

## *Inventory of Pteridophytes on the Territory of "Bulgarka" Nature Park*

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**Abstract.** This study reports data on the diversity of Pteridophyte of the "Bulgarka" Nature Park. Twenty-nine species belonging to the divisions Lycopodiophyta, Equisetophyta and Polypodiophyta were identified, including six new species to the park: *Asplenium onopteris*, *Dryopteris dilatata*, *Equisetum palustre*, *Huperzia selago*, *Ophioglossum vulgatum* and *Polystichum lonchitis*. Among the identified species the ferns were prevailing. Fifteen species were medicinal plants and eight species have conservation significance. The status of the populations and major threats to the habitats were discussed.

**Key words:** "Bulgarka" Nature Park, plant diversity, Lycopodiophyta, Equisetophyta, Polypodiophyta.

### **Introduction**

"Bulgarka" Nature Park is included in the system of protected areas in Bulgaria in 2002 to protect, restore and maintain the beech ecosystems and landscapes, typical for the Balkan Mountains. Within the park, located on the northern slopes of the central Balkan range above Gabrovo and Tryavna are included watershed of the upper stream of the Yantra river and the ridge of Shipka and Tryavna Mountain. The highest parts of the Natural Park are "Karadjova tower" peak - 1511 m and "Bedek" peak - 1488 m. The average altitude is 940 meters, at 1200 meters elevation difference. The total area of the research entity is 21,772.163 hectares.

One of the earliest and significant study with specific data from the slopes of "Shipchenska" Balkan Range have been conducted by NEICHEV (1909). The author published a list of more than 1280 species of

vascular plants, including 3 horsetail species, 21 fern species and 2 club-mosses species. Data were related to the treeless and deciduous forest belt of Central Balkan Range, between peak "Golyam Kademlya" (the "Triglav Massif") and peak "Bedek" (on the border between Shipchenski and Trevnenski part the Central Balkan Range). As a result, more than 100 new species for the Bulgarian flora have been reported. Each species from the published list is shown with its exact location, its abundance (rarely or very), and general characteristics of the community in which it is found. Studies on Pteridophyte in this region have been performed from KOZHUHAROV (1968). Systematic data on this plant group were collected and summarized in Flora of PR Bulgaria (JORDANOV, 1963), Flora of Bulgaria (STOYANOV *et al.*, 1966), Key to plants in Bulgaria (DELIPAVLOV & CHESHMEDZHIEV,

2003), as well as in *Conspectus of the Bulgarian Vascular Flora* (ASSYOV & PETROVA, 2006).

