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# 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 exclosures 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; Kasparek & 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 ± SD = 7.8 ± 6.0) graveyards in the studied districts (Fig. 1).

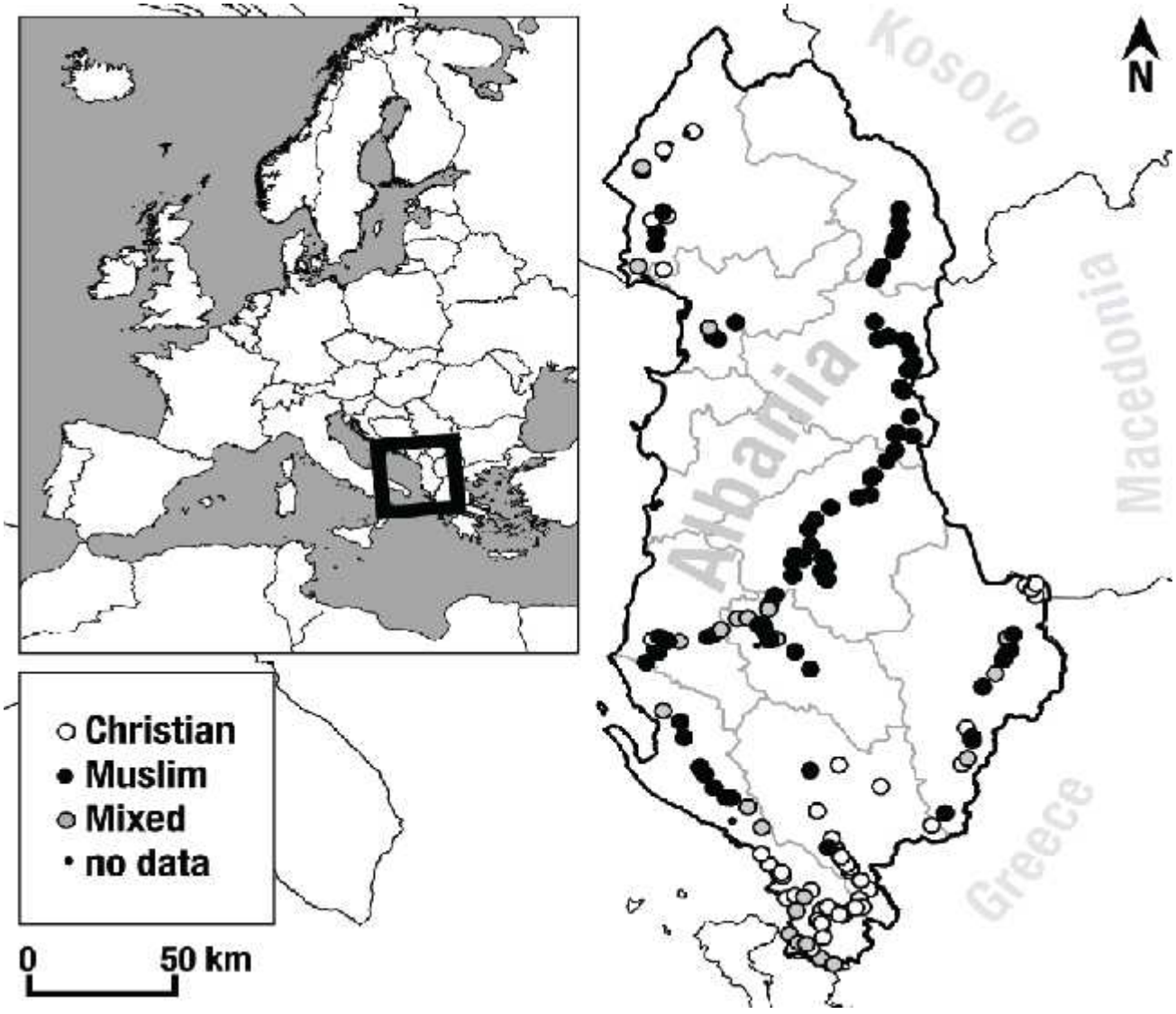


Fig. 1. Map of surveyed graveyards in Albania.

