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Medicinal plants of Razgrad Heights (Northeastern Bulgaria).

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ABSTRACT

The Razgrad Heights are situated in the Eastern Danube Plain (Northeastern Bulgaria). An investigation of medicinal plants as part of its flora is made for the first time. As a result of the field studies of the medicinal plants on the territory of the Razgrad Heights in 2017, 377 wild species from 256 genera and 72 families are described. This represents 44.78% of the species, 57.92% of the genera and 61.02% of the families of medicinal plants in Bulgaria. The most common of life forms are the hemicryptophytes (45.89%). Of the biological types with the highest number are the perennial herbaceous plants (55.70%). The described species of medicinal plants refer to 34 floristic elements. There are 2 Balkan endemic species, 1 Bulgarian endemic species and 35 relic species, of which 33 species are Tertiary relics and 2 species are Quaternary relics. The number of species with conservation status is 21 (5.57%). The anthropophytes are 256 species (67.90%). The obtained results are compared with the data on the medicinal plants in three sites in Northern Bulgaria: Frangen Plateau, Provadiya Plateau and Tarnovo Heights.

Keywords: analysis, anthropophytes, endemics, protected plants, relics

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INTRODUCTION

The Razgrad Heights are located in the eastern Danube plain (Northeastern Bulgaria) (Figure 1). The area of Razgrad Heights is 1240 km². The relief is hilly-plated. The name of the heights comes from the town of Razgrad in the northeast [1]. The figure also presents the geographical position of three other sites in Northern Bulgaria, which will be used for comparison.



Figure 1: Geographical position of Razgrad Heights (1), Frangen Plateau (2), Provadiya Plateau (3) and Turnovo Heights (4)

In floristic terms, the studied area is situated in the Northeastern Bulgaria floristic region [2]. The vegetation includes 13 forest communities, 4 grasslands and 3 types of farmland in the place of forests [3].

The medicinal plants of Razgrad Heights have not been studied so far. The aim of our study was to make an inventory of the medicinal plants. On the basis of this analysis, we compared the curative plants in three other sites in Northern Bulgaria. On the basis of the analysis we prepared, we compared the obtained results with the data on the medicinal plants in three sites in Northern Bulgaria: Frangen Plateau, Provadiya Plateau, and Tarnovo Heights.

MATERIALS AND METHODS

The present study of the medicinal plants of Razgrad Heights was conducted on the route method in 2017. The medicinal plants are under the Annex to the Medicinal Plants Act of the Republic of Bulgaria [4],

Stoyanov [5, 6], Stoyanov & Kitanov [7], Petkov [8], Pamukov & Ahtardzhiev [9], Landzhev [10], Nikolov [11], Ivanov [12].

The following sources are used in the determination of taxa and life forms of the plants: Handbook for Plants in Bulgaria [13], Flora of PR Bulgaria [14, 15], and Flora of the Republic of Bulgaria [16, 17]. The names of the species are under Conspectus of the Bulgarian vascular flora [18]. The abbreviations of the authors' names of the plants are according to the International Plant Names Index [19]. The names of the family are according to APG IV [20].

The life forms are represented in the system of Raunkiaer [21]. Biological types and economically significant species are defined by Delipavlov et al. [13]. The floristic elements and the endemics are according to Asyov et al. [18]. The relics are presented according to Zahariev [22].

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 of wild fauna and flora [23], Appendix I to Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) [24], Appendix II to Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) [25], Red Data Book of the Republic of Bulgaria, Vol. 1. Plants and Fungi [26], Red List of Bulgarian vascular plants [27], Annex III and Annex IV to Act on Amending and Supplementing the Biological Diversity Act of the Republic of Bulgaria [28]. Recorded are the species included in Order for special arrangements for the conservation and use of the medicinal plants in Bulgaria [29].

The poisonous plants are defined by Bernhard-Smith [30], Hiller and Bickerich [31], Wagstaff [32]. Plants causing side effects in contact with them are listed according to Rycroft et al. [33] and Tampion [34]. The anthropophytes are presented by Stefanov and Kitanov [35].

In preparing the analysis a comparison was made with the data on medicinal plants from other studied territories in Northern Bulgaria: Frangen Plateau [36, 37], Provadiya Plateau [38, 39], and Tarnovo Heights [40, 41].

RESULTS AND DISCUSSION

As a result of the field work carried out of Razgrad Heights, 377 species of medicinal plants belonging to 256 genera and 72 families were described. This represents 44.78% of the species, 57.92% of the genera and 61.02% of the families of medicinal plants in Bulgaria. The medicinal plants of Razgrad Heights are 9.19% from all species, 28.04% from all genera and 51.80% from all plant families of vascular plants in Bulgaria. Compared to the other studied areas (Figure 2), the number of medicinal plants of Razgrad Heights is less than that of Turnovo Heights (444 species), approximately equal to that of the Provadiya Plateau (376 species) and higher than that of the Frangen Plateau (362 species).

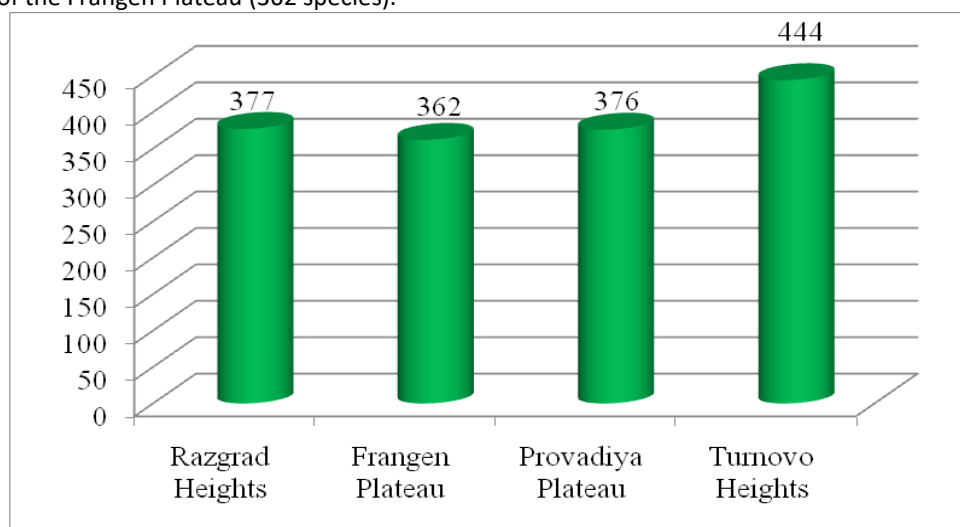


Figure 2: Comparison of Razgrad Heights with neighboring territories by the number of medicinal plants

