

MEDICINAL PLANTS IN RILOMANASTIRSKA GORA RESERVE

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Abstract: The knowledge on the diversity and distribution of medicinal plants in the protected areas has strong relation to the preservation of their genetic resources. This study was conducted to determine the current number of medicinal plant species and their conservation status in the "Rilomanastirska Gora" Reserve. The collected data will contribute to the implementation of adequate protection measures of medicinal plants in the management plan of "Rilomanastirska Gora" Reserve. As a result of our study, a systematic list of medicinal plants, distributed on the territory of "Rilomanastirska Gora" Reserve was prepared for the first time. The systematic list includes 270 species of medicinal plants belonging to 192 genera of 68 families. The current conservation status at national and international level was indicated. The main threats for the medicinal plants are established. Biodiversity conservation measures for the medicinal plants are proposed. This information was a part of the development of the Management plan of "Rilomanastirska Gora" Reserve and was funded by OP Environment 2007-2013.

INTRODUCTION

The "Rilomanastirska Gora" Reserve was designated by Order No. 307/0.04.1986 in order to preserve the primary forest ecosystems of coniferous and beech forests and deposits of rare and endangered species. It covers forest communities and an alpine area North and South of the River Rilska in Rila Mountain. It falls within the protection zone BG000496 "Rila Monastery" under the Habitats Directive.

So far, a study on the medicinal plants in "Rilomanastirska Gora" Reserve has not been performed. Georgiev and Tufekchiev (1989) described the state of the Rila Monastery Forest and indicated some species of conservational significance. They referred to a "compact field" of *Taxus baccata*, along the mountain slope South of "Kirilova Polyana" place and *Atropa belladonna* on the southern slope of Iliyana River. Libert and Englund (1989) described the population of *Rheum rhaponticum* on "Belya Ulei" place, and indicated some population parameters and specific biological features. Vitkova and Evstativa (1999) established 42

species of medicinal plants for the riverside of the Rilska River in the part of the territory of "Rilomanastirska Gora" Reserve. They found that the resources of medicinal plants in the area are not large. The populations of *Rumex alpinus*, *Hypericum perforatum*, *Alchemilla vulgaris* complex, *Rubus idaeus*, *Origanum vulgare* and *Thymus* sp. div. were well represented. Yankov et al. (2004), Terziyska (2012) and Tonkov et al. (2005) described the flora and medicinal plants both on the territory of the Reserve and Rila Monastery Nature Park. Georgieva (2007) described a population of *Gentiana lutea* ssp. *symphyandra* from the ridge of Brichebor, describing some basic population parameters of the species.

Obtaining of systematic and analytical information about medicinal plants in the "Rilomanastirska Gora" Reserve will be base for the proper management of this natural resource, aimed at preserving the genetic diversity and reducing the risk of negative anthropogenic factors on medicinal plants in this territory.

MATERIALS AND METHODS

The study was conducted during the period May-September 2015. First, an initial list of medicinal plants was prepared on the basis of data from the available botanical literature and data from the herbarium collections in Bulgarian herbariums in Sofia University "St. Kliment Ochridski", Faculty of Biology (SO), Institute of Biodiversity and Ecosystem Research at the Bulgarian Academy of Sciences (SOM) and Agricultural University - Plovdiv (SOA). The literature used is both data from basic literature sources about the Bulgarian flora (Assyov and Petrova 2012, Bisserkov (2015), Peev et al. 2015, Flora of the Republic of Bulgaria, Vol 1-11, and data from ecological, floristical and taxonomical surveys in the studied region (Ilieva et al., 1953; Simeonovski, 1965; Georgiev and Tufekchiev, 1989; Vitkova and Evastheva, 1999; Georgieva and Evstatieva, 2000; Peev, 2001; Evstatieva, 2003; Evstatieva et al., 2003; Yankov et al., 2004; Tonkov et al., 2005; Terzijska, 2012; Tosheva et al., 2014). The membership of the taxa in the group of medicinal plants was established after consultation of the Medicinal Plants Act (2017), as well as the types of medicinal plants that are used according to the Forestry Act (2017).

Field work was conducted on 12 transects. They follow existing hiking trails, trails that now are abandoned, rock chutes, transects through forest habitats. Species lists for all transects was prepared on the field.

The plant species were determined following Delipavlov and Chesmedziev (2003). The current conservation status was indicated at national and international level - Biodiversity Act, Order № RD-89/03.02.2017 of MOEW for the special regime of protection and use of medicinal plants, Red Data Book of the Republic of Bulgaria (2015); Bulgarian Red List (2009), IUCN (2017) (2017) and CITES Convention (2017).

