

Plants with conservation status, endemics and relics within the Tarnovski Heights (Northern Bulgaria)

Dimcho Zahariev^{1*}, Lidiya Taneva²

¹ University of Shumen, Shumen, Bulgaria

² Master Student in University of Shumen, Shumen, Bulgaria

* E-mail: d.zahariev@shu.bg

Abstract

The Tarnovski Heights are located in northern part of the Republic of Bulgaria around the city of Veliko Tarnovo, a town with a 6,000 years history and the capital of the Second Bulgarian Kingdom (XII-XIV AD). Nowadays on the territory of the Tarnovski Heights, there are 12 protected areas and 4 protected zones of the European ecological network NATURA 2000. The aim of our study was to investigate the following three important groups of plants: species with conservation status, endemics and relics. This study within the Tarnovski Heights is performed for the first time. The total number of plant species with conservation status established by us is 64 (6.64% of the total number of species). One of those species is included in the Appendix II of Directive 92/43/EEC. One species is included in the Appendix I of the Berne Convention. Twenty-two of the species are included in the Appendix II of CITES. In the Red Data Book of Republic of Bulgaria, there are 10 species. The Red List of Bulgarian Vascular Plants features 30 species. In the Act on Amending and Supplementing the Biological Diversity Act of the Republic of Bulgaria are included 42 species. Gathering herbs is prohibited from the natural habitats of 10 species. A restrictive regime for gathering herbs from natural habitats is imposed for 6 species. 9 species (0.93%) are Balkan endemics and 3 species (0.31%) are Bulgarian endemics. The flora of the Tarnovski Heights includes a significant number of relic species as well – a total of 59 (6.12%): 50 of them are Tertiary relics and 9 species are Quaternary relics. The obtained data are compared with data of the Frangensko Plateau (Northeastern Bulgaria), near which is located the city of Varna, an important commercial and port town since the Antiquity with about 7,000 years of history. Both regions were settled as early as the ancient times and were major trading centers for centuries.

Keywords: Tarnovski Heights, Bulgaria, vascular plants, conservation status, endemics, relics

1. Introduction

The studied area is located in the central part of Northern Bulgaria, which a part of European Union (Figure 1). The Tarnovski Heights are interconnected plateaus, hills and ridges. To the Tarnovski Heights we

count also the Prisovski Ridge. Geographically speaking, the ridge is a separate positive form of the relief. From an environmental point of view, both geographical sites, Tarnovski Heights and Prisovski Ridge, are included in one protected zone of the National Ecological Network of the Republic of Bulgaria named Tarnovski Heights (with code BG0000213). Therefore, in this study, they will be considered together under the name Tarnovski Heights.



Fig. 1. Geographical position of the Republic of Bulgaria: light green color – European Union, dark green color – Republic of Bulgaria

The Tarnovski Heights are located in 7 quadrants of Universal Transverse Mercator network: LH67, LH77, LH86, LH87, LH96, LH97 and MH07 (Fig. 2). They are oriented in an east–west. Their length is about 48 km, and their maximum width in the middle is about 12.5 km. The average altitude is 360–400 m a.s.l. The maximum altitude is 439.8 m a.s.l. [1]. The total area is about 360 km².

On the territory of the Tarnovski Heights, there are 12 protected areas and 4 protected zones of the European ecological network NATURA 2000. The protected areas include 7 protected sites and 5 natural monuments [2].

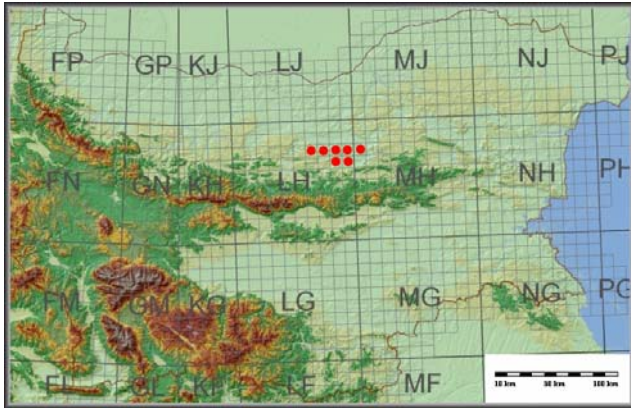


Fig. 2. Geographical position of Tarnovski Heights within the Republic of Bulgaria