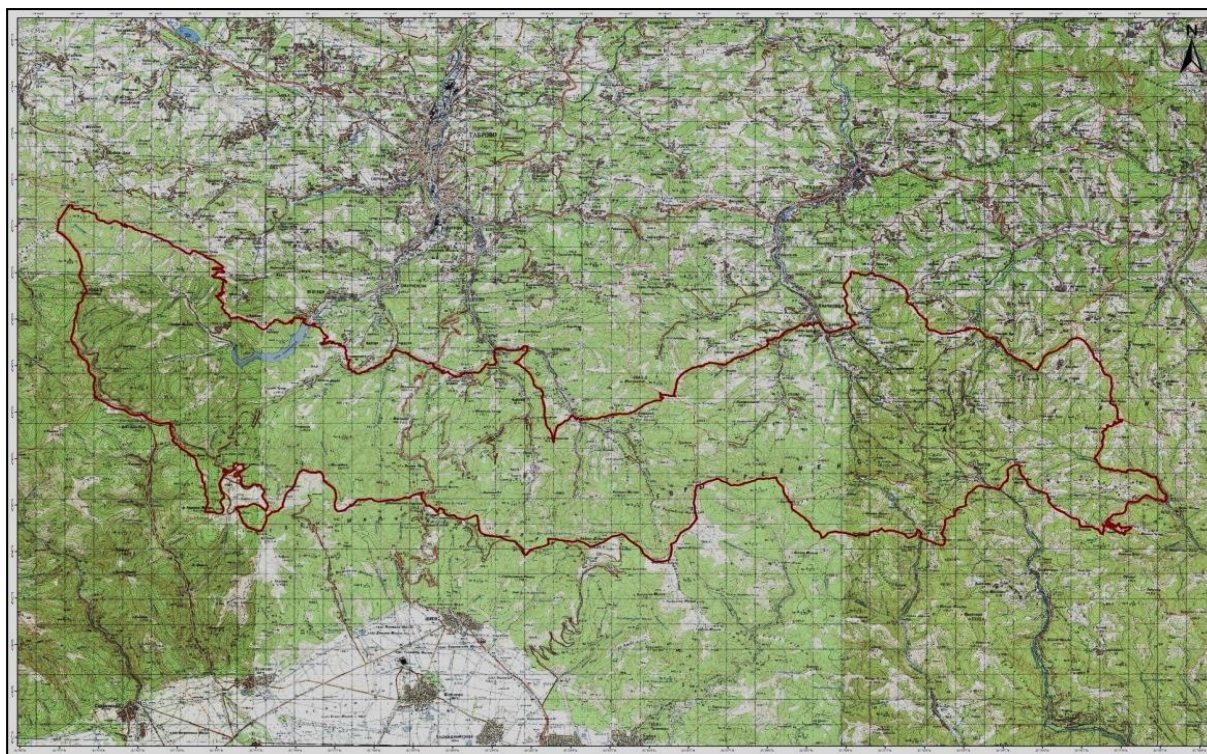
#### Materials and Methods

Inventory of the Pteridophyte was carried out from May to October 2012 and during the spring of 2013 (Fig. 1). A routing method with transect transitions was used. Transects were selected according to the specificities of different floristic groups, peculiarities of the terrain and altitude, aiming to cover maximum area and all typical and representative of the floristic diversity areas from the territory of "Bulgarka" Nature Park. A handheld GPS receiver GARMIN 530 was used for inspection of the localities.

The collected materials were herbarized and identified at the Department of Botany of Plovdiv University "Paisii Hilendarski" using a stereo magnifying glass and identification keys (TUTIN *et al.*, 1993; JORDANOV, 1963; DELIPAVLOV & CHESHMEDZHIEV, 2003). Vaucher specimen (No 059735) from *Huperzia selago* was deposited in the Herbarium of the Agricultural University of Plovdiv (SOA).

#### Results and Discussion

Twenty-nine species Pteridophyte relating to divisions Lycopodiophyta, Equisetophyta and Polypodiophyta were established during the terrain inventory of the "Bulgarka" Nature Park. The full list of the plant species is presented in Table 1.



**Fig. 1.** Topographic map of the study area.

**Table 1.** Taxonomic diversity of the Pteridophyte on the territory of "Bulgarka" Nature Park

DIVISION LYCOPODIOPHYTA		
Family	Genus	Species
Huperziaceae	<i>Huperzia</i> Bernh.	<i>Huperzia selago</i> (L.) Bernh. ex Schrank & C.F.P. Mart.
Selaginellaceae	<i>Selaginella</i> Beauv.	<i>Selaginella helvetica</i> (L.) Spring.