The majority of families, to which the medicinal plants refer, 59 (81.94%) are presented by 1-4 genera. Only 13 (18.06%) of the families are represented by 5 or more genera. Most genera belong to the following families: Ateraceae (33 genera), Lamiaceae (23 genera), Fabaceae (20 genera), Apiaceae (16 genera), Brassicaceae (13 genera), Rosaceae (12 genera), Ranunculaceae (9 genera), Boraginaceae (7 genera), and Scrophulariaceae (7 genera).

Most families, 51 (70.83%) are presented by 1-4 species. Only 21 families (29.17%) are represented by 5 or more species. Most species belong to the following families: Asteraceae (44 species), Lamiaceae (43 species), Fabaceae (33 species), and Rosaceae (20 species). This distribution is the closest to the ratio of Tarnovo Heights, where 71.60% of families are presented by 5 or more species. The percentage of families with 1-4 species of Frangen Plateau and Provadiya Plateau is higher - 76.25% and 77.91% respectively. However, the data are relatively close.

The majority of genera, 252 (98.44%) are presented by 1-4 species. Only 4 (1.56%) of genera are represented by 5 or 6 species. For comparison, the data for the other territories are roughly the same. The number of families with 1-4 species is as follows: of Provadiya Plateau is 98.85%, of Frangen Plateau is 97.93%, and of Tarnovo Heights is 96.83%.

The obtained results for the high percentage of families and genera with a small number of lower taxa may be explained by the fact that a relatively small number of species of a genus belong to medicinal plants. This also applies to the genera of a family - the genera that include medicinal plants are comparatively small compared to the total number of genera in the family.

The life forms on the territory of Razgrad Heights are represented by 6 groups and 7 subgroups of life forms. The largest number species, 173 species (45.89%) belong to group of the hemicryptophytes, followed by phanerophytes, 67 species (17.77%). Among the phanerophytes with the largest number of species are mesophanerophytes, 32 species (8.49%) and microphanerophytes, 22 species (5.84%). The groups of therophytes and cryptophytes also include a large number of species: 54 species (14.32%) and 44 species (11.67%), respectively. With the smallest number of species are chamaephytes, 16 species (4.24%).

In the neighboring geographic objects, these groups also have the largest number of species. In Figure 3 only the first 4 life forms by number of species are presented. Similar results for all objects considered can be explained by the fact that they are located at the same latitude and have close climatic conditions.

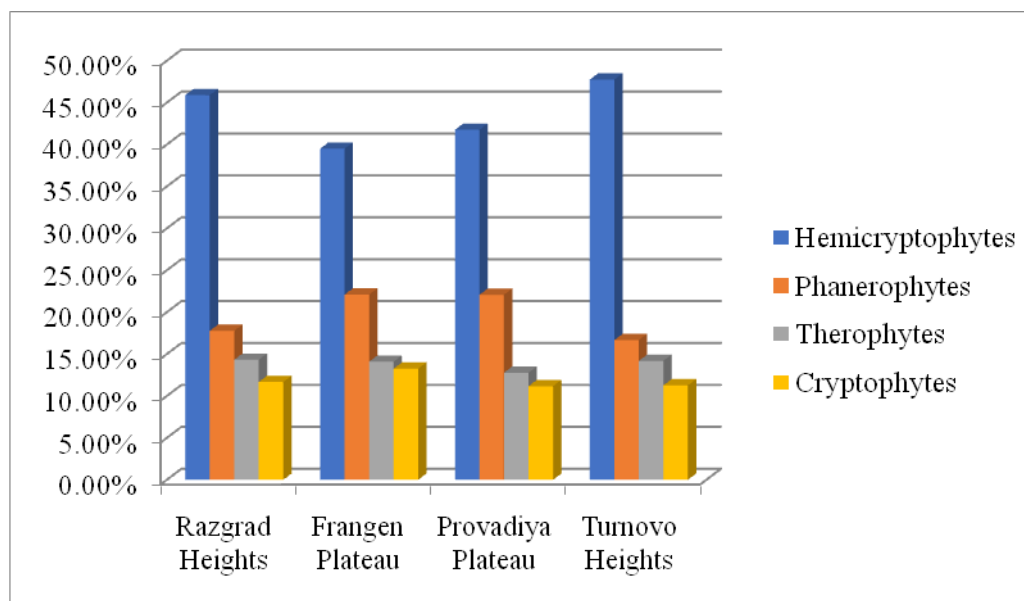


Figure 3: Comparison of Razgrad Heights with neighboring territories by life forms