The first botanical study in the area is by Joseph Velenovski in 1885 as a part of his research in Northern Bulgaria. Vasil Kovachev also conducts its own study in the area of the Veliko Tarnovo Town and published it in 1892 together with the data from other regions in his second botanical article, Materials on the Flora of Northern Bulgaria [3]. In 1901, the famous Bulgarian botanist Ivan Urumov published a list of identified plants in the so-called then Tarnovo District and Lovech District [4].

Data for individual plant species in the region of Veliko Tarnovo are listed in the multi-volume series Flora of the People's Republic of Bulgaria [5, 6] and Flora of the Republic of Bulgaria [7, 8].

So far, the flora of the Tarnovski Heights as a single geographical site has not been studied. There are no studies on plant species with conservation status, endemics and relics.

2. Materials and Methods

This survey was conducted on the route method in the period 2015-2016. In determining the species we used The Handbook for Vascular Plants in Bulgaria [9], Flora of the People's Republic of Bulgaria, Volumes 1 to 9 [5, 6] and Flora of the Republic of Bulgaria, Volumes 10 to 11 [7, 8]. The names of the species are under Conspectus of the Bulgarian Vascular Flora [10]. The abbreviations of the authors' names of the plants are according to the International Plant Names Index [11].

The conservation statute is recognized using the following documents: Annex II to Council Directive 92/43/EEC of the European Community to Protect Natural Habitats and Wild Fauna and Flora [12], Appendix I to Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) [13], Appendix II to Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) [14], Red Data Book of

Republic of Bulgaria, Vol. 1. Plants and Fungi [15], Red List of Bulgarian Vascular Plants [16], Annex II, Annex III and Annex IV to Act on Amending and Supplementing the Biological Diversity Act of the Republic of Bulgaria [17]. Some species are included in Order for special arrangements for the conservation and use of the medicinal plants in Bulgaria [18].

The endemics are assessed according to Asyov & al. [10]. The relics are assessed according to Zahariev [19].

3. Results and Discussion

As a result of our fieldwork, we have identified 964 species of vascular plants in the flora of the Tarnovski Heights. In this article, we will list the results of the identified plant species with conservation status, endemics and relics.

The total number of species of conservation status, which we found in the Tarnovski Heights, is 64 (6.64% of the total number of species). Established species are the following: *Acanthus balcanicus* Heywood & I. Richardson, *Acer heldreichii* Boiss. & Heldr., *Aegilops lorentii* Hochst., *Anacamptis pyramidalis* (L.) Rich., *Anemone sylvestris* L., *Angelica pancicii* Vandas ex Velen., *Arum alpinum* Schott & Kotschy, *Asparagus tenuifolius* Lam., *Bupleurum affine* Sadler, *B. praealtum* L., *B. tenuissimum* L., *Cephalanthera damasonium* Druce, *C. longifolia* (L.) Fritsch, *Cercis siliquastrum* L., *Crocus flavus* Weston, *C. pallasii* Goldb., *Cyclamen hederifolium* Aiton, *Dactylorhiza romana* (Sebast.) Soó, *Dryopteris filix-mas* (L.) Schott, *Echinops banaticus* Rochel & Borza, *E. sphaerocephalus* L., *Epipactis helleborine* (L.) Crantz, *E. microphylla* Sw., *Fraxinus pallisiae* Wilmott, *Galanthus elwesii* Hook.f., *G. nivalis* L., *Galium rubioides* L., *Gladiolus communis* L., *Gymnadenia conopsea* (L.) R.Br., *Hesperis sylvestris* Crantz, *Himantoglossum caprinum* Spreng., *Hypericum boissieri* Petrovič, *Inula spiraeifolia* L., *Jurinea ledebourii* Bunge, *Lemna gibba* L., *Lilium martagon* L., *Limodorum abortivum* (L.) Sw., *Neottia nidus-avis* (L.) Rich., *Nepeta ucrainica* L., *Onosma heterophylla* Griseb., *Ophrys apifera* Huds., *O. cornuta* Steven ex M.Bieb., *Orchis morio* L., *O. purpurea* Huds., *O. simia* Lam., *O. tridentata* Scop., *Paeonia peregrina* Mill., *Pastinaca umbrosa* Steven ex DC., *Platanthera chlorantha* (Custer) Rchb., *Polygonatum odoratum* (Mill.) Druce, *Primula veris* L., *Pulmonaria mollis* Ten., *Ruscus aculeatus* L., *R. hypoglossum* L., *Ruta graveolens* L., *Salix caprea* L., *Salvia verbenaca* L., *Scilla bifolia* L., *Spiranthes spiralis* (L.) Chevall., *Stachys leucoglossa* Griseb., *Sternbergia colchiciflora* Waldst. & Kit., *Stipa capillata* L., *S. epilosa* Martinovský, *Vicia pisiformis* L.