RESULTS AND DISCUSSION

There are 270 medicinal plants, belonging to 192 genera and 68 families in "Rilomanastirska Gora" Reserve. These medicinal plants represented 33%

of the higher flora in the Reserve (816 species). The taxonomic groups of the medicinal plants in the Reserve can be presented as follows: with the largest count were Magnoliophyta - 253 species (93%), Pinophyta and Polypodiophyta were represented with 7 species, Lycopodiophyta - 2 species, Equisetophyta and Lichenophyta with 1 species. The largest families were: Asteraceae (25 species), Rosaceae (21 species), Lamiaceae (20 species), Ranunculaceae (17 species) Fabaceae (16 species) and Caryophyllaceae with 10 species. (Fig. 1).

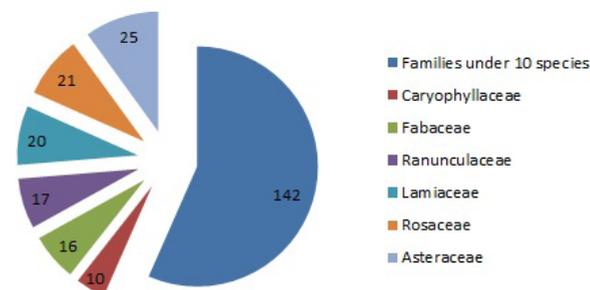


Fig. 1. Distribution of families in Magnoliophyta

The forest ecosystems were represented by medicinal species such as *Picea abies*, *Pinus peuce*, *Pinus sylvestris*, *Fagus sylvatica* and *Quercus* ssp. The beech forests were mainly a habitat of the species under a special regime of usage *Galium odoratum*. Group of 7-8 individuals of the endangered species *Taxus baccata* was established in the spruce forests along the Rilska River. On rocky places, in both forest habitats, the *Geranium macrorrhizum* formed extensive stains.

The most abundant in medicinal plants were the grassy places found above the upper border of the forest, as well as the brightened places in forests and forest meadows. Among the forest meadows, the most common were *Rubus idaeus*, *Hypericum perforatum*, *H. maculatum*, *Fragaria vesca*, *Primula veris*, *Alchemilla vulgaris complex*, *Origanum vilgare*, etc. In old clearing near Iliyana River we established small population of *Atropa belladonna*.

Pinus mugo, *Vaccinium myrtillus*, *V. vitis-idaea* *Bruckenthalia spiculifolia* and more limited *Juniperus sibirica* were distributed in the subalpine zone. Grass species with conservational significance were *Gentiana lutea* and *G. punctata*.

In the high mountainous area, rocky ecosystems were with sparsely vegetation, but often rare species of conservational significance were found there. From the medicinal plants the most important species is *Rheum rhaponticum*, which was represented by small populations in the “Belia Ulej” place and the rocks above the Tiha Rila River. In a rock furrow below Monastery Lakes, a small population of *Rhodiola rosea* was found.

Certain types of medicinal plants have a preference for higher soil and air humidity, which is why they occupy the wet valleys of rivers, streams or rocks. Such are *Polypodium vulgare*, *Dryopteris filix-mas*, *Caltha palustris*, *Angelica pancicii*, *A. sylvestris*, *Heracleum sibiricum*, etc.

There were 32 medicinal plants, belonging to 22 families in "Rilomanastirska Gora" Reserve, included in Appendices 3 and 4 of the BDA and medicinal plants under a special regime of protection and use, according to Order No RD-89 of 03.02.2017 of MOEW (Table 1).

Table 1. Medicinal plants and lichen with conservational significance in "Rilomanastirska Gora" Reserve (BDA -Biological Diversity Act -; № RD 65– Order № RD-89/03.02.2017 of MOEW for the special regime of protection and use of medicinal plants in 2017; RDB - Red Data Book; BRL - Bulgarian Red List; IUCN - IUCN Red List; CITES - Convention on International Trade in Endangered Species of Wild Fauna and Flora; CR - Critically Endangered; EN-Endangered; VU – Vulnerable; DD - Data deficient; LC - Least Concern); II – Appendix II of CITES Convention