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

| Taxon | Number of graveyards | Number of districts | Total number of observed individuals |
|---|---|---|---|
| *Serapias parviflora* Parl. | 44 | 12 | 5873 |
| *Orchis morio* L. | 30 | 9 | 13367 |
| *Orchis fragrans* Ten. | 13 | 5 | 1737 |
| *Ophrys crassicornis* (Renz) J. Devillers-Tersshuren & P. Devillers | 13 | 5 | 377 |
| *Serapias vomeracea* (Burm.f.) Briq. | 12 | 5 | 166 |
| *Ophrys sicula* Todaro | 11 | 5 | 455 |
| *Ophrys apifera* Huds. | 10 | 6 | 260 |
| *Anacamptis pyramidalis* (L.) Rich. | 10 | 8 | 179 |
| *Ophrys mammosa* Desf. | 8 | 3 | 34 |
| *Himantoglossum jankae* Somlyay *et al*. | 6 | 5 | 106 |
| *Epipactis microphylla* (Ehrh.) Sw. | 6 | 5 | 77 |
| *Ophrys* sp. | 6 | 5 | 26 |
| *Neotinea tridentata* Scop. | 6 | 4 | 12 |
| *Anacamptis laxiflora* (Lam.) Bateman *et al*. | 5 | 4 | 2011 |
| *Platanthera chlorantha* (Custer) Rchb. | 5 | 4 | 77 |
| *Limodorum abortivum* (L.) Sw. | 5 | 3 | 16 |
| *Ophrys ferrum-equinum* Desf. | 4 | 2 | 35 |
| *Epipactis helleborine* (L.) Crantz | 4 | 3 | 8 |
| *Ophrys bombyliflora* Link | 3 | 2 | 32 |
| *Orchis purpurea* Hudson | 2 | 1 | 16 |
| *Ophrys sphegodes* Miller | 2 | 1 | 2 |
| *Cephalanthera rubra* (L.) Rich. | 1 | 1 | 50 |
| *Ophrys epirotica* (Renz) J.Devillers-Tersshuren & P. Devillers | 1 | 1 | 20 |
| *Ophrys attica* (Boiss. & Orphanides) B.D. Jackson | 1 | 1 | 8 |
| *Cephalanthera longifolia* (L.) Fristch | 1 | 1 | 3 |
| *Ophrys speculum* Link | 1 | 1 | 2 |
| *Orchis intacta* Link | 1 | 1 | 1 |
| *Neottia ovata* (L.) Bluff & Fingerhuth | 1 | 1 | 1 |
| *Dactylorhiza sambucina* (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 Garmine 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 ± SD = 3.3±3.3), and in 1–42 graveyards (mean ± 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 ± 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.

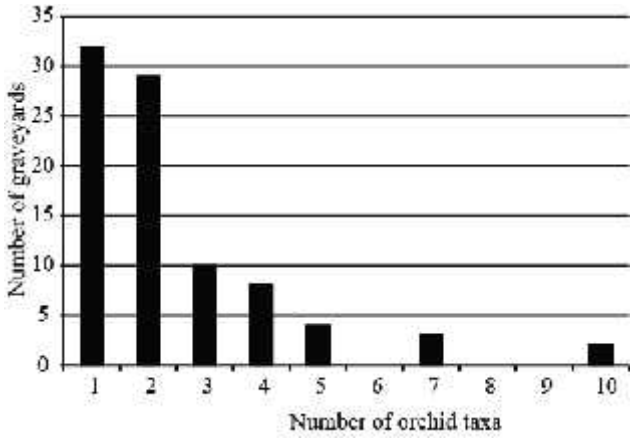


Fig. 2. Distribution of number of taxa in the 88 graveyards with orchids.

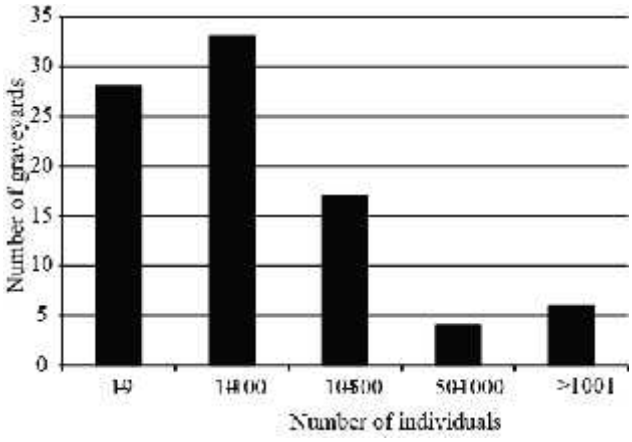


Fig. 3. Distribution of number of individuals in graveyards with orchids.

The mean number (±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 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 $km^2$, 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.