In Annex II (Plant and animal species of Community interest whose conservation requires

designation of special areas of conservation) of Directive 92/43/EEC and in Appendix I of the Bern Convention is included *Himantoglossum caprinum*.

Two species are listed in Annex V (Animal and plant species of Community interest whose taking in the wild and exploitation may be the subject of management measures) of Directive 92/43/EEC: *Galanthus nivalis* and *Ruscus aculeatus*.

In Appendix II of CITES Convention are included 22 species, of which 18 species are from the Orchidaceae family: *Anacamptis pyramidalis*, *Cephalanthera damasonium*, *C. longifolia*, *Cyclamen hederifolium*, *Dactylorhiza romana*, *Epipactis helleborine*, *E. microphylla*, *Galanthus elwesii*, *G. nivalis*, *Gymnadenia conopsea*, *Himantoglossum caprinum*, *Limodorum abortivum*, *Neottia nidus-avis*, *Ophrys apifera*, *O. cornuta*, *Orchis morio*, *O. purpurea*, *O. simia*, *O. tridentata*, *Sternbergia colchiciflora*, *Platanthera chlorantha*, *Spiranthes spiralis*.

In the Red Data Book of Republic of Bulgaria are included 10 species. Of them in the category Endangered are included 7 species: *Galanthus elwesii*, *G. nivalis*, *Inula spiraeifolia*, *Jurinea ledebourii*, *Ophrys apifera*, *Ruta graveolens*, *Stachys leucoglossa*. In category Vulnerable are 3 species: *Acer heldreichii*, *Himantoglossum caprinum*, *Hypericum boissieri*.

In the Red List of Bulgarian Vascular Plants are included 30 species in the following categories: In category Endangered are included 7 species: *Galanthus elwesii*, *G. nivalis*, *Inula spiraeifolia*, *Jurinea ledebourii*, *Ophrys apifera*, *Ruta graveolens*, *Stachys leucoglossa*. In category Vulnerable are 13 species: *Acer heldreichii*, *Anacamptis pyramidalis*, *Angelica pancicii*, *Dactylorhiza romana*, *Epipactis microphylla*, *Fraxinus pallisiae*, *Hesperis sylvestris*, *Himantoglossum caprinum*, *Hypericum boissieri*, *Limodorum abortivum*, *Ophrys cornuta*, *Pastinaca umbrosa*, *Spiranthes spiralis*. In category Nearly Threatened are 5 species: *Anemone sylvestris*, *Cercis siliquastrum*, *Galium rubioides*, *Lemna gibba*, *Vicia pisiformis*. In category Least Concern are 4 species: *Acanthus balcanicus*, *Onosma heterophylla*, *Pulmonaria mollis*, *Salvia verbenaca*. In category Data Deficient is *Arum alpinum*.

