

## ASPECTS OF BIODIVERSITY IN A SPA RESORT: INSIGHT FROM THE FAIRY GLADE, UPPER BORSEC (HARGHITA COUNTY, ROMANIA)

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### Abstract

*Part of the Borsec Round Chair natural reserve included in the Natura 2000 network and declared site of community importance, the Fairy Glade (Poiana Zânelor) draw attention of tourists and local people for many years due to various spa facilities such as traditional bathrooms. Although intensively analyzed in terms of architectural heritage, leisure opportunities and properties of its mineral springs, the Borsec resort still has unknown aspects regarding conservation of biological diversity.*

*This paper was designed with a purpose to report the herbs and terrestrial arthropods gathered and identified following the biological exploration of the Fairy Glade from Upper Borsec area, Harghita County, in a field trip taking place in September 2019. The species were noted in an alphabetical order of the genera, then of species within the genera.*

*Regarding the number of species, of the 21 plant families listed for Fairy Glade, the most dominant were Asteraceae and Fabaceae while other families (Boraginaceae, Campanulaceae, Caprifoliaceae, Caryophyllaceae, Chenopodiaceae, Colchicaceae, Cyperaceae, Dipsacaceae, Equisetaceae, Gentianaceae, Geraniaceae, Juncaceae, Lamiaceae, Plantaginaceae, Poaceae, Ranunculaceae, Rubiaceae, Scrophulariaceae, Violaceae) were represented by a smaller number of species. Concerning arthropods, six orders of insects (Diptera, Hemiptera, Hymenoptera, Lepidoptera, Orthoptera, Neuroptera) and also specimens of philodromid crab spiders (Arachnida: Araneae) were identified in the herbaceous vegetation of the Fairy Glade.*

*The taxa listed in this study complete the data already known in the literature about the values of the Natura 2000 site ROSCI0252 Toplița - Borsec Round Chair.*

**Key words:** Borsec, Fairy Glade, herbs, insects, spa resort.

### INTRODUCTION

Placed in the centre of Romania, eastern Transylvania namely in Harghita County, at an altitude of 900 m above sea level, Borsec (Borszék in Hungarian) and the surroundings are known mainly for their spas and mineral waters springs.

There are two interconnected basins in this intracarpatic depression: Borsecul de Jos (The Lower Borsec, larger, to the south) and the resort itself or Borsecul de Sus (The Upper Borsec) smaller, on a higher plateau in the northern part (Tofan and Niță, 2017).

A typical mountain spa also named the “Pearl of the Carpathians”, Upper Borsec achieved renown over hundreds of years of existence due to various factors such as the international recognition of mineral springs, architectural heritage, favourable climatic conditions, spacious leisure areas, the presence of protected

natural reservations and relaxing mountain routes (<https://cndd.ro/wp-content/uploads/>; <http://www.borsecinfo.ro/en>).

In Upper Borsec there are many facilities for hot baths in tubs or covered pools with carbonated mineral water, mineral springs for internal treatment (recommended for cardiovascular, dermatological, digestive or endocrine diseases, biliary dyskinesia, renal and urinary system disorders etc.), gym, electrotherapy and hydrotherapy, installations for baths with herbs or paraffin packing (<https://www.outdooractive.com/>).

Located just East and West of Borsec, the Toplița - Borsec Round Chair area was included in the Natura 2000 network and declared a site of community importance (<http://scaunulborsec.romaqua-group.ro/>).

The most important objectives of the karst zone Scaunul Rotund (Kerekszék, The Round Chair Natural Reserve) – the largest travertine deposit

in the country, extended on 70 ha include Poiana Zânelor (Tündérkert Ferredő, The Fairy Glade sometimes referred as Fairies Glade), Grotă Urșilor (Medvebarlang, The Bear Cave), Peștera de Gheață (Jégbarlang, The Ice Cave), Izvorul Străvechi (Ősforrás, The Ancient Spring or Mofeta) and the two travertine quarries exploited for industrial purposes but currently having ceased activity (<http://www.visitborsec.ro/en/>).

The Fairy Glade (in Romanian: Poiana Zânelor) represents a group of springs visited by both tourists and local people for several attractions like mineral water pool and foot baths used in different cures and therapies, (<http://vilariki.com/en/attractions/>).

In the area there are indicator panels using English, Hungarian and Romanian languages, hand-painted on wood and decorated with floral motifs (Figure 1).

The Fairy Glade also has belvedere points and picnic locations, a wardrobe and resting points and for all these facilities there is no program or entrance fee (<https://visitharghita.com/en/places/>).