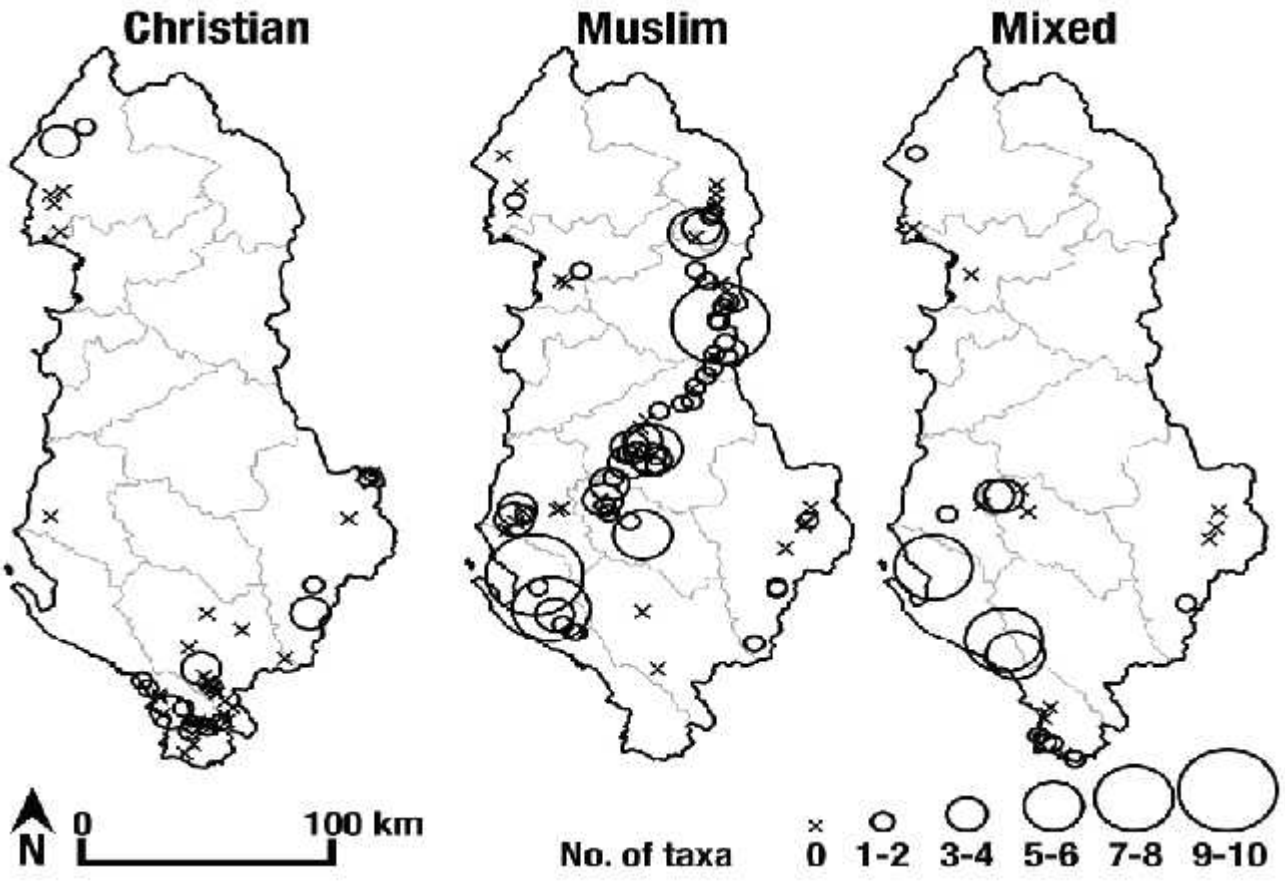


Fig. 4. Distribution of number of orchid taxa in graveyards studied.