In the Act on Amending and Supplementing the Biological Diversity Act of the Republic of Bulgaria are included 42 species. In Annex II (Species whose habitat conservation is done through protected areas) is *Aegilops lorentii*. In Annex III (Protected species) are included 15 species: *Anacamptis pyramidalis*, *Anemone sylvestris*, *Arum alpinum*, *Galanthus elwesii*, *G. nivalis*, *Galium rubioides*, *Hesperis sylvestris*, *Himantoglossum caprinum*, *Hypericum boissieri*, *Inula spiraeifolia*, *Jurinea ledebourii*, *Limodorum abortivum*, *Nepeta ucrainica*, *Ophrys apifera*, *O. cornuta*. In Annex IV (Species under

the conservation and regulated use of the nature) are included 26 species: *Asparagus tenuifolius*, *Bupleurum affine*, *B. praealtum*, *B. tenuissimum*, *Crocus flavus*, *C. pallasii*, *Cyclamen hederifolium*, *Dactylorhiza romana*, *Dryopteris filix-mas*, *Echinops banaticus*, *E. sphaerocephalus*, *Gladiolus communis*, *Lilium martagon*, *Orchis morio*, *O. purpurea*, *O. simia*, *O. tridentata*, *Paeonia peregrina*, *Polygonatum odoratum*, *Primula veris*, *Ruscus aculeatus*, *R. hypoglossum*, *Salix caprea*, *Scilla bifolia*, *Stipa capillata*, *S. epilosa*.

In the Order on special arrangements for conservation and use of medicinal plants from 2014 are included 16 species. Gathering herbs from natural habitats is prohibited for 10 species: *Angelica pancicii*, *Asarum europaeum*, *Asplenium trichomanes*, *Inula helenium*, *Orchis morio*, *O. purpurea*, *O. simia*, *O. tridentata*, *Ruscus aculeatus*, *Valeriana officinalis*. Under restricted collection of herbs from their natural habitats are 6 species: *Betonica officinalis*, *Carlina acanthifolia*, *Galium odoratum*, *Paeonia peregrina*, *Primula veris*, *Sedum acre*. That order does not reflect the conservation status of the species under question, so they are not included in the list at the beginning of this part of the article. However, we believe that these types deserve to be mentioned for the purpose of their conservation.

Of the plants with conservation status, one species is listed in 6 environmental documents, 3 species are included in 4 documents, 7 species are included in 3 documents, 14 species are included in 2 documents, and 39 species are included in only one document.

Compared with the Frangensko Plateau that is situated on 160 km to the east in the eastern part of the Danube Plain (Northeastern Bulgaria) and has the same surface area (360 km²), the percentage of species with conservation status is almost identical. Within the Frangensko Plateau have been identified 50 species (6.42% of the total number of species) [20]. We think that the main reasons for the similar results are: the similar altitude of both geographical sites, the preserved forests on the slopes and the similar rates of anthropogenic influence in the past and until today. Both regions were settled as early as the ancient times and were major trading centers for centuries. Near the Frangensko Plateau is located the city of Varna, an important commercial and port town since the Antiquity with about 7,000 years of history. The Tarnovski Heights are located around the city of Veliko Tarnovo, a town with a 6,000 years history and the capital of the Second Bulgarian Kingdom (XII-XIV AD).

During our study of the Tarnovski Heights, we found 9 Balkan endemics (0.93% of the total number of species): *Acanthus balcanicus* Heywood & I. Richardson, *Acer heldreichii* Boiss. & Heldr., *Achillea clypeolata* Sm., *Angelica pancicii* Vandas ex Velen., *Centaurea chrysolepis* Vis., *Hypericum boissieri* Petrovič, *Koeleria*

simonkaii Adamovič, *Salvia ringens* Sm., *Stachys leucoglossa* Griseb. The number of the Bulgarian endemic species established by us is 3 (0.31% of the total number of species): *Cerastium bulgaricum* R.Uechtr., *Verbascum formanekii* Borbás ex Formánek, *Veronica krumovii* (Peev) Peev.