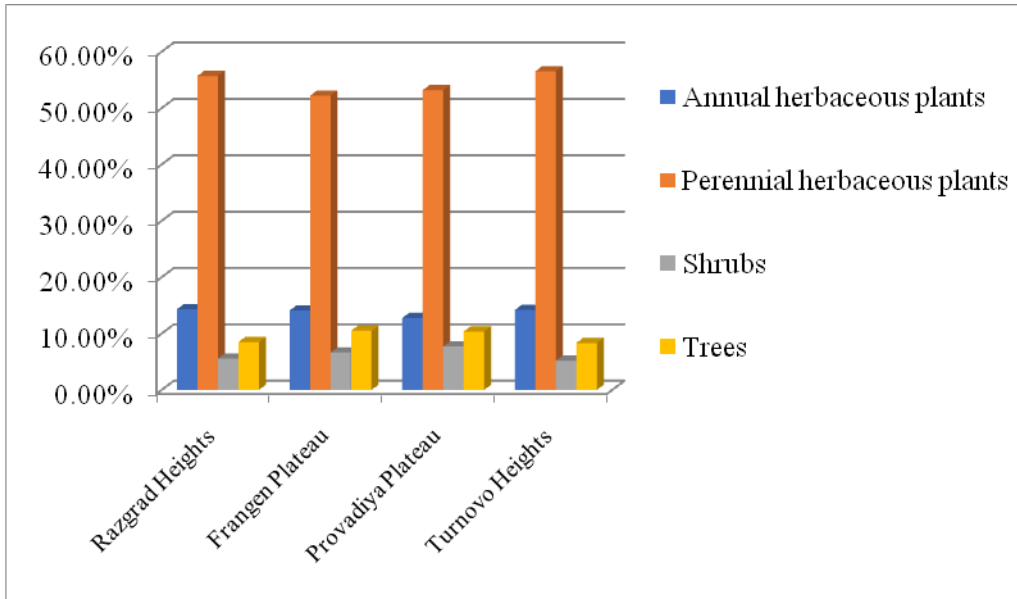


Figure 4: Comparison of Razgrad Heights with neighboring territories by biological types

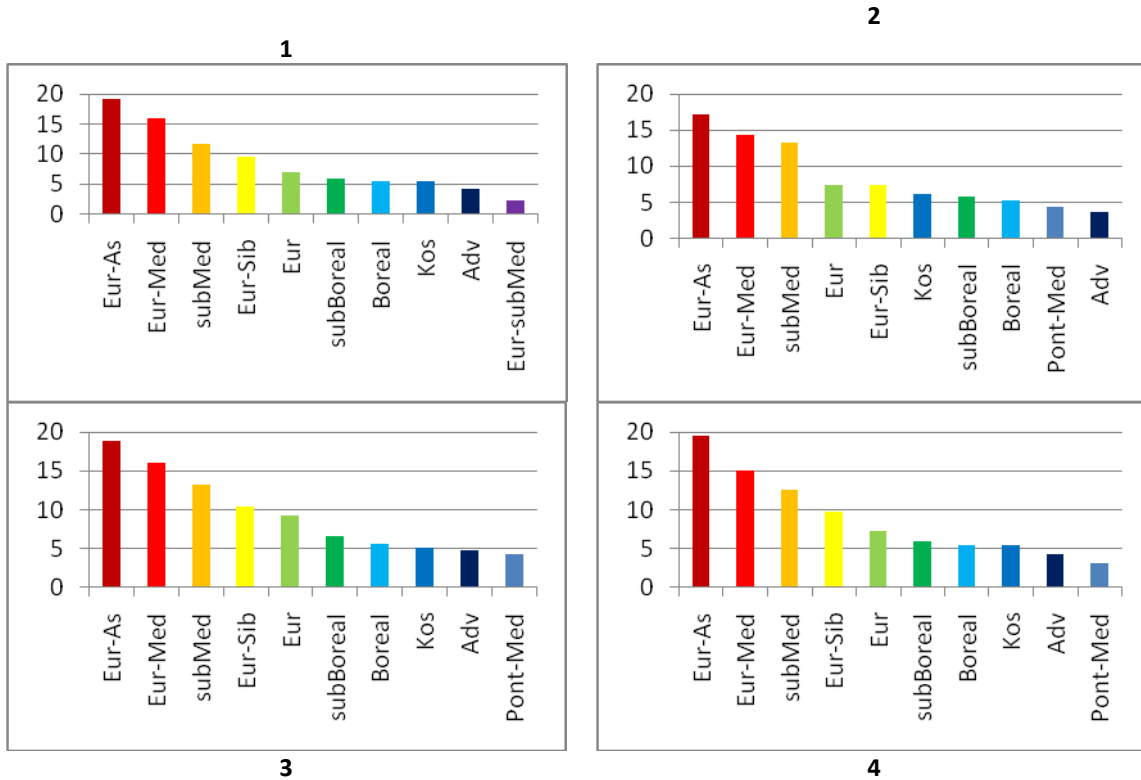


Figure 5: Comparison of the Razgrad Heights with neighboring territories by phytogeographical structure: Razgrad Heights (1), Frangen Plateau (2), Provadiya Plateau (3) and Turnovo Heights (4)

In Razgrad Heights we have identified medicinal plants belong to all biological types. The results show the prevalence of perennial herbaceous plants, 210 species (55.7%). Next, the numbers of species are: annual herbaceous plants, 54 species (14.32%), trees, 32 species (8.49%), and shrubs, 21 species (5.57%). The biannual herbaceous plants and transitions forms between the major biological types are represented with the smallest number of species. The reason for the group of perennial herbaceous plants being the most numerous species is the wide variety of communities and habitats that are located on the territory of the Razgrad Heights. The distribution of the biological types among the medicinal plants in the neighboring

geographic objects shows close results. In Figure 4 shows the first 4 groups of biological types by species number for each territory.

The described medicinal plants belong to 34 different floristic elements. The distribution of the first 10 of them is very similar in the four compared territories (Figure 5). The largest number of medicinal plants of Razgrad Heights, 72 species (19.10%) belongs to European-Asiatic floristic elements. Secondly, with 60 species (15.92%) are European-Mediterranean floristic elements. Thirdly, with 44 species (11.67%) are Sub-Mediterranean floristic elements.

The percentage of adventive species (4.24%) and cosmopolitan species (5.57%) corresponds to the percentage found in the neighboring geographic objects we use for comparison. Of the Frangen Plateau the percentage of adventive species is 3.59%, and the percentage of cosmopolitan species is 6.08%. Of the Provadiya Plateau the percentage of adventive species is 4.79%, and the percentage of cosmopolitan species is 5.05%. Of the Tarnovo Heights the percentage of adventive species is 4.28%, and the percentage of cosmopolitan species is 5.41%.

The close results can be explained by the geographical proximity of the compared territories and hence the closeness of climatic conditions that are of major importance in the distribution of floristic elements.

Among the medicinal plants, we found 3 endemic species (0.80%). Of these, 2 species are Balkan endemics: *Acanthus balcanicus* Heywood & I. Richardson and *Achillea clypeolata* Sm. One species is Bulgarian endemic: *Seseli rhodopaeum* Velen. Compared to the other territories (Figure 6), the endemic rate is relatively high and yields only that of the Frangen Plateau.