Figure 1. Natural Spa facilities at Fairy Glade, Upper Borsec

While data about history, demographic analysis, tourism infrastructure, healing properties and chemical composition of mineral springs of Borsec have been reported so far (Munteanu, 2013; Tofan, 2014; Levei et al., 2016; Tofan and Niță, 2017; Bálint et al., 2018), there is still poor information concerning biodiversity associated with this

resort area. The need for protection of habitat and resident species - plants, invertebrates and vertebrates - was addressed in the framework of the project “Ensuring the management of the Natura 2000 site ROSCI0252 Toplița - Borsec Round Chair” whose beneficiary is the company Romaqua Group S.A. and in 2014 an informative electronic brochure was published (<https://romaqua-group.ro/>).

Considering the fact that Fairy Glade is placed on the territory of a protected area frequently visited all year long and therefore subjected to the anthropogenic disturbance, there is a constant requirement for providing knowledge about biodiversity components in order to design new strategic management conservation plans (<https://www.primaria-borsec.ro/>).

Hence, the purpose of this paper was to investigate from another perspective – other than that of spa, rest and recreation tourism – the local environment and to develop models of checklist species, based on the collected samples in biological surveys.

## MATERIALS AND METHODS

The selected habitat for collecting both plants and arthropods at Poiana Zânelor (Fairy Glade), Harghita County was located at 46°58'9.30"N/25°33'59.49"E geographical coordinates (Figure 2).

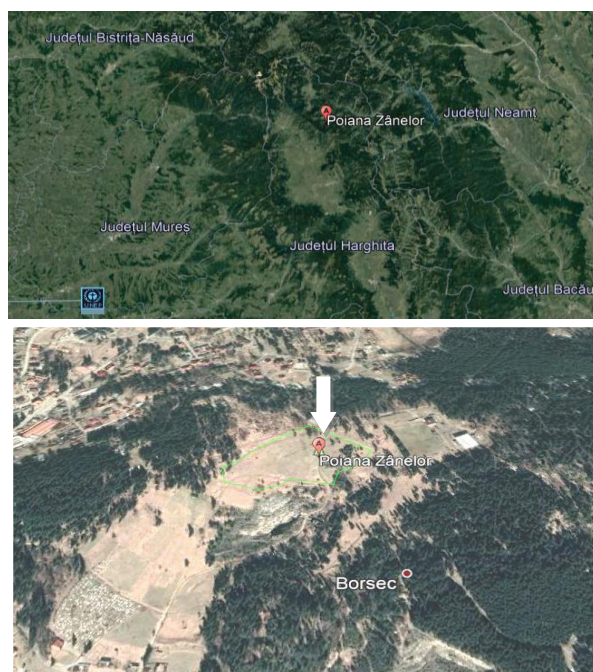


Figure 2. Geographic indication of Poiana Zânelor, Upper Borsec (map source: Google Earth)



The sampling and storing procedure took place in September 2019, following the method depicted before by Dobrin et al. (2013) and Stavrescu et al. (2018). Biological material was photographed and gathered from two alpine pastures that bordered the waking path leading to the therapeutic baths (Figure 3).

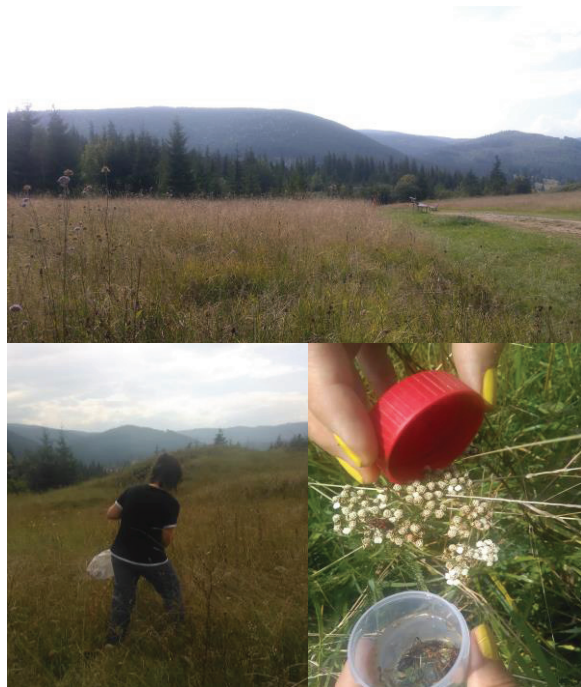


Figure 3. Sampling herbs and insects at Fairy Glade, Upper Borsec

The guides of Cozari (2008), Leraut (2012) and Rakosy (2013) were used in identifying insect species (Figure 4), while taxonomy for harvested herbs was noted according to The Plant List (<http://www.theplantlist.org/>), Invasive Species Compendium (<http://www.cabi.org/isc/>) and Plants For A Future (<http://pfaf.org/>) electronic data bases.