DIVISION EQUISETOPHYTA		
Family	Genus	Species
Equisetaceae	<i>Equisetum</i> L.	<i>Equisetum arvense</i> L.
		<i>Equisetum palustre</i> L.
		<i>Equisetum ramosissimum</i> Desf.
		<i>Equisetum sylvaticum</i> L.
		<i>Equisetum telmateia</i> Ehrh.
DIVISION POLYPODIOPHYTA		
Family	Genus	Species
Anthyriaceae	<i>Anthyrium</i> Roth	<i>Anthyrium filix-femina</i> (L.) Roth
	<i>Cystopteris</i> Bernh.	<i>Cystopteris fragilis</i> (L.) Bernh.
Aspidiaceae	<i>Dryopteris</i> Adanson	<i>Dryopteris carthusiana</i> (Villar) H.P. Fuchs
		<i>Dryopteris dilatata</i> (Hoffm.) A. Gray
		<i>Dryopteris filix-mas</i> (L.) Schott
	<i>Gymnocarpium</i> Newman	<i>Gymnocarpium dryopteris</i> (L.) Newman
	<i>Polystichum</i> Roth	<i>Polystichum aculeatum</i> (L.) Roth
		<i>Polystichum lonchitis</i> (L.) Roth
<i>Polystichum setiferum</i> (Forskål) Woynar		
Aspleniaceae	<i>Asplenium</i> L.	<i>Asplenium adiantum-nigrum</i> L.
		<i>Asplenium onopteris</i> L.
		<i>Asplenium ruta-muraria</i> L.
		<i>Asplenium septentrionale</i> (L.) Hoffm.
		<i>Asplenium trichomanes</i> L.
		<i>Asplenium viride</i> Hudson
		<i>Phyllitis scolopendrium</i> (L.) Newman
		<i>Ceterach</i> DC.
<i>Phyllitis</i> Hill	<i>Phyllitis scolopendrium</i> (L.) Newman	
Hypolepidaceae	<i>Pteridium</i> Gled. ex Scop.	<i>Pteridium aquilinum</i> (L.) Kuhn
Ophioglossaceae	<i>Botrychium</i> Swartz	<i>Botrychium lunaria</i> (L.) Swartz
	<i>Ophioglossum</i> L.	<i>Ophioglossum vulgatum</i> L.
Polypodiaceae	<i>Polypodium</i> L.	<i>Polypodium vulgare</i> L.
Thelypteridaceae	<i>Phegopteris</i> (C. Presl) Fée	<i>Phegopteris connectilis</i> (Michx) Watt



Fig. 2. Photo of *Huperzia selago*, „Bulgarka“ Nature Park.

Distribution of the species by groups was as follows: 2 species from 2 families belonged to division Lycopodiophyta, 5 species from 1 family - to division Equisetophyta and 22 species from 7 families - to division Polypodiophyta.

Amid all floristic richness in these groups in Bulgaria, 50% of the club-mosses (Lycopodiophyta) families, 47% of the ferns (Polypodiophyta) families and 100% of horsetails (Equisetophyta) families were represented in the Park.

Six new species for the territory of "Bulgarka" Nature Park were established: *Huperzia selago* (Fig. 2), *Equisetum palustre*, *Dryopteris dilatata*, *Polystichum lonchitis*, *Asplenium onopteris* and *Ophioglossum vulgatum*. The conservation significant species *Cystopteris regia* (= *C. alpina*), referred by NEICHEV (1909), was not confirmed, although targeted search.

Well represented throughout the park were the populations of the following species: male fern (*Dryopteris filix-mas*), hard shield fern (*Polystichum aculeatum*), soft shield fern (*Polystichum setiferum*), female fern (*Athyrium filix-femina*), fragile fern (*Cystopteris fragilis*), hart's-tongue fern (*Phyllitis scolopendrium*), maidenhair spleenwort (*Asplenium trichomanes*), black spleenwort (*Asplenium adiantum-nigrum*), wall rue (*Asplenium ruta-muraria*), common polypody (*Polypodium vulgare*), bracken or eagle fern (*Pteridium aquilinum*) and field horsetail (*Equisetum arvense*).

Relatively rare, but with stable populations were the species: spinulose woodfern (*Dryopteris carthusiana*), broad bruckler fern (*Dryopteris dilatata*), green spleenwort (*Asplenium viride*), northern spleenwort (*Asplenium septentrionale*), branched horsetail (*Equisetum ramosissimum*), great horsetail (*Equisetum telmateia*) and marsh horsetail (*Equisetum palustre*).

With single localities, but in good density were the species: Swiss clubmoss (*Selaginella helvetica*), common moonwort (*Botrychium lunaria*) and adders-tongue fern (*Ophioglossum vulgatum*).

In critical condition with single habitats and single individuals were: northern

firmoss (*Huperzia selago*) and wood horsetail (*Equisetum sylvaticum*).