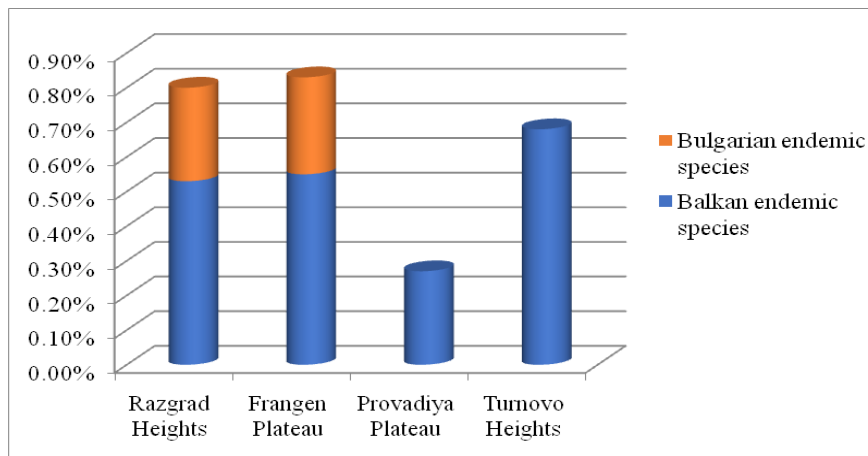


Figure 6: Comparison of Razgrad Heights with neighboring territories by endemic species

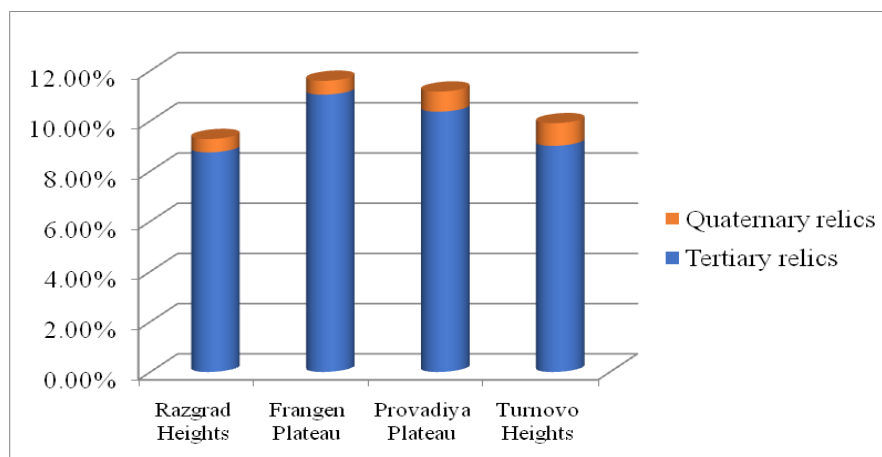


Figure 7: Comparison of Razgrad Heights with neighboring territories by relic species

The number of relict species is 35 (9.28%). The majority of these relic species are Tertiary relicts. They are 33 species: *Acer campestre* L., *A. platanoides* L., *A. pseudoplatanus* L., *A. tataricum* L., *Asarum europaeum* L., *Carpinus betulus* L., *Clematis vitalba* L., *Colutea arborescens* L., *Corylus avellana* 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., *Lycopus europaeus* L., *Paliurus spina-christi* Mill., *Populus alba* L., *P. nigra* L., *P. tremula* L., *Quercus dalechampii* Ten., *Ruscus aculeatus* L., *Salix alba* L., *S. caprea* L., *S. fragilis* L., *S. purpurea* L., *Staphylea pinnata* L., *Syringa vulgaris* L., *Tamus communis* L., *Ulmus minor* Mill., *Viscum album* L. Quaternary relicts are represented by *Adonis vernalis* L. and *Galanthus nivalis* L. The percentage of relict species among medicinal plants at Razgrad Heights is lowest compared to other territories (Figure 7).

The number of species with conservation status is 21 (5.57%). One of them is *Himantoglossum caprinum* Spreng. It is included in Annex II of Directive 92/43/EEC (Plant and animal species of Community interest whose conservation requires the designation of special areas of conservation) and in Appendix I of the Bern Convention. Two species are included in Annex V of Directive 92/43/EEC (Animal and plant species of Community interest whose taking in the wild and exploitation may be subject to management measures): *Galanthus nivalis* L. and *Ruscus aculeatus* L.

In Appendix II of CITES Convention are included 11 species: *Adonis vernalis* L., *Anacamptis pyramidalis* (L.) Rich., *Cyclamen hederifolium* Aiton, *Galanthus elwesii* Hook.f., *G. nivalis* L., *Himantoglossum caprinum* Spreng., *Ophrys cornuta* Steven ex M.Bieb., *Orchis morio* L., *O. purpurea* Huds., *O. simia* Lam., *O. tridentata* Scop.

In the Red List of Bulgarian vascular plants are included 8 species. In the category Endangered are enlisted 2 species: *Galanthus elwesii* Hook.f. and *G. nivalis* L. In category Vulnerable are included 3 species: *Anacamptis pyramidalis* (L.) Rich., *Himantoglossum caprinum* Spreng., *Ophrys cornuta* Steven ex M.Bieb. In the category Nearly Threatened is one species: *Anemone sylvestris* L. In the category Least Concern are 2 species: *Acanthus balcanicus* Heywood & I. Richardson, *Pulmonaria mollis* Ten.

In the Red Data Book of Republic of Bulgaria are included 3 species. Two of them are in the category Endangered: *Galanthus elwesii* Hook.f. and *G. nivalis* L. One species is in the category Vulnerable: *Himantoglossum caprinum* Spreng.