Figure 4. Sample of insects collected from Fairy Glade

For both plants and insects, the names of species were arranged alphabetically, rather than phylogenetically, according to Abbate (2005) and Ahmed et al. (2017).

In the compiled checklists, the name of each species is followed by the corresponding family and order name, respectively. In scientific nomenclature, synonyms (syn.) of some taxons were provided.

## RESULTS AND DISCUSSIONS

The biological survey carried out in September 2019 in the Fairy Glade, Upper Borsec has resulted in two checklists of herbs and entomological species, respectively.

### I. Herbs

The following plant species were identified by us in September 2019 in the grassland of Fairy Glade:

1. *Achillea millefolium* L. (common yarrow), Asteraceae;
2. *Agropyron repens* (L.) P. Beauv. syn. *Elymus repens* (L.) Gould. (quackgrass), Poaceae;
3. *Atriplex patula* L. (spreading orach), Chenopodiaceae;
4. *Campanula glomerata* L. (clustered bellflower), Campanulaceae;
5. *C. rapunculoides* L. (creeping bellflower), Campanulaceae;
6. *Carex* sp. (sedges), Cyperaceae;
7. *Carlina acaulis* L. (stemless carline thistle), Asteraceae;
8. *Centaurium erythraea* Rafn. (European centaury), Gentianaceae;
9. *Cirsium arvense* (L.) Scop. (field thistle), Asteraceae;
10. *C. lanceolatum* (L.) Scop. syn. *C. vulgare* (Savi) Ten. (thistle), Asteraceae;
11. *Colchicum autumnale* L. (autumn crocus), Colchicaceae;
12. *Coronilla varia* L. (crown vetch), Fabaceae;
13. *Dactylis glomerata* L. (cocksfoot), Poaceae;
14. *Echium vulgare* L. (common viper's bugloss), Boraginaceae;
15. *Equisetum palustre* L. (marsh horsetail), Equisetaceae;

16. *Galium aparine* L. (goosegrass), Rubiaceae;
17. *G. verum* L. (yellow spring bedstraw), Rubiaceae;
18. *Gentiana asclepiadea* L. (willow gentian), Gentianaceae;
19. *Geranium pratense* L. (meadow crane's bill), Geraniaceae;
20. *G. sanguineum* L. (bloody crane's bill), Geraniaceae;
21. *Inula britannica* L. (meadow fleabane), Asteraceae;
22. *Juncus effusus* L. (common rush), Juncaceae;
23. *Knautia arvensis* (L.) Coult. (field scabious), Dipsacaceae;
24. *Linaria vulgaris* Mill. (common toadflax), Plantaginaceae;
25. *Lotus corniculatus* L. (bird's-foot trefoil), Fabaceae;
26. *Lychnis flos-cuculi* L. (ragged robin), Caryophyllaceae;
27. *Mentha longifolia* (L.) Huds. (horsemint), Lamiaceae;
28. *Myosotis* sp. (forget-me-not), Boraginaceae;
29. *Origanum vulgare* L. (wild marjoram), Lamiaceae;
30. *Ranunculus acer* L. syn. *R. acris* L. (creeping buttercup), Ranunculaceae;
31. *Scabiosa ochroleuca* L. (cream pincushions), Caprifoliaceae;
32. *Scorzonera humilis* L. (viper's grass), Asteraceae;
33. *Stachys sylvatica* L. (hedge woundwort), Lamiaceae;
34. *Stellaria media* (L.) Vill. (common cickweed), Caryophyllaceae;
35. *Taraxacum officinale* (L.) Weber ex F.H. Wigg. (dandelion), Asteraceae;
36. *Tragopogon pratensis* L. (goat's beard), Asteraceae;
37. *Trifolium pratense* L. (red clover), Fabaceae;
38. *T. repens* L. (white clover), Fabaceae;
39. *Verbascum nigrum* L. (dark mullein), Scrophulariaceae;
40. *Viola tricolor* L. (European wild pansy), Violaceae.