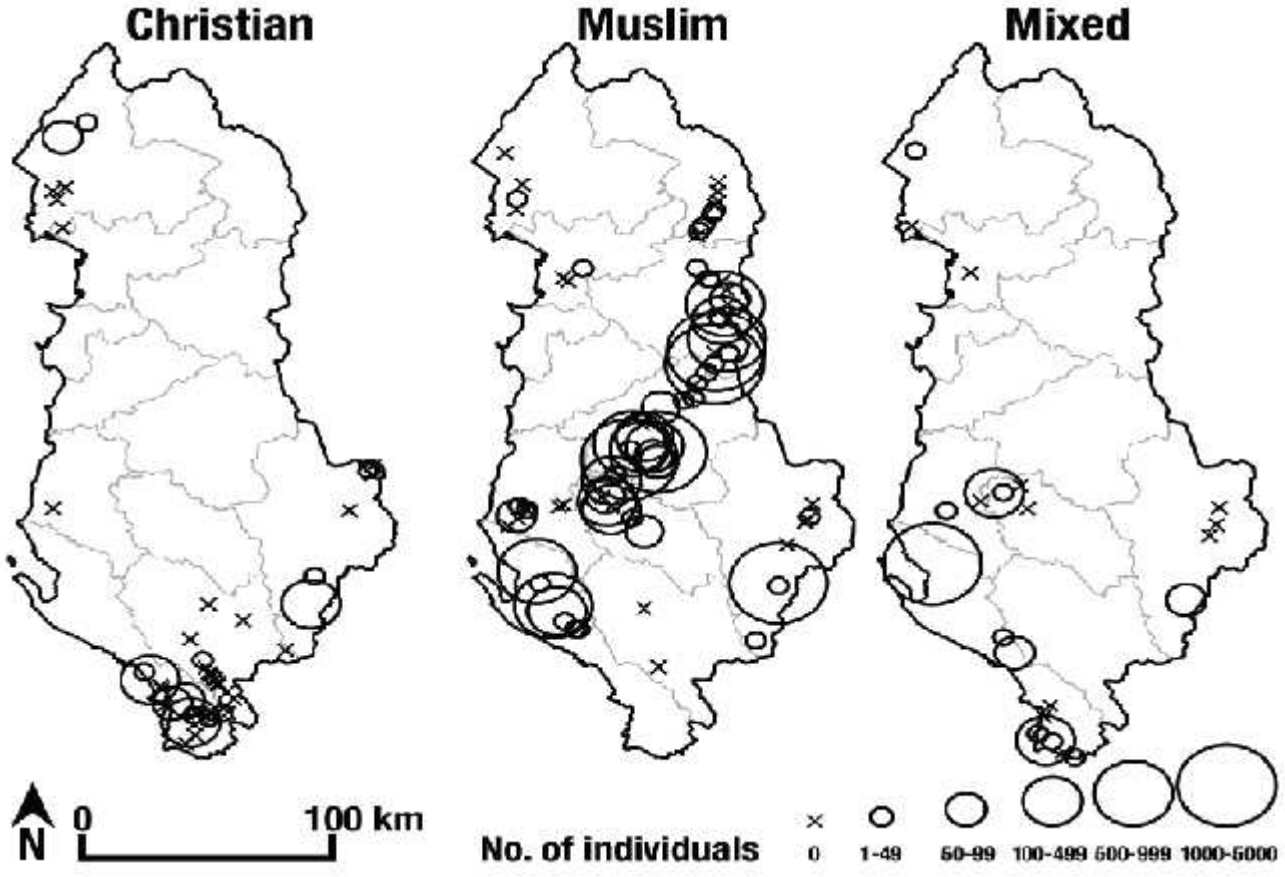


Fig. 5. Distribution of number of orchid individuals in graveyards studied.