In the Act on Amending and Supplementing the Biological Diversity Act of the Republic of Bulgaria are included 18 species. In Annex III (Protected species) are included 6 species: *Anacamptis pyramidalis* (L.) Rich., *Anemone sylvestris* L., *Galanthus elwesii* Hook.f., *G. nivalis* L., *Himantoglossum caprinum* Spreng., *Ophrys cornuta* Steven ex M.Bieb. In Annex IV (Species under the conservation and regulated use of the nature) are included 12 species: *Asparagus officinalis* L., *Cyclamen hederifolium* Aiton, *Echinops sphaerocephalus* L., *Lilium martagon* L., *Orchis morio* L., *O. purpurea* Huds., *O. simia* Lam., *O. tridentata* Scop., *Polygonatum odoratum* (Mill.) Druce, *Ruscus aculeatus* L., *Salix caprea* L., *Scilla bifolia* L.

The percentage of species with conservation status among medicinal plants of Razgrad Heights is the lowest in comparison to the other territories (Figure 8).

The collection of herbs from medicinal plants must take into account the species included in Order No RD-56 of 01.02.2018 on the special regime for the protection and use of medicinal plants in 2018. In this annual order issued by the Minister of Environment and Waters lists two groups of medicinal plants. The first group includes medicinal plants that are prohibited from collecting herbs from their natural habitats. Of the medicinal plants that occur in the territory of Razgrad Heights to this group are following 11 species: *Adonis vernalis* L., *Althaea officinalis* L., *Asarum europaeum* L., *Convallaria majalis* L., *Inula helenium* L., *Orchis morio* L., *Orchis purpurea* Huds., *Orchis simia* Lam., *Orchis tridentata* Scop., *Ruscus aculeatus* L., *Valeriana officinalis* L.

The second group includes medicinal plants that are under restricted collection of herbs from their natural habitats. This group includes following 4 species: *Betonica officinalis* L., *Carlina acanthifolia* All., *Galium odoratum* (L.) Scop., *Sedum acre* L. Quotas for the collection of herbs from these plants and the areas in which they can be collected are set out in a separate annex to the order.

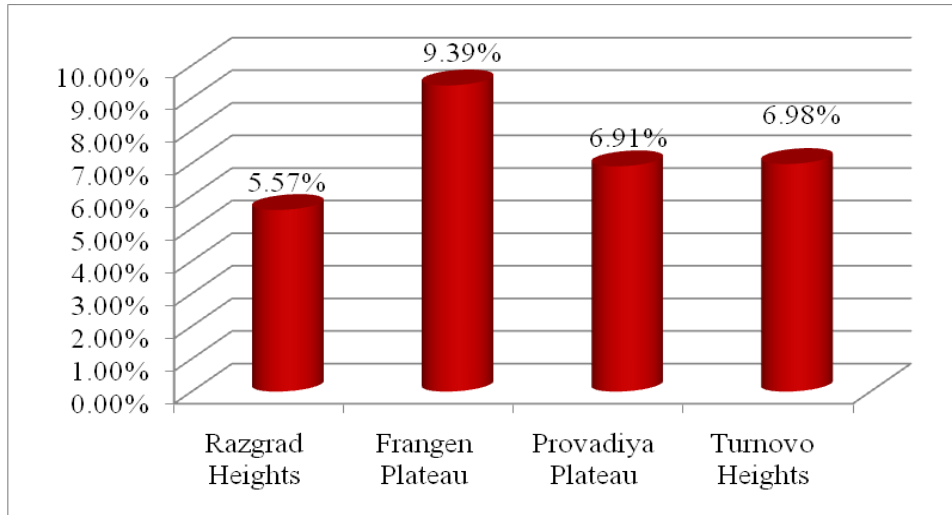


Figure 8: Comparison of Razgrad Heights with neighboring territories by species with conservation status

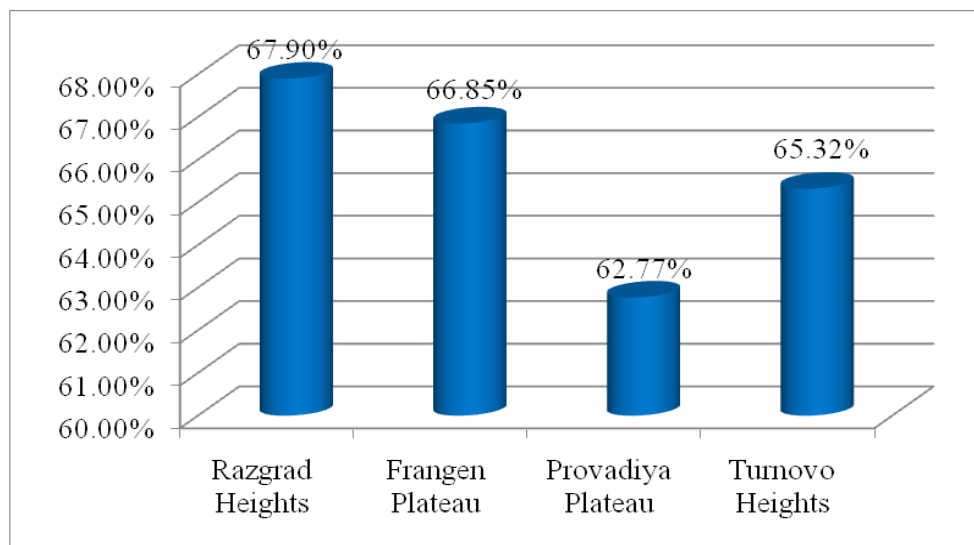


Figure 9: Comparison of Razgrad Heights with neighboring territories by antropophytes

Among medicinal plants there are species that are poisonous to varying degrees. A small number of medicinal plants are highly poisonous. These are, for example: *Adonis vernalis* L., *Datura stramonium* L., *Digitalis lanata* Ehrh. Another part of the medicinal plants are poisonous only at higher doses. These are, for example: *Equisetum arvense* L., *Rhamnus catharticus* L., *Valeriana officinalis* L. Plants causing side effects in physical contact with them or their constituents are for example: *Ailanthus altissima* (Mill.) Swingle, *Bituminaria bituminosa* (L.) Stirt., *Chelidonium majus* L., *Clematis vitalba* L., *Conium maculatum* L., *Dictamnus albus* L., *Hypericum perforatum* L., *Lactuca serriola* L., *Tamus communis* L. In contact with the plant, *Dictamnus albus* L. can cause particularly severe damage to the human skin.

