i>
76.	Kolonjë	Qinam	40.40025° N, 020.69630° E	0.55	1067	M	–
77.	Kolonjë	Selenica	40.38900° N, 020.69731° E	1	1053	M	–
78.	Korçë	Dishnicë	40.65208° N, 020.81662° E	0.97	890	C+M	–
79.	Korçë	Gollomboc	40.86072° N, 020.93892° E	0.38	857	C	–
80.	Korçë	Gorica e Madhë	40.89269° N, 020.90194° E	0.46	924	C	–
81.	Korçë	Gorica e Vogel	40.88041° N, 020.92440° E	0.17	860	C	–
82.	Korçë	Kallamas	40.89778° N, 020.94147° E	0.21	870	C	–
83.	Korçë	Korçë	40.60519° N, 020.78555° E	15.64	900	C+M	–
84.	Korçë	Kuci i Zi	40.67194° N, 020.83024° E	0.81	890	M	–
85.	Korçë	Mollaj	40.56286° N, 020.73747° E	0.92	888	M	–
86.	Korçë	Nevecisht	40.65848° N, 020.82040° E	0.5	885	M	–
87.	Korçë	Pendavinj	40.70923° N, 020.83497° E	2.07	823	C	–
88.	Korçë	Plasë	40.68069° N, 020.84183° E	1.08	890	M	<i>Platanthera chlorantha</i> , <i>Himantoglossum jankae</i>
89.	Korçë	Pojan	40.72463° N, 020.83010° E	1.17	820	C+M	–
90.	Korçë	Zvezdë	40.73677° N, 020.85444° E	1.29	830	M	–
91.	Kuçovë	Gegë	40.83473° N, 019.92311° E	0.65	106	M	<i>Anacamptis laxiflora</i> , <i>Serapias parviflora</i> , <i>Orchis fragrans</i> , <i>Ophrys</i> sp.
92.	Kuçovë	Kucovë	40.81698° N, 019.91651° E	3.61	55	C+M	–
93.	Kukës	Bicaj	41.99516° N, 020.40588° E	3.47	482	M	–
94.	Kukës	Draj-Reç	41.88846° N, 020.33123° E	NA	500	M	<i>Platanthera chlorantha</i> , <i>Epipactis microphylla</i> , <i>Epipactis helleborine</i> , <i>Limodorum abortivum</i> , <i>Cephalanthera longifolia</i>
95.	Kukës	Gostil	42.05210° N, 020.41723° E	2.79	378	M	–
96.	Kukës	Kolesjan	41.95906° N, 020.39334° E	0.36	671	M	–
97.	Kukës	Kolesjan	41.97331° N, 020.40301° E	1.08	225	M	<i>Anacamptis laxiflora</i>
98.	Kukës	Kukes	42.09101° N, 020.41964° E	3.17	356	M	–
99.	Kukës	Nangë	42.01132° N, 020.42091° E	1.02	413	M	–
100.	Kukës	Ujmisht	41.91067° N, 020.35206° E	NA	650	M	<i>Platanthera chlorantha</i> , <i>Epipactis microphylla</i> , <i>Limodorum abortivum</i>

Table 5. (Cont'd.).