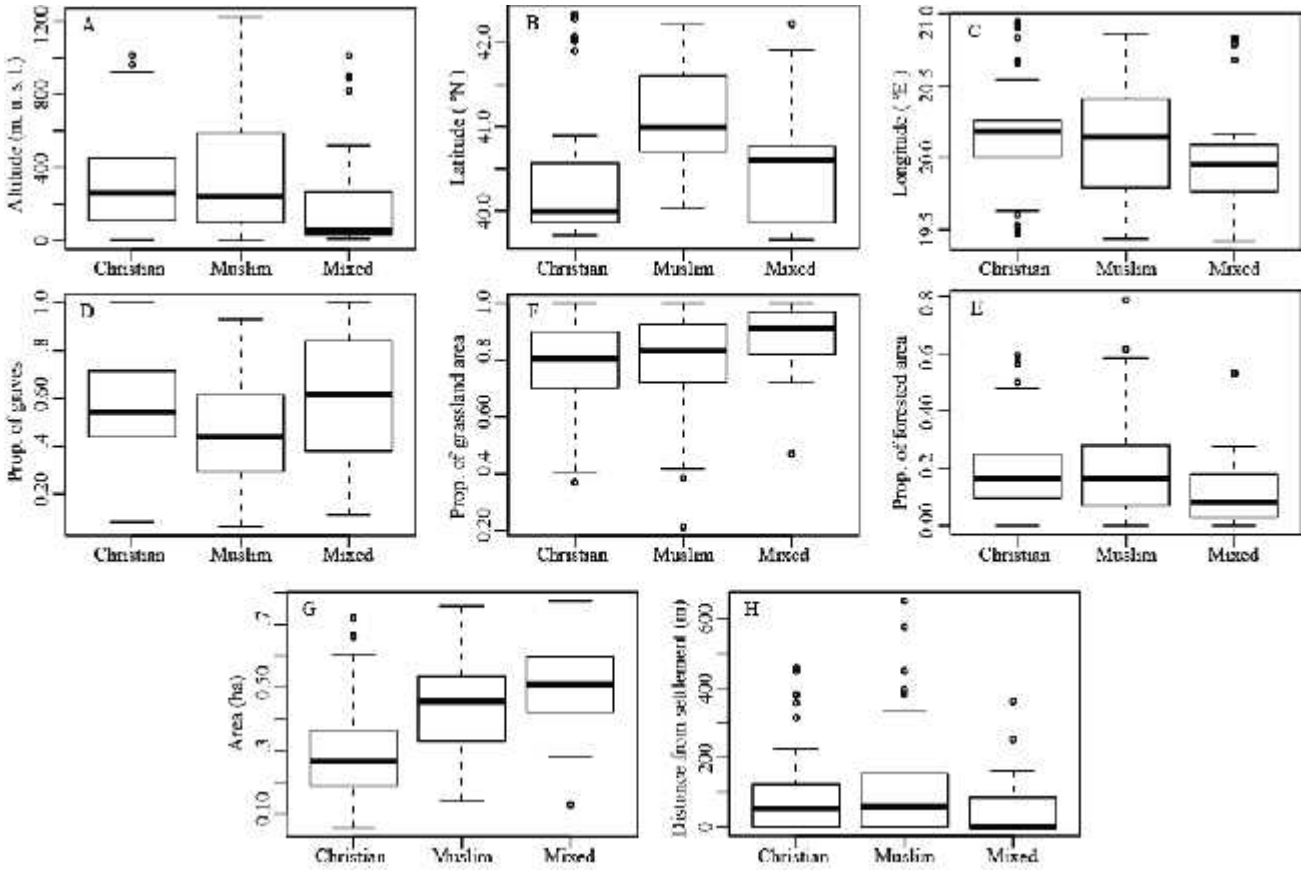


Fig. 6. Comparison of some characteristics of the studied graveyards. A. Elevation about see level (m), B. Geographic latitude (°), Geographic longitude (°), D. proportion of territory covered by graves, E. proportion of forested area, F. proportion of grassland area, G. Total area, H. Graveyard distance 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 individulas** | **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 | | | | |