The antropophytes among the medicinal plants on the territory of Razgrad Heights are 256 species (67.90%). Therefore, the majority of medicinal plants in the studied area are linked to human activity to varying degrees. Most of them are perennial herbaceous plants, 133 species (35.28%). Secondary in number of species are the annual herbaceous plants with 50 species (13.26%). The group of annual to biennial herbaceous plants includes 18 species (4.77%). The trees are 13 species (3.45%). The remaining biological types among the antropophytes have a smaller number of species.

The percentage of the antropophytes among the medicinal plants of Razgrad Heights is higher but relatively close to that of the other compared territories (Figure 9). The reason for this can be found in the

presence of a large number of settlements, the considerable area of the arable lands around them and the well-developed road infrastructure in the heights.

CONCLUSION

The results obtained from the study of the medicinal plants of the Razgrad Heights are comparable with the results of analogous studies of the medicinal plants of the Frangen Plateau, Provadiya Plateau and Turnovo Heights situated in the northern part of Bulgaria. The results of this study can be used as a basis for comparison studies of medicinal plants in other parts of the country.

ACKNOWLEDGMENTS

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Appendix

Systematic list of medicinal plant species, established in Razgrad Heights (Northeastern Bulgaria)

Division Equisetophyta

Fam. Equisetaceae: *Equisetum arvense* L.

Division Polypodiophyta

Fam. Aspleniaceae: *Asplenium adiantum-nigrum* L.; *Asplenium ruta-muraria* L.

Division Magnoliophyta

Class Magnoliopsida

Fam. Acanthaceae: *Acanthus balcanicus* Heywood & I. Richardson; **Fam. Amaranthaceae:** *Amaranthus retroflexus* L.; *Chenopodium album* L.; *Chenopodium hybridum* L.; **Fam. Anacardiaceae:** *Cotinus coggygria* Scop.; **Fam. Apiaceae:** *Aegopodium podagraria* L.; *Aethusa cynapium* L.; *Angelica sylvestris* L.; *Anthriscus cerefolium* Hoffm.; *Chaerophyllum temulentum* L.; *Conium maculatum* L.; *Daucus carota* L.; *Eryngium campestre* L.; *Foeniculum vulgare* Mill.; *Heracleum sibiricum* L.; *Pastinaca sativa* L.; *Peucedanum cervaria* Cusson ex Lapeyr.; *Scandix pecten-veneris* L.; *Seseli rhodopaeum* Velen.; *Seseli tortuosum* L.; *Tordylium maximum* L.; *Torilis arvensis* (Huds.) Link; **Fam. Apocynaceae:** *Vinca herbacea* Waldst. & Kit.; *Vinca minor* L.; *Vincetoxicum hirundinaria* Medik.; **Fam. Araliaceae:** *Hedera helix* L.; **Fam. Aristolochiaceae:** *Aristolochia clematitis* L.; *Asarum europaeum* L.; **Fam. Asteraceae:** *Achillea clypeolata* Sm.; *Achillea millefolium* L.; *Anthemis cotula* L.; *Arctium lappa* L.; *Arctium minus* Bernh.; *Arctium tomentosum* Mill.; *Artemisia absinthium* L.; *Artemisia annua* L.; *Artemisia vulgaris* L.; *Bellis perennis* L.; *Bidens tripartita* L.; *Carduus acanthoides* L.; *Carlina acanthifolia* All.; *Carlina vulgaris* L.; *Carthamus lanatus* L.; *Centaurea calcitrapa* L.; *Centaurea cyanus* L.; *Centaurea rocheliana* (Heuff.) Dostál; *Centaurea solstitialis* L.; *Cichorium intybus* L.; *Cirsium arvense* (L.) Scop.; *Cirsium vulgare* (Savi) Ten.; *Cota tinctoria* (L.) J.Gay.; *Echinops sphaerocephalus* L.; *Erigeron canadensis* L.; *Eupatorium cannabinum* L.; *Galinsoga parviflora* Cav.; *Hieracium pilosella* L.; *Hypochoeris radicata* L.; *Inula britanica* L.; *Inula helenium* L.; *Jacobaea vulgaris* Gaertn.; *Lactuca serriola* L.; *Leucanthemum vulgare* Lam.; *Matricaria chamomilla* L.; *Pulicaria dysenterica* (L.) Bernh.; *Scorzonera hispanica* L.; *Solidago gigantea* Aiton; *Taraxacum officinale* F.H.Wigg.; *Tragopogon pratensis* L.; *Tripleurospermum tenuifolium* Freyn ex Freyn & E.Brandis; *Tussilago farfara* L.; *Xanthium spinosum* L.; *Xanthium strumarium* L.; *Xeranthemum annuum* L.; **Fam. Betulaceae:** *Carpinus betulus* L.; *Corylus avellana* L.; **Fam. Boraginaceae:** *Buglossoides arvensis* (L.) I.M.Johnst.; *Buglossoides purpureocaerulea* (L.) I.M.Johnst.; *Cerinthe minor* L.; *Echium italicum* L.; *Echium vulgare* L.; *Heliotropium europaeum* L.; *Myosotis arvensis* (L.) Hill.; *Pulmonaria mollis* Wulfen ex Hornem.; *Pulmonaria officinalis* L.; *Symphytum officinale* L.; **Fam. Brassicaceae:** *Alliaria petiolata* (M.Bieb.) Cavara & Grande; *Alyssum alyssoides* (L.) L.; *Barbarea vulgaris* W.T.Aiton; *Capsella bursa-pastoris* (L.) Medik.; *Cardamine bulbifera* Crantz; *Cardaria draba* (L.) Desv.; *Descurainia sophia* (L.) Webb ex Prantl; *Erysimum diffusum* Ehrh.; *Lepidium campestre* (L.) W.T.Aiton; *Myagrum perfoliatum* L.; *Rorippa sylvestris* (L.) Besser; *Sisymbrium officinale* (L.) Scop; *Thlaspi alliaceum* L.; **Fam. Campanulaceae:** *Campanula persicifolia* L.; **Fam. Cannabaceae:** *Cannabis sativa* L.; *Humulus lupulus* L.; **Fam. Caprifoliaceae:** *Dipsacus fullonum* L.; *Dipsacus laciniatus* L.;