No.	District	Settlement	Latitude, longitude	Area [ha]	Elevation a.s.l. [m]	Religious affiliation	Orchid taxa
101.	Kurbın	Milot	41.68066° N, 019.72123° E	0.72	70	M	–
102.	Lezhë	Fang	41.73255° N, 019.79009° E	0.29	99	M	<i>Serapias parviflora</i>
103.	Lezhë	Pllanë	41.69210° N, 019.69775° E	NA	19	M	–
104.	Lezhë	Zejmen	41.71642° N, 019.68682° E	1.59	12	C+M	–
105.	Librazhd	Allaj	41.23821° N, 020.30879° E	NA	450	M	–
106.	Librazhd	Librazhd	41.18452° N, 020.30627° E	0.97	268	M	<i>Serapias parviflora</i> , <i>Ophrys apifera</i>
107.	Librazhd	Mirakë	41.17493° N, 020.26011° E	0.34	220	M	<i>Serapias parviflora</i>
108.	Librazhd	Zgosht	41.24498° N, 020.31964° E	2.77	551	M	<i>Epipactis microphylla</i>
109.	Malësi e Madhe	Dedaj	42.29239° N, 019.53505° E	0.65	473	NA	<i>Anacamptis pyramidalis</i> , <i>Himantoglossum jankae</i>
110.	Malësi e Madhe	Ducaj	42.33887° N, 019.62650° E	0.07	698	C	–
111.	Malësi e Madhe	Koplik	42.21195° N, 019.43198° E	0.54	61	M	–
112.	Malësi e Madhe	Koplik	42.22306° N, 019.43204° E	2.01	53	C+M	<i>Serapias parviflora</i> , <i>Orchis fragrans</i>
113.	Malësi e Madhe	Mucovilë	42.25314° N, 019.51816° E	0.35	390	NA	<i>Neotinea tridentata</i>
114.	Malësi e Madhe	Xhaj	42.33019° N, 019.60145° E	0.21	655	NA	<i>Anacamptis pyramidalis</i> , <i>Himantoglossum jankae</i> , <i>Neotinea tridentata</i>
115.	Malësi e Madhe	Zagorë	42.27761° N, 019.51241° E	NA	397	C	<i>Anacamptis pyramidalis</i> , <i>Serapias parviflora</i> , <i>Ophrys sp.</i>
116.	Përmet	Carshovë	40.11424° N, 020.54120° E	0.21	337	C	–
117.	Përmet	Dragot	40.29218° N, 020.07542° E	0.42	157	M	–
118.	Përmet	Kelcyrë	40.30977° N, 020.18552° E	0.41	183	C	–
119.	Përmet	Permet	40.24114° N, 020.34561° E	1.15	238	C	–
120.	Sarandë	Berdenesh	39.83611° N, 020.02275° E	1.03	32	C+M	–
121.	Sarandë	Cerkovicë	39.82990° N, 020.21004° E	0.18	373	C	–
122.	Sarandë	Cifliq	39.68106° N, 020.11453° E	0.15	32	C+M	–
123.	Sarandë	Dermish	39.84270° N, 020.12736° E	0.47	180	C	–
124.	Sarandë	Dërmish	39.83488° N, 020.11776° E	0.85	45	C	<i>Serapias parviflora</i>
125.	Sarandë	Dhiver	39.83147° N, 020.18093° E	0.57	530	C	–
126.	Sarandë	Konispol	39.66079° N, 020.16508° E	1.34	150	C+M	<i>Serapias parviflora</i>
127.	Sarandë	Ksamil	39.75984° N, 019.99659° E	0.58	52	C+M	<i>Anacamptis laxiflora</i>
128.	Sarandë	Kulluricë	39.80482° N, 020.10446° E	0.38	31	C	<i>Ophrys ferrum-equinum</i> , <i>Serapias parviflora</i>
129.	Sarandë	Leshnice e Siperme	39.84745° N, 020.27528° E	NA	637	C	–
130.	Sarandë	Livadhja	39.79490° N, 020.11915° E	0.2	42	C	–
131.	Sarandë	Lukovë	39.98762° N, 019.91718° E	0.63	258	C	<i>Serapias parviflora</i> , <i>Ophrys bombyliflora</i>
132.	Sarandë	Memoraq	39.84689° N, 020.14438° E	0.27	135	C	–
133.	Sarandë	Mursi	39.71219° N, 020.08229° E	0.61	29	C	–
134.	Sarandë	Nivicë	39.94776° N, 019.97066° E	0.43	230	C	–

Table 5. (Cont'd.).