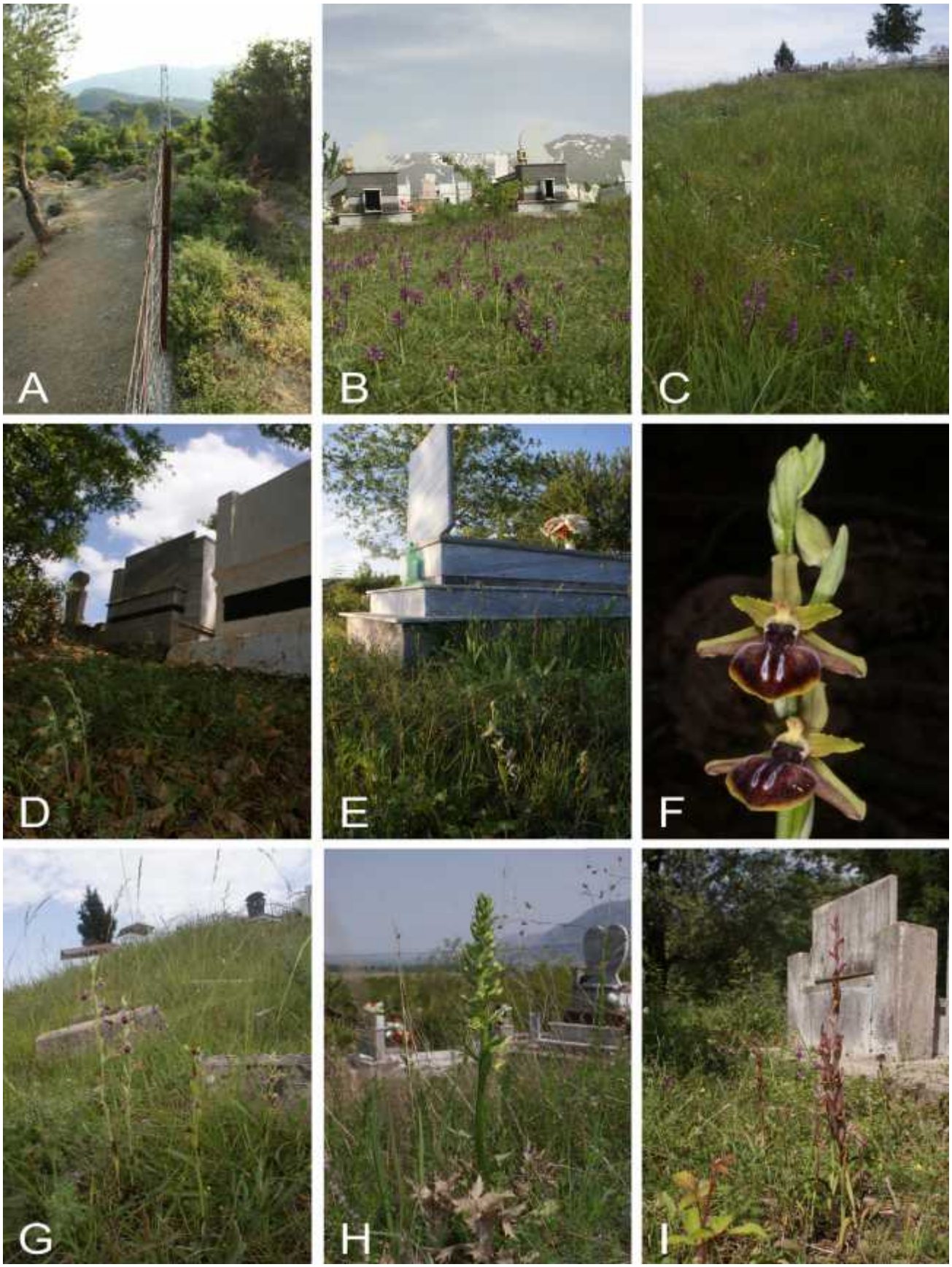


Fig. 7. A: Effect of fence of graveyards on grazing: plant cover is considerable lower outside left) and inside right) of graveyard [Drashovicë no. 158) Vlorë]; B: *Anacamptis morio* [Qinam no. 77) Kolonjë]; C: *Anacamptis laxiflora* [Vlorë no. 166) Vlorë]; D: *Epipactis microphylla* [Zgosht no. 108) Librazhd]; E: *Ophrys apifera* [Shtrazë no. 44) Elbasan]; F: *Ophrys epirotica* [Cerenec 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 / geograhic 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 $\chi^2$ (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 ± SD) | Number of orchid individuals (Mean ± SD) | Percentage of graveyards with orchids |
|---|---|---|---|
| Christian | 0.67±1.19 | 17±47 | 29.4% |
| Mixed | 1.57±2.21 | 147±545 | 52.2% |
| Muslim | 1.54±1.98 | 241±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 | *Ophrys mammosa, Serapias parviflora, Ophrys sicula* |
| 3. | Berat | Lagjja e Shkallës | 40.74577° N, 019.90177° E | 0.18 | 106 | M | *Serapias parviflora, Orchis fragrans* |
| 4. | Berat | Moravë | 40.76848° N, 019.89344° E | 0.41 | 31 | M | *Ophrys mammosa, Serapias parviflora, Orchis fragrans, Ophrys apifera* |
| 5. | Berat | Paftal | 40.69717° N, 19.872900° E | 0.43 | 472 | NA | *Ophrys mammosa, Ophrys sicula* |
| 6. | Berat | Poshnjë | 40.78852° N, 019.83691° E | 1.06 | 41 | C+M | *Anacamptis pyramidalis, Ophrys mammosa, Serapias parviflora, Neotinea tridentata* |
| 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 | *Serapias parviflora, Orchis fragrans* |
| 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 | *Ophrys apifera* |
| 11. | Bulqizë | Cerenec i Eperm | 41.51296° N, 020.43402° E | 1.46 | 652 | M | *Platanthera chlorantha, Epipactis microphylla, Ophrys oestrifera, Epipactis helleborine, Ophrys sp., Cephalanthera rubra, Limodorum abortivum, Ophrys epirotica, Neottia ovata* |
| 12. | Bulqizë | Cerenec i Poshtem | 41.51610° N, 020.43066° E | 1.43 | 588 | M | *Epipactis helleborine* |
| 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 | *Dactylorhiza sambucina* |
| 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 | *Limodorum abortivum* |
| 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 | *Anacamptis pyramidalis, Serapias parviflora* |
| 22. | Dibër | Arras | 41.73431° N, 020.32132° E | 0.55 | 442 | M | *Platanthera chlorantha* |
| 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 | *Epipactis microphylla, Limodorum abortivum* |
| 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 | *Serapias parviflora, Serapias vomeracea, Orchis fragrans* |