Compared with the Frangensko Plateau the percentage of the Balkan endemics and the Bulgarian endemics in the Tarnovski Heights is higher. Within the Frangensko Plateau, Balkan endemics are 5 species (0.64% of the total number of species), and only one species is a Bulgarian endemic (0.13% of the total number of species) [20]. The relatively small difference in the percentage of the total number of species may be explained by the similar conditions that we pointed to already when we compared the species with conservation status.

The flora of the Tarnovski Heights includes 59 relic species (6.12% of the total number of species). Of these, 50 species are Tertiary relics: *Acer campestre* L., *A. heldreichii* Boiss. & Heldr., *A. platanoides* L., *A. pseudoplatanus* L., *A. tataricum* L., *Asarum europaeum* L., *Betula pendula* Roth, *Butomus umbellatus* L., *Campanula lingulata* Waldst. & Kit., *Carpinus betulus* L., *C. orientalis* Mill., *Clematis vitalba* L., *Colutea arborescens* L., *Corylus avellana* L., *C. colurna* L., *Cotinus coggygria* Scop., *Crataegus pentagyna* Waldst. & Kit. ex Willd., *Dictamnus albus* L., *Fraxinus excelsior* L., *F. ornus* L., *Hedera helix* L., *Isopyrum thalictroides* L., *Juglans regia* L., *Juniperus communis* L., *Lathyrus aureus* (Steven) Bornm., *Limodorum abortivum* (L.) Sw., *Lycopus europaeus* L., *Paliurus spina-christi* Mill., *Populus alba* L., *P. nigra* L., *P. tremula* L., *Quercus cerris* L., *Q. dalechampii* Ten., *Q. pubescens* Willd., *Rumex acetosa* L., *Ruscus aculeatus* L., *R. hypoglossum* L., *Ruta graveolens* L., *Salix alba* L., *S. caprea* L., *S. fragilis* L., *S. purpurea* L., *Sanicula europaea* L., *Staphylea pinnata* L., *Syringa vulgaris* L., *Tamus communis* L., *Ulmus minor* Mill., *Viburnum lantana* L., *Viscum album* L., *Vitis sylvestris* C.C.Gmel.

The Quaternary relics are represented by 4 glacial relics and 5 interglacial relics. The glacial relics are: *Epilobium palustre* L., *Galanthus nivalis* L., *Gymnadenia conopsea* (L.) R.Br., *Parnassia palustris* L. The interglacial relics are: *Asparagus tenuifolius* Lam., *Hyacinthella leucophaea* Schur, *Iris pumila* L., *Ranunculus illyricus* L., *Sternbergia colchiciflora* Waldst. & Kit.

Compared with the Frangensko Plateau, the percentage of the relic species in the Tarnovski Heights is higher. Within the Frangensko Plateau, the relic species are 38 (4.88% of the total number of species) [20]. The relatively small difference in the percentage of the total number of species may be explained by the similar

conditions as already pointed out in our comparison of species with conservation status.

4. Conclusions

The study of plant species with conservation status, endemics and relics within the Tarnovski Heights is performed for the first time. As a result, we found a wide variety of species in each of the three groups of studied plants. This diversity is comparable with the data from similar sites, such as the Frangensko Plateau. Both the Tarnovski Heights and the Frangensko Plateau are examples of areas with relatively preserved biodiversity in regions with prolonged presence of human. The results presented by us are suitable for comparison with other geographical sites.