Knautia arvensis Coult.; *Sambucus ebulus* L.; *Sambucus nigra* L.; *Scabiosa ochroleuca* L.; *Valeriana officinalis* L.; **Fam. Caryophyllaceae:** *Herniaria incana* Lam.; *Lychnis coronaria* (L.) Desr.; *Saponaria officinalis* L.; *Silene otites* Sm.; *Stellaria media* (L.) Vill.; **Fam. Celastraceae:** *Euonymus europaeus* L.; *Euonymus verrucosus* Scop.; **Fam. Convolvulaceae:** *Calystegia sepium* (L.) R.Br.; *Convolvulus arvensis* L.; *Cuscuta europaea* L.; **Fam. Cornaceae:** *Cornus mas* L.; **Fam. Crassulaceae:** *Sedum acre* L.; *Sedum maximum* Suter; **Fam. Dioscoreaceae:** *Tamus communis* L.; **Fam. Euphorbiaceae:** *Euphorbia amygdaloides* L.; *Mercurialis perennis* L.; **Fam. Fabaceae:** *Amorpha fruticosa* L.; *Anthyllis vulneraria* L.; *Astragalus glycyphylloides* DC.; *Astragalus glycyphyllos* L.; *Bituminaria bituminosa* (L.) C.H.Stirt.; *Chamaecytisus hirsutus* Link; *Colutea arborescens* L.; *Coronilla scorpioides* W.D.J.Koch; *Coronilla varia* L.; *Galega officinalis* L.; *Genista ovata* Waldst. & Kit.; *Genista tinctoria* L.; *Gleditsia triacanthos* L.; *Laburnum anagyroides* Medik.; *Lathyrus niger* (L.) Bernh.; *Lathyrus sylvestris* L.; *Lathyrus tuberosus* L.; *Lathyrus vernus* (L.) Bernh.; *Lotus corniculatus* L.; *Medicago sativa* L.; *Melilotus alba* Medik.; *Melilotus officinalis* Pall.; *Ononis arvensis* L.; *Ononis spinosa* L.; *Robinia pseudoacacia* L.; *Trifolium alpestre* L.; *Trifolium arvense* L.; *Trifolium pratense* L.; *Trifolium repens* L.; *Trigonella coerulea* Auct.; *Vicia cracca* L.; *Vicia grandiflora* Scop.; *Vicia sativa* L.; **Fam. Fagaceae:** *Quercus dalechampii* Ten.; *Quercus frainetto* Ten.; **Fam. Gentianaceae:** *Centaurium erythraea* Rafn; *Centaurium pulchellum* (Sw.) Druce; **Fam. Geraniaceae:** *Erodium cicutarium* (L.) ÌHer.; *Geranium pyrenaicum* Burm.f.; **Fam. Haloragaceae:** *Myriophyllum spicatum* L.; **Fam. Hypericaceae:** *Hypericum perforatum* L.; **Fam. Juglandaceae:** *Juglans regia* L.; **Fam. Lamiaceae:** *Acinos arvensis* (Lam.) Dandy; *Ajuga chamaepitys* (L.) Schreb.; *Ajuga laxmanii* (L.) Benth.; *Ajuga reptans* L.; *Ballota nigra* L.; *Betonica officinalis* L.; *Calamintha nepeta* (L.) Savi; *Calamintha sylvatica* Bromf.; *Clinopodium vulgare* L.; *Galeopsis speciosa* Mill.; *Glechoma hederacea* L.; *Glechoma hirsuta* Waldst. & Kit.; *Lamium maculatum* L.; *Lamium purpureum* L.; *Leonurus cardiaca* L.; *Lycopus europaeus* L.; *Marrubium peregrinum* L.; *Marrubium vulgare* L.; *Melissa officinalis* L.; *Mentha aquatica* L.; *Mentha arvensis* L.; *Mentha longifolia* (L.) Huds.; *Mentha pulegium* L.; *Mentha spicata* L.; *Origanum vulgare* L.; *Phlomis tuberosa* L.; *Prunella vulgaris* L.; *Salvia nemorosa* L.; *Salvia sclarea* L.; *Salvia verticillata* L.; *Scutellaria altissima* L.; *Scutellaria galericulata* L.; *Sideritis montana* L.; *Stachys annua* L.; *Stachys germanica* L.; *Stachys sylvatica* L.; *Teucrium chamaedrys* L.; *Teucrium polium* L.; *Teucrium scordium* L.; *Thymus callieri* Halácsy ex Litv.; *Thymus glabrescens* Willd.; *Thymus pulegioides* L.; *Thymus sibthorpii* Benth.; **Loranthaceae:** *Viscum album* L.; **Fam. Lythraceae:** *Lythrum salicaria* L.; *Lythrum virgatum* L.; **Fam. Malvaceae:** *Alcea pallida* (Waldst. & Kit. ex Willd.) Waldst. & Kit.; *Althaea officinalis* L.; *Lavatera thuringiaca* L.; *Malva sylvestris* L.; *Tilia cordata* Mill.; *Tilia platyphyllos* Scop.; *Tilia tomentosa* Moench; **Fam. Moraceae:** *Morus alba* L.; *Morus nigra* L.; **Fam. Oleaceae:** *Fraxinus excelsior* L.; *Fraxinus ornus* L.; *Fraxinus oxycarpa* Willd.; *Ligustrum vulgare* L.; *Syringa vulgaris* L.; **Fam. Onagraceae:** *Epilobium parviflorum* Schreb.; **Fam. Orobanchaceae:** *Orobanche minor* Sm.; **Fam. Papaveraceae:** *Chelidonium majus* L.; *Corydalis bulbosa* (L.) DC.; *Corydalis solida* Sw.; *Fumaria officinalis* L.; *Fumaria vaillantii* Loisel.; *Papaver rhoeas* L.; **Fam. Phytolaccaceae:** *Phytolacca americana* L.; **Fam. Plantaginaceae:** *Plantago lanceolata* L.; *Plantago major* L.; *Plantago media* L.; **Fam. Polygalaceae:** *Polygala major* Jacq.; *Polygala vulgaris* L.; **Fam. Polygonaceae:** *Fallopia dumetorum* (L.) Holub; *Persicaria amphibia* (L.) Gray; *Persicaria hydropiper* (L.) Spach; *Persicaria lapathifolia* (L.) Gray; *Persicaria maculata* (Sibth.) Gray; *Persicaria mitis* (Schrank) Assenov; *Polygonum aviculare* L.; *Rumex aquaticus* L.; *Rumex crispus* L.; *Rumex obtusifolius* L.; *Rumex palustris* Sm.; *Rumex patientia* L.; *Rumex pulcher* L.; **Fam. Portulacaceae:** *Portulaca oleracea* L.; **Fam. Primulaceae:** *Anagallis arvensis* L.; *Cyclamen hederifolium* Aiton; *Lysimachia nummularia* L.; **Fam. Ranunculaceae:** *Adonis aestivalis* L.; *Adonis vernalis* L.; *Anemone ranunculoides* L.; *Anemone sylvestris* L.; *Clematis vitalba* L.; *Consolida hispanica* (Costa) Greuter & Burdet; *Consolida regalis* Gray; *Helleborus odoratus* Waldst. & Kit. ex Willd.; *Isopyrum thalictroides* L.; *Nigella arvensis* L.; *Ranunculus ficaria* L.; *Ranunculus polyanthemos* L.; *Ranunculus repens* L.; *Thalictrum aquilegifolium* L.; *Thalictrum minus* L.; **Fam. Resedaceae:** *Reseda lutea* L.; **Fam. Rhamnaceae:** *Paliurus spina-christi* Mill.; *Rhamnus catharticus* L.; **Fam. Rosaceae:** *Agrimonia eupatoria* L.; *Crataegus monogyna* Jacq.; *Crataegus pentagyna* Waldst. & Kit. ex Willd.; *Filipendula vulgaris* Moench; *Fragaria vesca* L.; *Geum urbanum* L.; *Potentilla argentea* L.; *Potentilla reptans* L.; *Prunus avium* L.; *Prunus cerasifera* Ehrh.; *Prunus mahaleb* L.; *Prunus spinosa* L.; *Pyrus pyraeaster* (L.) Burgsd.; *Pyrus sativa* DC.; *Rosa canina* L.; *Rubus caesius* L.; *Rubus hirtus* Waldst. & Kit.; *Sanguisorba minor* Scop.; *Sorbus aucuparia* L.; *Sorbus torminalis* (L.) Crantz; **Fam. Rubiaceae:** *Cruciata glabra* (L.) Ehrend.; *Cruciata laevipes* Opiz; *Galium aparine* L.; *Galium odoratum* Scop.; *Galium verum* L.; **Fam. Rutaceae:** *Dictamnus albus* L.; **Fam. Salicaceae:** *Populus alba* L.; *Populus nigra* L.; *Populus tremula* L.; *Salix alba* L.; *Salix caprea* L.; *Salix fragilis* L.; *Salix purpurea* L.; **Fam. Sapindaceae:** *Acer campestre* L.; *Acer negundo* L.; *Acer platanoides* L.; *Acer pseudoplatanus* L.; *Acer tataricum* L.; **Fam. Scrophulariaceae:** *Digitalis lanata* Ehrh.; *Lathraea squamaria* L.; *Linaria vulgaris* Mill.; *Pseudolysimachion orchideum* (Crantz) Wraber; *Scrophularia nodosa* L.; *Scrophularia umbrosa* Dumort.; *Verbascum densiflorum* Bertol.; *Verbascum phoeniceum* L.; *Veronica anagallis-aquatica* L.; *Veronica austriaca* L.; *Veronica chamaedrys* L.; *Veronica officinalis* L.; **Fam. Simaroubaceae:** *Ailanthus altissima* (Mill.) Swingle; **Fam. Solanaceae:** *Datura stramonium*