No.	District	Settlement	Latitude, longitude	Area [ha]	Elevation a.s.l. [m]	Religious affiliation	Orchid taxa
135.	Sarandë	Pilo	39.84540° N, 020.24924° E	0.25	495	C	<i>Ophrys ferrum-equinum</i> , <i>Serapias parviflora</i>
136.	Sarandë	Piqeras	40.02163° N, 019.88850° E	0.57	226	C	<i>Ophrys sicula</i>
137.	Sarandë	Saranda	39.87658° N, 019.98497° E	3.07	30	C	–
138.	Sarandë	Sarandë	39.88638° N, 020.01819° E	0.5	88	C	<i>Anacamptis pyramidalis</i> , <i>Ophrys mammosa</i> , <i>Serapias parviflora</i> , <i>Ophrys sicula</i>
139.	Sarandë	Shen Vasil	39.96126° N, 019.96607° E	0.34	276	C	–
140.	Sarandë	Shendelli	39.73232° N, 020.03194° E	0.82	9	C+M	<i>Serapias parviflora</i> , <i>Serapias vomeracea</i>
141.	Sarandë	Shëndrë	39.82034° N, 020.19850° E	0.14	347	C	–
142.	Sarandë	Shëndrë	39.82349° N, 020.18766° E	0.06	405	C	<i>Ophrys ferrum-equinum</i> , <i>Serapias parviflora</i>
143.	Sarandë	Vagalat	39.74904° N, 020.12481° E	0.66	71	C	–
144.	Sarandë	Vrion	39.88054° N, 020.05239° E	0.81	21	C+M	–
145.	Sarandë	Xarrë	39.72716° N, 020.06163° E	0.41	37	C+M	<i>Serapias parviflora</i>
146.	Shkodër	Berdicë	42.01875° N, 019.48684° E	0.82	45	C	–
147.	Shkodër	Berdicë	42.02122° N, 019.48606° E	1.02	19	M	<i>Anacamptis pyramidalis</i> , <i>Ophrys oestrifera</i>
148.	Shkodër	Gomsiqë	41.91087° N, 019.41615° E	1.63	8	C+M	–
149.	Shkodër	Shiroka	42.05540° N, 019.46754° E	0.51	14	C	–
150.	Shkodër	Shkoder	42.06994° N, 019.52681° E	3.18	21	C	–
151.	Shkodër	Shkoder	42.08263° N, 019.51070° E	3.5	31	M	–
152.	Shkodër	Torovicë	41.90047° N, 019.51252° E	0.36	3	C	–
153.	Shkodër	Trush	41.97943° N, 019.48342° E	1.15	4	M	–
154.	Skrapar	Çepan	40.61994° N, 020.07576° E	0.5	203	M	<i>Anacamptis pyramidalis</i> , <i>Serapias vomeracea</i> , <i>Ophrys sicula</i> , <i>Ophrys oestrifera</i> , <i>Ophrys apifera</i>
155.	Vlorë	Bishan	40.64245° N, 019.44692° E	0.75	3	M	–
156.	Vlorë	Bletëz	40.20294° N, 019.77307° E	NA	288	M	<i>Serapias parviflora</i>
157.	Vlorë	Brataj	40.28053° N, 019.67008° E	1.43	175	M	<i>Serapias parviflora</i> , <i>Ophrys sicula</i> , <i>Orchis fragrans</i>
158.	Vlorë	Drashovicë	40.45022° N, 019.57796° E	0.97	86	M	<i>Ophrys ferrum-equinum</i> , <i>Ophrys mammosa</i> , <i>Anacamptis laxiflora</i> , <i>Serapias parviflora</i> , <i>Serapias vomeracea</i> , <i>Ophrys sicula</i> , <i>Ophrys oestrifera</i> , <i>Ophrys apifera</i> , <i>Ophrys sp.</i>
159.	Vlorë	Fterë	40.10735° N, 019.88984° E	NA	386	C+M	<i>Ophrys mammosa</i> , <i>Serapias parviflora</i> , <i>Serapias vomeracea</i> , <i>Ophrys sicula</i>
160.	Vlorë	Hor	40.23709° N, 019.70633° E	0.85	228	M	<i>Ophrys oestrifera</i>
161.	Vlorë	Kallarat	40.20382° N, 019.75444° E	0.97	273	M	<i>Serapias parviflora</i> , <i>Serapias vomeracea</i>
162.	Vlorë	Kotë	40.39895° N, 019.59239° E	1.12	115	M	<i>Ophrys sp.</i>
163.	Vlorë	Kuc	40.17307° N, 019.83705° E	1.17	520	C+M	<i>Serapias parviflora</i> , <i>Serapias vomeracea</i> , <i>Epipactis microphylla</i> , <i>Ophrys oestrifera</i> , <i>Epipactis helleborine</i> , <i>Neotinea maculata</i>
164.	Vlorë	Lepenicë	40.30280° N, 019.65306° E	0.39	159	M	<i>Ophrys mammosa</i> , <i>Serapias parviflora</i> , <i>Serapias vomeracea</i> , <i>Ophrys sicula</i> , <i>Ophrys bombyliflora</i> , <i>Ophrys oestrifera</i> , <i>Ophrys apifera</i>
165.	Vlorë	Pilur	40.12898° N, 19.776310° E	0.3	713	NA	<i>Himantoglossum jankae</i>
166.	Vlorë	Vlorë	40.48549° N, 019.51166° E	15.53	85	C+M	<i>Anacamptis laxiflora</i> , <i>Serapias parviflora</i> , <i>Serapias vomeracea</i> , <i>Ophrys sicula</i> , <i>Ophrys bombyliflora</i> , <i>Ophrys oestrifera</i> , <i>Ophrys apifera</i>

Abbreviations of religious affiliation: C – Christian, M – Muslim, C+M – mixed, NA – no data

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