**Table 5. (Cont'd.).**

| No. | District | Settlement | Latitude, longitude | Area [ha] | Elevation a.s.l. [m] | Religious affiliation | Orchid taxa |
|---|---|---|---|---|---|---|---|
| 33. | Elbasan | Cingari I Siperm | 40.95470° N, 020.13982° E | 0.52 | 440 | M | *Serapias parviflora* |
| 34. | Elbasan | Drizë | 40.91499° N, 020.13499° E | 0.3 | 185 | M | *Serapias parviflora* |
| 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 | *Serapias parviflora*, *Orchis fragrans* |
| 37. | Elbasan | Gostimë | 40.99046° N, 020.01798° E | 2.43 | 97 | M | *Serapias parviflora*, *Ophrys oestrifera*, *Orchis fragrans*, *Ophrys apifera* |
| 38. | Elbasan | Labinot-Fushë | 41.14317° N, 020.15363° E | 0.43 | 153 | M | *Serapias parviflora*, *Ophrys oestrifera* |
| 39. | Elbasan | Lumas | 40.96862° N, 020.00663° E | NA | 81 | M | *Serapias parviflora*, *Orchis fragrans* |
| 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 | *Serapias parviflora*, *Ophrys oestrifera*, *Orchis fragrans* |
| 42. | Elbasan | Plak | 40.98190° N, 020.12470° E | 0.8 | 321 | M | *Anacamptis pyramidalis*, *Serapias parviflora*, *Himantoglossum jankae*, *Ophrys oestrifera*, *Orchis fragrans* |
| 43. | Elbasan | Shpanja | 40.97875° N, 020.04972° E | 1.62 | 117 | M | *Serapias parviflora*, *Orchis fragrans* |
| 44. | Elbasan | Shtrazë | 40.93850° N, 020.11905° E | 0.25 | 239 | M | *Serapias parviflora*, *Ophrys oestrifera*, *Ophrys apifera* |
| 45. | Fier | Fier | 40.71101° N, 019.57451° E | 9.47 | 30 | C+M | *Ophrys apifera* |
| 46. | Fier | Jaru | 40.68496° N, 019.48241° E | 1.13 | 45 | M | *Serapias parviflora*, *Serapias vomeracea*, *Ophrys sicula*, *Ophrys speculum* |
| 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 | *Serapias parviflora*, *Serapias vomeracea*, *Ophrys sp.* |
| 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 | *Serapias vomeracea* |
| 55. | Gjirokastër | Bodrishtë | 39.90548° N, 020.30210° E | 0.41 | 313 | C | – |
| 56. | Gjirokastër | Dervican | 40.03971° N, 020.17297° E | 0.81 | 205 | C | – |
| 57. | Gjirokastër | Farshtan | 39.96391° N, 020.22970° E | 0.27 | 343 | C | – |
| 58. | Gjirokastër | Gjirokastra | 40.07113° N, 020.15912° E | 5.43 | 200 | C | *Anacamptis pyramidalis*, *Ophrys attica*, *Serapias parviflora* |
| 59. | Gjirokastër | Goranxi | 40.01672° N, 020.18722° E | 0.31 | 265 | C | – |
| 60. | Gjirokastër | Goricë | 39.97516° N, 020.22953° E | 0.15 | 297 | C | – |
| 61. | Gjirokastër | Haskovë | 40.00503° N, 020.19905° E | 0.24 | 300 | C | – |
| 62. | Gjirokastër | Jorgucat | 39.93490° N, 020.26966° E | 0.92 | 250 | C | – |
| 63. | Gjirokastër | Kerrë | 39.87500° N, 020.26458° E | 0.26 | 760 | C | – |
| 64. | Gjirokastër | Lazarat | 40.04162° N, 020.14630° E | 1.76 | 490 | M | – |
| 65. | Gjirokastër | Palokaster | 40.16059° N, 020.10219° E | 0.36 | 189 | C | – |
| 66. | Gjirokastër | 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. | Gjirokastër | Terihat | 39.98531° N, 020.21593° E | 0.23 | 340 | C | – |
| 68. | Gjirokastër | Vanister | 40.01193° N, 020.19543° E | 0.31 | 216 | C | – |
| 69. | Gramsh | Cerujë | 40.91256° N, 020.14081° E | 0.65 | 198 | M | *Serapias parviflora, Neotinea tridentata* |
| 70. | Kavajë | Hallula | 41.15751° N, 19.496860° E | 0.93 | 38 | NA | *Ophrys sphegodes* |
| 71. | Kavajë | Peqinaj | 41.14415° N, 19.475570° E | 0.2 | 133 | NA | *Ophrys sphegodes* |
| 72. | Kolonjë | Borovë | 40.31187° N, 020.65736° E | 0.92 | 1013 | C | *Himantoglossum jankae, Orchis purpurea* |
| 73. | Kolonjë | Erseka | 40.33160° N, 020.67847° E | 1.49 | 1012 | C+M | *Orchis purpurea* |
| 74. | Kolonjë | Leskovik | 40.15456° N, 020.59278° E | 0.74 | 930 | M | *Neotinea tridentata* |
| 75. | Kolonjë | Mollas | 40.43001° N, 020.67438° E | 0.5 | 963 | C | *Neotinea tridentata* |
| 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 | *Platanthera chlorantha, Himantoglossum jankae* |
| 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 | *Anacamptis laxiflora, Serapias parviflora, Orchis fragrans, Ophrys* 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 | *Platanthera chlorantha, Epipactis microphylla, Epipactis helleborine, Limodorum abortivum, Cephalanthera longifolia* |
| 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 | *Anacamptis laxiflora* |
| 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 | *Platanthera chlorantha, Epipactis microphylla, Limodorum abortivum* |