Among all 21 plant families identified in the herbaceous vegetation of the Fairy Glade, the

most dominant were Asteraceae with eight species, and Fabaceae with four species, the rest of the families (Boraginaceae, Campanulaceae, Caprifoliaceae, Caryophyllaceae, Chenopidiaceae, Colchicaceae, Cyperaceae, Dipsacaceae, Equisetaceae, Gentianaceae, Geraniaceae, Juncaceae, Lamiaceae, Plantaginaceae, Poaceae, Ranunculaceae, Rubiaceae, Scrophulariaceae, Violaceae) having a smaller number of species.

From the species listed above, *Elymus repens* has been reported before at Borsec by Negrean (2010). *Carex* sp., *Gentiana asclepiadea*, *Ranunculus acer* and *Trifolium repens* were also mentioned in the brochure describing the values of the Natura 2000 site Toplița - Borsec Round Chair (<https://romaqua-group.ro/>).

## II. Arthropods

In September 2019, we identified the following taxa of insects and arachnids in the herbaceous vegetation of Fairy Glade, Upper Borsec:

1. *Anthocoris nemorum* L. (common flowerbug), Hemiptera: Anthocoridae;
2. *Coenonympha glycerion* Borkhausen (chestnut heath) Lepidoptera: Nymphalidae;
3. *Chrysopa perla* L. (green lacewing), Neuroptera: Chrysopidae;
4. *Dociostaurus maroccanus* Thunberg (Maroccan locust), Orthoptera: Acrididae;
5. *Eurydema ornata* L. (ornamental shield bug), Hemiptera: Pentatomidae;
6. *Lycaena phlaeas* L. (small copper), Lepidoptera: Lycaenidae;
7. *Nezara viridula* L. (southern green shield bug), Hemiptera: Pentatomidae;
8. *Pentatoma rufipes* L. (forest bug), Hemiptera: Pentatomidae;
9. *Philodromus* spp. Walckenaer (philodromid crab spiders), Arachnida: Araneae, Philodromidae;
10. *Pyrrhocoris apterus* L. (firebug), Hemiptera: Pyrrhocoridae;
11. *Tipula maxima* Poda (true crane fly), Diptera: Tipulidae.
12. Hymenoptera, Megachilidae.

In the analyzed sample, members of the order Hemiptera *Nezara viridula* and *Pyrrhocoris*

*apterus* were represented by both larval and adult specimens, while for the rest of arthropods only adults were identified.

There have been few recent scientific reports of insects associated with Borsec resort.

Ban-Calefariu and Sarospataki (2007) have made a synthesis based on faunal data from literature regarding bumble-bees spread in different areas of Romania, noting for Borsec the presence of several Hymenoptera species from *Bombus* genus. Krištín et al. (2013) studied Orthoptera along the entire Romanian Carpathian region, including grasslands from Borsec Pass surrounded by spruce forests in Călimani Mountains. Kolcsár and Salmela (2017) collected and registered Dipteran species *Mycomya alpina* Matile and *Phronia forcipula* Winnertz from the pine forest of Giurgeu Mountains.

Based on the premise that Borsec depression allows various forms of tourism including scientific tourism based on observation and study of flora and fauna (Ștefan and Zsolt, 2013), the data presented in this report could represent the starting point for further insight into other taxa belonging to this popular spa destination.

## CONCLUSIONS

In the alpine grasslands from Fairy Glade, one of the most visited destinations due spa facilities within Toplița - Borsec Round Chair Natura 2000 protected area, a total of 21 families of plant species, specimens from six insect orders and one family of arachnids were recorded in a field trip carried out in September 2019.

It cannot be concluded that the survey was exhaustive being limited to one season of observations, however at the present level of knowledge it can be noticed that in the collected biological samples the leading taxa were Asteraceae and Fabaceae for floristic composition and Hemiptera for insect biodiversity, respectively.

It is desirable to consider that both nowadays and especially in the distant future, by reading and understanding the information about the species already noted on the panels placed in this protected area, on their way to baths treatment or just traveling to other

recommended objectives, the visitors of Fairy Glade become aware of the value of natural heritage and contribute to maintaining the ecological integrity of the landscape.