References

- [1] N. Michev, C. Mihaylov, I. Vaptsarov, S. Kiradzhiev, Geographical Dictionary of Bulgaria, Sofia, Nauka & Izkustvo, 1980.
- [2] Register of protected areas and protected zones in Bulgaria, Ministry of Environment and Water, <http://eea.government.bg/zpo/en/> [accessed 19 August 2017].
- [3] S. Stanev, Little Known Names from Bulgarian Botany, Sofia–Moscow, Pensoft, 2001.
- [4] I. Urumov, Materials for the flora of the Lovech and Tarnovo District. An additional list of the plants collected in the Lovech and Tarnovo District, Sbornik narodni umotvorenia, nauka i knizhnina, Vol. 18, 1901, pp. 1–43.
- [5] D. Yordanov (main ed.), Flora of PR Bulgaria, Vol. 1–7, Sofia, Publishing House of BAS, 1963–1979.
- [6] V. Velchev (main ed.), Flora of PR Bulgaria, Vol. 8–9, Sofia, Publishing House of BAS, 1982–1989.
- [7] S. Kozuharov (main ed.), Flora of the Republic of Bulgaria, Vol. 10, Sofia, Prof. M. Drinov Acad. Publ., 1995.
- [8] D. Peev (main ed.), Flora of the Republic of Bulgaria, Vol. 11, Sofia, Prof. M. Drinov Acad. Publ., 2012.
- [9] D. Delipavlov, I. Cheshmedzhiev, M. Popova, D. Tersijski, I. Kovachev, Handbook for Plants in Bulgaria, Plovdiv, Agrar. Univ. Acad. Press, 2011.
- [10] B. Asyov, A. Petrova, D. Dimitrov, R. Vasilev, Conspectus of the Bulgarian vascular flora. Distribution maps and floristic elements, Sofia, Bulgarian Biodiversity Foundation, 2012.
- [11] International Plant Names Index (IPNI), <http://www.ipni.org/> [accessed 19 August 2017].

- [12] Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora, Annex II. OJ L 206, 22 July 1992.
- [13] Convention on the Conservation of European Wildlife and Natural Habitats, Appendix I, 1979, <http://conventions.coe.int/Treaty/FR/Treaties/Html/104-1.htm> [accessed 19 August 2017].
- [14] Convention on International Trade in Endangered Species of Wild Fauna and Flora, Appendix II, 1973, <http://www.cites.org/eng/app/appendices.shtml> [accessed 19 August 2017].
- [15] D. Peev & al. (eds), Red Data Book of the Republic of Bulgaria. Vol. 1. Plants and Fungi, Sofia, Institute of Biodiversity and Ecosystem Research – BAS & Ministry of Environment and Water, 2015.
- [16] A. Petrova, V. Vladimirov (Eds), Red List of Bulgarian vascular plants, Phytol. Balcan., Vol. 15, No 1, 2009, pp. 63–94.
- [17] Act on Amending and Supplementing the Biological Diversity Act of the Republic of Bulgaria. Annex II, Annex III and Annex IV, State Gazette number 94, 16 November 2007.
- [18] Order number RD-89 from 3 February 2017 for Special Arrangements for Conservation and Use of Medicinal Plants, http://www5.moew.government.bg/?_page_id=45594 [accessed 19 August 2017].
- [19] D. Zahariev, Biodiversity of relict vascular plants in Bulgaria, Int. Jour. of Res. St. in Biosc., Vol. 4, No 1, 2016, pp. 38–51.
- [20] D. Zahariev, L. Behchet, The plants with conservation status, endemics and relicts of Frangensko Plateau, Proceedings of the Second student scientific conference “Ecology and Environment”, Vol. 1, 2014, pp. 35–43.

the Faculty of Natural Sciences, University of Shumen Bishop Konstantin Preslavski, Shumen, Bulgaria.

Dimcho Zahariev is currently an Associated Professor in the Faculty of Natural Sciences, University of Shumen Bishop Konstantin Preslavski, Shumen, Bulgaria. He is PhD in biology (Botany scientific specialty). He teaches Anatomy and Morphology of Plants, Plant Systematics, Phytogeography and conservation of the biological diversity, Floristic diversity in Bulgaria. His research interests are in: Floristry, Medicinal plants and Biodiversity. Member of the Bulgarian Phytosociological Association.

Lidiya Taneva is a Master Student in Ecology and Environmental Protection, Master's Degree Program "Management and Conservation of Ecosystems" in