**Table 5. (Cont'd.).**

| No. | District | Settlement | Latitude, longitude | Area [ha] | Elevation a.s.l. [m] | Religious affiliation | Orchid taxa |
|---|---|---|---|---|---|---|---|
| 101. | Kurbin | Milot | 41.68066° N, 019.72123° E | 0.72 | 70 | M | – |
| 102. | Lezhë | Fang | 41.73255° N, 019.79009° E | 0.29 | 99 | M | *Serapias parviflora* |
| 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 | *Serapias parviflora*, *Ophrys apifera* |
| 107. | Librazhd | Mirakë | 41.17493° N, 020.26011° E | 0.34 | 220 | M | *Serapias parviflora* |
| 108. | Librazhd | Zgosht | 41.24498° N, 020.31964° E | 2.77 | 551 | M | *Epipactis microphylla* |
| 109. | Malësi e Madhe | Dedaj | 42.29239° N, 019.53505° E | 0.65 | 473 | NA | *Anacamptis pyramidalis*, *Himantoglossum jankae* |
| 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 | *Serapias parviflora*, *Orchis fragrans* |
| 113. | Malësi e Madhe | Mucovilë | 42.25314° N, 019.51816° E | 0.35 | 390 | NA | *Neotinea tridentata* |
| 114. | Malësi e Madhe | Xhaj | 42.33019° N, 019.60145° E | 0.21 | 655 | NA | *Anacamptis pyramidalis*, *Himantoglossum jankae*, *Neotinea tridentata* |
| 115. | Malësi e Madhe | Zagorë | 42.27761° N, 019.51241° E | NA | 397 | C | *Anacamptis pyramidalis*, *Serapias parviflora*, *Ophrys sp.* |
| 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 | *Serapias parviflora* |
| 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 | *Serapias parviflora* |
| 127. | Sarandë | Ksamil | 39.75984° N, 019.99659° E | 0.58 | 52 | C+M | *Anacamptis laxiflora* |
| 128. | Sarandë | Kulluricë | 39.80482° N, 020.10446° E | 0.38 | 31 | C | *Ophrys ferrum-equinum*, *Serapias parviflora* |
| 129. | Sarandë | Leshnice e Sipermë | 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 | *Serapias parviflora*, *Ophrys bombyliflora* |
| 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 | *Ophrys ferrum-equinum, Serapias parviflora* |
| 136. | Sarandë | Piqeras | 40.02163° N, 019.88850° E | 0.57 | 226 | C | *Ophrys sicula* |
| 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 | *Anacamptis pyramidalis, Ophrys mammosa, Serapias parviflora, Ophrys sicula* |
| 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 | *Serapias parviflora, Serapias vomeracea* |
| 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 | *Ophrys ferrum-equinum, Serapias parviflora* |
| 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 | *Serapias parviflora* |
| 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 | *Anacamptis pyramidalis, Ophrys oestrifera* |
| 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 | *Anacamptis pyramidalis, Serapias vomeracea, Ophrys sicula, Ophrys oestrifera, Ophrys apifera* |
| 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 | *Serapias parviflora* |
| 157. | Vlorë | Brataj | 40.28053° N, 019.67008° E | 1.43 | 175 | M | *Serapias parviflora, Ophrys sicula, Orchis fragrans* |
| 158. | Vlorë | Drashovicë | 40.45022° N, 019.57796° E | 0.97 | 86 | M | *Ophrys ferrum-equinum, Ophrys mammosa, Anacamptis laxiflora, Serapias parviflora, Serapias vomeracea, Ophrys sicula, Ophrys oestrifera, Ophrys apifera, Ophrys* sp. |
| 159. | Vlorë | Fterë | 40.10735° N, 019.88984° E | NA | 386 | C+M | *Ophrys mammosa, Serapias parviflora, Serapias vomeracea, Ophrys sicula* |
| 160. | Vlorë | Hor | 40.23709° N, 019.70633° E | 0.85 | 228 | M | *Ophrys oestrifera* |
| 161. | Vlorë | Kallarat | 40.20382° N, 019.75444° E | 0.97 | 273 | M | *Serapias parviflora, Serapias vomeracea* |
| 162. | Vlorë | Kotë | 40.39895° N, 019.59239° E | 1.12 | 115 | M | *Ophrys* sp. |
| 163. | Vlorë | Kuc | 40.17307° N, 019.83705° E | 1.17 | 520 | C+M | *Serapias parviflora, Serapias vomeracea, Epipactis microphylla, Ophrys oestrifera, Epipactis helleborine, Neotinea maculata* |
| 164. | Vlorë | Lepenicë | 40.30280° N, 019.65306° E | 0.39 | 159 | M | *Ophrys mammosa, Serapias parviflora, Serapias vomeracea, Ophrys sicula, Ophrys bombyliflora, Ophrys oestrifera, Ophrys apifera* |
| 165. | Vlorë | Pilur | 40.12898° N, 19.776310° E | 0.3 | 713 | NA | *Himantoglossum jankae* |
| 166. | Vlorë | Vlorë | 40.48549° N, 019.51166° E | 15.53 | 85 | C+M | *Anacamptis laxiflora, Serapias parviflora, Serapias vomeracea, Ophrys sicula, Ophrys bombyliflora, Ophrys oestrifera, Ophrys apifera* |

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

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