Identified threats regarding the investigated group plants were mainly loss of the habitats. Real danger of direct and indirect destruction of grasslands in the last few years represent a growing interest in placing wind generators and photovoltaics. There is a wind park within the Nature Park near "Bouzloudja peak", "Atovo padalo" peak, "Karadjova tower" peak, "Bedek" peak, as well as investment interest to build wind turbines near the ridge parts of the massif ("Ispolin" peak, "Tuzlata" peak and "Ostrusha" peak), in close proximity to the park. The construction of ski slope of "Ispolin" peak, situated to the northwest of "Uzana" locality, will damage in a large extent the species and their habitats in the area through the used facilities and related infrastructure.

Rocky habitats were directly threatened by liquidation of the entire area or part of it by building new roads and illegal opening of quarries for aggregates. Threat to forest habitats was carrying out forest-economic events with high intensity. For the wet habitats, the main threat was the change in the hydrological regime.

The threat of habitat loss due to development of the invasive species as Japanese knotweed (*Reynoutria japonica*) and himalayan balsam (*Impatiens grandulifera*) was real for riparian and hydrophilic habitats. Northern firmoss (*Huperzia selago*) felt a negative impact from scots pine (*Pinus sylvestris*), by taking away habitats.

Among the identified species, two plant species (*Equisetum palustre* and *Equisetum ramosissimum*) are included in the IUCN Red List of Threatened Species (IUCN, 2015), category LC - Least Concern. In this category, widespread and abundant taxa are included. According to Bulgarian legislation, the [Biological Diversity Act \(2002\)](#) includes 6 species, while the [Medicinal Plants Act \(2000\)](#) - 15 species (Table 2).

## Conclusions

As a result of the field research within the "Bulgarka" Nature Park, twenty-nine species of pteridophytes were recorded,

including six new species to the park: *Asplenium onopteris*, *Dryopteris dilatata*, *Equisetum palustre*, *Huperzia selago*, *Ophioglossum vulgatum* and *Polystichum lonchitis*. Largest group was the fern plants. More than half of the identified species were medicinal plants and eight species were of

conservation significance. The main threats to the study group Pteridophyta were related to habitat loss, the cause of which are the anthropogenic impact and the dissemination of woody and invasive plant species.

**Table 2.** Conservation significant species and medicinal Pteridophyte species on the territory of “Bulgarka” Nature Park.

Taxon	IUCN	BDA	MPA
<i>Anthyrium filix-femina</i>	-	-	-
<i>Asplenium adiantum-nigrum</i>	-	-	+
<i>Asplenium onopteris</i>	-	-	-
<i>Asplenium ruta-muraria</i>	-	-	+
<i>Asplenium septentrionale</i>	-	-	+
<i>Asplenium trichomanes</i>	-	-	+
<i>Asplenium viride</i>	-	-	-
<i>Botrychium lunaria</i>	-	-	-
<i>Ceterach officinarum</i>	-	-	+
<i>Cystopteris fragilis</i>	-	-	-
<i>Dryopteris carthusiana</i>	-	+	-
<i>Dryopteris dilatata</i>	-	+	-
<i>Dryopteris filix-mas</i>	-	+	+
<i>Equisetum arvense</i>	-	-	+
<i>Equisetum palustre</i>	LC	-	+
<i>Equisetum ramosissimum</i>	LC	-	-
<i>Equisetum sylvaticum</i>	-	-	+
<i>Equisetum telmateia</i>	-	-	+
<i>Gymnocarpium dryopteris</i>	-	-	-
<i>Huperzia selago</i>	-	-	-
<i>Ophioglossum vulgatum</i>	-	-	+
<i>Phegopteris connectilis</i>	-	-	-
<i>Phyllitis scolopendrium</i>	-	-	+
<i>Polypodium vulgare</i>	-	-	+
<i>Polystichum aculeatum</i>	-	+	-
<i>Polystichum lonchitis</i>	-	+	+
<i>Polystichum setiferum</i>	-	+	-
<i>Pteridium aquilinum</i>	-	-	+
<i>Selaginella helvetica</i>	-	-	-

Legend: IUCN (IUCN Red List of Threatened Plants, version 2015.2) – LC (Least Concern); BDA – Biological Diversity Act; MPA – Medicinal Plants Act.

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