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## REFERENCES

- Abbate, G. (2005). An Annotated Checklist of the Italian Vascular Flora, eds. Conti F., Abbate G. Palombi Publisher, 420 pp.
- Ahmed, J., Rahman, I.U., Shah, A.H., Ijaz, F., Khan, Z., Ali, N., Muhammad, S., Ahmed, Z., Afzal, M. (2017). First Floristic Checklist of Dilbori (OGHI), District Mansehra, KP, Pakistan. J. Appl. Environ. Biol. Sci., 7(3), 41-48.
- Dobrin, I., Săndulescu, E.B., Stavrescu-Bedivan, M.M. (2013). Summer field trip to Sfântu Gheorghe branch at Ilgani de Jos (Tulcea County, Romania): a naturalistic approach. Agrolife Scientific Journal, II (2), 79-82.
- Bálint, G., Sólyom, A., Zsigmond, C. (2018). Studiu sociologic pentru realizarea PUG-ului orașului Borsec (Sociological Study for the Implementation of the General Urban Plan of the City of Borsec). Reconnect Working Papers, 8(16). Available at SSRN: <https://ssrn.com/abstract=3300214>.
- Ban-Calefariu, M.C., Sarospataki, M. (2007). Contributions to the knowledge of *Bombus* and *Psithyrus* genera (Apoidea: Apidae) in Romania. Travaux du Museum National d'Histoire Naturelle «Grigore Antipa», Vol. L, 239-258.
- Cozari, T. (2008). Fluturii. Mică Enciclopedie, Edit. Arc, Chișinău, 160 pp.
- Kolcsár, L.P., Salmela, J. (2017). New taxonomic and faunistic records of fungus gnats (Insecta, Diptera) from Montenegro, Romania, and Serbia. Check List 13(5), 533-559.
- Krištín, A., Jarčuška, B., Kaňuch, P., Iorgu, E.I., Iorgu, I. Ș. (2013). Notes on Orthoptera (Insecta) and their assemblages in the Romanian Carpathians. Travaux du Muséum National d'Histoire Naturelle «Grigore Antipa», Vol. LVI (1), 19-32.
- Leraut, P. (2012). Le guide entomologique. Delachaux et Niestle SA Paris.
- Levei, E.A., Hoaghia, M.A., Senila, M., Miclean, M., Tanaselia, C., Carstea, E.M. (2016). Chemical composition of some Romanian bottled natural mineral waters. Studia UBB Chemia, LXI, 3, Tom II, 391-400.
- Munteanu, C. (2013). Ape minerale terapeutice. Ed. Balneară București, 57 pp., available at <http://bioclima.ro/APE%20TERAP.pdf>.
- Negrean, G. (2010). *Blumeria graminis*, materiale inedite din România (gazde, gazde noi, coronime noi). Satu

- Mare - Studii și Comunicări Seria Științele Naturii, Vol. X-XI, 21-34.
- Rakosy, L. (2013). Fluturii diurni din Romania. Cunoaștere, protecție, conservare. Ed. Mega Cluj, 352 pp.
- Stavrescu-Bedivan, M.M., Săndulescu, E. B., Gutue, M., Ciceoi, R., Dobrin, I. (2018). Updated checklists of plant and insect species of Ilgani de Sus (Tulcea county, Romania). Scientific Papers, Series A, Agronomy, LXI (2), 132-137.
- Ștefan, D., Zsolt, M.S. (2013). The evolution of curative tourism at Borsec. Aerul și Apa. Componente ale Mediului. Babes Bolyai University Faculty of Geography, 185-192.
- Tofan, G.B. (2014). The history of Borsec mineral water bottling. Studia UBB Geographia, LIX, 1, 165-176.
- Tofan, G.B., Niță, A. (2017). The villa, identity component in the tourism infrastructure of Borsec spa resort. Studia UBB Geographia LXII, 2, 113-121.
- \*\*\*[https://cndd.ro/wp-content/uploads/2018/08/AgLoc21\\_Borsec\\_eng.pdf](https://cndd.ro/wp-content/uploads/2018/08/AgLoc21_Borsec_eng.pdf).
- \*\*\*<http://www.borsecinfo.ro/en>.
- \*\*\*<https://www.outdooractive.com/en/poi/transylvania/borsec/40175813/>.
- \*\*\*<http://www.visitborsec.ro/en/Reservation-Borsec/Protected-Areas-Scaunul-Rotund-u25199.html>.
- \*\*\*<http://vilariki.com/en/attractions/traditional-bath-in-the-fairies-glade/>.
- \*\*\*<https://visitharghita.com/en/places/>.
- \*\*\*[https://romaqua-group.ro/wp-content/uploads/2018/08/Brosura\\_elevi.pdf](https://romaqua-group.ro/wp-content/uploads/2018/08/Brosura_elevi.pdf).
- \*\*\*[https://www.primaria-borsec.ro/stb/sdd\\_2018.pdf](https://www.primaria-borsec.ro/stb/sdd_2018.pdf).
- \*\*\* <http://www.theplantlist.org/>.
- \*\*\* <http://www.cabi.org/isc/>.
- \*\*\*<http://www.pfaf.org/>.