Family	Species	BDA	№ RD-89	RDB	BRL	IUCN	CITES
Palmeliaceae	<i>Cetraria islandica</i>		+				
Aspidiaceae	<i>Dryopteris filix-mas</i>	Annex 4					
Aspleniaceae	<i>Asplenium trichomanes</i>		+				
Cupressaceae	<i>Juniperus sabina</i>	Annex 3		EN	EN		
Taxaceae	<i>Taxus baccata</i>	Annex 3		EN	EN		
Amaryllidaceae	<i>Galanthus elwesii</i>	Annex 3		EN	EN	DD	II
Apiaceae	<i>Angelica pancicii</i>		+		VU		
Asteraceae	<i>Ligularia glauca</i>	Annex 3		CR	CR		
Crassulaceae	<i>Rhodiola rosea</i>	Annex 3		CR	CR		
Gentianaceae	<i>Gentiana lutea ssp. symphyandra</i>	Annex 3		EN	EN	LC	
	<i>Gentiana punctata</i>	Annex 3		EN	EN		
Iridaceae	<i>Gladiolus communis</i>	Annex 4					
Lamiaceae	<i>Betonica officinalis</i>		+				
Liliaceae	<i>Lilium martagon</i>	Annex 4					
	<i>Polygonatum odoratum</i>						
Orchidaceae	<i>Dactylorhiza cordigera</i>	Annex 4				LC	II
	<i>Dactylorhiza saccifera</i>	Annex 4				LC	II
	<i>Dactylorhiza sambucina</i>	Annex 4				LC	II
	<i>Gymnadenia conopsea</i>					LC	II
	<i>Orchis pallens</i>	Annex 4	+			LC	II
	<i>Orchis simia</i>	Annex 4	+			LC	II
	<i>Orchis tridentata</i>	Annex 4	+				II
	<i>Orchis ustulata</i>	Annex 4	+		VU		II
Polygonaceae	<i>Rheum rhaponticum</i>	Annex 3		CR	CR		
Primulaceae	<i>Primula veris</i>	Annex 4	+				
Ranunculaceae	<i>Anemone sylvestris</i>	Annex 3			NT		
	<i>Aquilegia nigricans</i>	Annex 3			VU		
Rosaceae	<i>Alchemilla vulgaris complex</i>		+				
Rubiaceae	<i>Galium odoratum</i>		+				
Solanaceae	<i>Atropa bella-donna</i>		+		VU		
Salicaceae	<i>Salix caprea</i>	Annex 4					
Valerianaceae	<i>Valeriana officinalis</i>		+				

The medicinal plants included in Annex 3 of the BDA are protected throughout the country. There are 10 such medicinal plants in the Reserve - *Taxus baccata*, *Juniperus sabina*, *Aquilegia nigricans*, *Anemone sylvestris*, *Rheum rhaponticum*, *Rhodiola rosea*, *Gentiana lutea*, *Gentiana punctata*, *Ligularia glauca* and *Galanthus elwesii*. Annex 4 of the BDA includes species under conservation and regulated use from nature. On the territory of the Reserve, there were 12 such medicinal plants - *Dryopteris filix-mas*, *Salix caprea*, *Primula veris*, *Gladiolus communis*, *Lilium martagon*, , *Dactylorhiza cordigera*, *D. saccifera*, *D. sambucina*, *Orchis pallens*, *O. ustulata*, *O. simia*, *O. tridentata*. Most of the conservation species were from Orchidaceae family, with 7 species of conservation significance, followed by the Gentianaceae family with 2 species. The rest of the families were with one conservational significant species.

According to the Medicinal Plants Act, "Separate species of wild growing medicinal plants are placed under a special conservation regime and usage, when their biodiversity or resources show a sustained downward trend or a risk of such a trend." The special regime is determined annually by an order of the Minister of Environment and Waters. Medicinal species under special regime of protection and use (according to Order No RD-89/03.02.2017) are 13. Of these 8 species are forbidden to be collected from the natural habitats - *Cetraria islandica*, *Asplenium trichomanes*, *Valeriana officinalis*, *Angelica pancicii*, *Orchis pallens*, *O. ustulata*, *O. simia* and *O. tridentata*. For 5 species, annual quotas are set for their collection - *Sedum acre*, *Betonica officinalis*, *Primula veris*, *Alchemilla vulgaris complex* and *Atropa belladonna*.

In the Red Book of Bulgaria, vol. 1. Plants and fungi 8 species from the medicinal plants distributed in the Reserve are included. Critically Endangered (CR) are 3 species - *Rhodiola rosea*, *Ligularia glauca*, *Rheum rhaponticum*. Five species are in category Endangered (EN) - *Taxus baccata*, *Juniperus sabina*, *Gentiana lutea*, *G. punctata*, *Galanthus elwesii*. In the Red List of Higher Plants in Bulgaria (Petrova and Vladimirov, 2009), besides these eight species, there are also four Vulnerable (VU) species - *Aquilegia nigricans*, *Atropa bella-donna*, *Angelica pancicii* and *Orchis ustulata* and one Near Threatened (NT) - *Anemone sylvestris*.