L.; *Hyoscyamus niger* L.; *Lycium barbarum* L.; *Solanum dulcamara* L.; *Solanum nigrum* L.; **Fam. Staphyleaceae:** *Staphylea pinnata* L.; **Fam. Ulmaceae:** *Ulmus glabra* Huds.; *Ulmus minor* Mill.; **Fam. Urticaceae:** *Parietaria lusitanica* L.; *Parietaria officinalis* L.; *Urtica dioica* L.; **Fam. Verbenaceae:** *Verbena officinalis* L.; **Fam. Violaceae:** *Viola odorata* L.; *Viola tricolor* L.

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Fam. Alismataceae: *Alisma plantago-aquatica* L.; **Fam. Amaryllidaceae:** *Allium rotundum* L.; *Allium ursinum* L.; *Galanthus elwesii* Hook.f.; *Galanthus nivalis* L.; **Fam. Araceae:** *Arum maculatum* L.; *Lemna minor* L.; **Fam. Asparagaceae:** *Asparagus officinalis* L.; *Convallaria majalis* L.; *Polygonatum multiflorum* (L.) All.; *Polygonatum odoratum* (Mill.) Druce; *Ruscus aculeatus* L.; *Scilla bifolia* L.; **Fam. Hydrocharitaceae:** *Najas marina* L.; **Fam. Iridaceae:** *Iris graminea* L.; *Iris pseudacorus* L.; **Fam. Juncaceae:** *Juncus inflexus* L.; **Fam. Liliaceae:** *Lilium martagon* L.; **Fam. Orchidaceae:** *Anacamptis pyramidalis* (L.) Rich.; *Himantoglossum caprinum* Spreng.; *Ophrys cornuta* Steven ex M.Bieb.; *Orchis morio* L.; *Orchis purpurea* Huds.; *Orchis simia* Lam.; *Orchis tridentata* Scop.; **Fam. Poaceae:** *Anthoxanthum odoratum* L.; *Cynodon dactylon* (L.) Pers.; *Elymus repens* (L.) Gould; *Lolium temulentum* L.; *Sclerochloa dura* (L.) P.Beauv.; *Sorghum halepense* (L.) Pers.; **Fam. Typhaceae:** *Sparganium erectum* L.; *Typha angustifolia* L.; *Typha latifolia* L.

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