The endemic element among the medicinal plants in "Rilomanastirska Gora" Reserve is represented by one Bulgarian endemic (*Rheum rhaponticum*) and one Balkan endemic (*Angelica pancicii*) species (Petrova, 2006; Petrova and Vladimirov, 2010).

From the list, 9 species are included in the European nature conservation documents. The IUCN Red List (2017) includes as Least Concern (LC) 7 species - *Gentiana lutea*, *Dactylorhiza cordigera*, *D. saccifera*, *D. sambucina*, *Gymnadenia conopsea*, *Orchis pallens*, *O. simia* and one species - *Galanthus elwesii* in the Data Deficient (DD) category.

The CITES Convention (2017) includes 9 of the medicinal plants found in the Reserve. These are *Gymnadenia conopsea*, *Galanthus elwesii*, *Dactylorhiza cordigera*, *D. saccifera*, *D. sambucina*, *Orchis pallens*, *O. simia*, *O. tridentata*, *O. ustulata*.

The main natural threats to the medicinal plants in the “Rilomanastirska Gora” Reserve are landslides and collapsing rocks, most often as a result of avalanches, which are a real threat to species of rocky habitats - *Rheum rhaponticum*, *Rhodiola rosea*, *Sedum acre*, etc. as well as storms, leading to the eradication of trees, which has been observed in many forest communities.

The status of the reserve territory does not imply usage of medicinal plants resources. The study shows that harvesting of berries, herbs and mushrooms occurs in the adjacent areas, but is probably also practiced on the territory of the Reserve, which requires constant control by the park guard. The main anthropogenic threat to medicinal plants is the collection and destruction of species with conservational significance, which occurs even though forbidden. Illegal gathering of *Gentiana lutea* ssp. *symphyandra* and *Rhodiola rosea* was established in the area of “Rilomanastirska Gora” Reserve. Forest fires, caused by human activity, are a major threat, burning large areas of forest and grass vegetation. For species growing on rocky habitats a real threat is the unregulated alpinism and rock climbing. This applies mainly to *Rheum rhaponticum*, *Rhodiola rosea* and *Sedum acre*. For *Cetraria islandica* a potential threat is air pollution, as the species does not tolerate it.

The use of medicinal plants is an ancient tradition in Bulgaria. Collecting roots and rhizomes for treatment, however, leads to the destruction of the entire plant. In spite of nature conservation status, rhizomes of *Gentiana lutea* ssp. *symphyandra*, *Rheum rhaponticum* and *Rhodiola rosea* are illegally collected. The environmental conditions sometimes are also a threatening factor for the existence of the species. Thus, after the fall of the large avalanche in the “Belija ulej” years ago, the population of *Rheum rhaponticum* fell sharply, from more than 100 specimens to only 4 survivors. Other medicinal plants, such as *Taxus baccata* are used also for timber and as ornamental plants (*Galanthus elwesii*), and therefore are subject of attack, which leads to their destruction.

In connection with these arguments, we suggest that the following nature protection measures could be taken:

1. A more detailed study of the populations with exact determination of the size, number and density of *Gentiana lutea* ssp. *symphyandra*, *Rheum rhaponticum*, *Rhodiola rosea*, *Taxus baccata* and *Galanthus elwesii* must be undertaken. Their ecological and biological features with special attention to the propagation biology must be established. Determination of the female *Taxus baccata* individuals for further reintroduction activity is also of crucial importance.

2. A reserve gene pool from *Gentiana lutea* ssp. *symphyandra*, *Rheum rhaponticum*, *Rhodiola rosea*, *Taxus baccata* and *Galanthus elwesii* must be created. The growing of the young plants must be in suitable environmental conditions, close to the Reserve and under the supervision of the Reserve Management. This gene pool, if necessary, can be used to reintroduce disappeared or disappearing populations of the species.

CONCLUSIONS

“Rilomanastirska Gora” Reserve is an area that stores a rich gene pool of medicinal plants. The protected plants in the Reserve are in good condition and there is no direct danger of destroying their populations. The protection regime in the Reserve allows preservation of the populations of medicinal plants in their natural appearance. Real threats are forest fires, avalanche danger and illegal gathering of conservationally significant medicinal plants.

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