

A Floristic Study of Carpathian Natural Protected Area in Ukraine

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Abstract - We performed the floristic study of Carpathian mountains in Ukraine from April 2008 till October 2009. We designated eight important areas to investigate in Ukraine Carpathians including Svydovets, Chornohora, Kuziy-Trybushany, Maramorosh, Uholka-Shyrokyi Luh, Narcissi Valley, Chorna Hora, and Yulivska Hora. The total numbers of vascular plants in investigated area were 1,349 species from 502 genera and 112 families. The endemic species to Carpathians numbered to 65 from 49 genera belonging to 24 families, and it was corresponded to 4.8% of the 1,349 vascular species. We prepared the list of vascular plants with compiling database on useful plants. Ukraine Carpathians endemic species could be applied as high value products in research and practice. Moreover, the flora of Carpathian mountains which is distributed in five nations in eastern Europe and famous for Primeval Beech Forests (*Fagus sylvatica*), is useful to compare the floristic study with Korean flora.

Key words - Flora, Carpathian, Vascular plants, Useful plants

Introduction

The Carpathian mountains are distributed from middle to east Europe with 1,300 km length and 130,000 km² areas. The Carpathians reach to the eastern Rumania through the western Ukraine from the border of Poland and eastern Slovakia. Curving, hugely to eastward, where Hungarian basin is located. The temperature of the Carpathians is colder than that of the Alps owing to the northbound location. The size is similar to the Alps, but the height is significantly lower. Carpathian mountains are divided into lots of mountain mass showing hills piled on hummocks. There are many rising penneplains with top-flattened peaks and small hills with basins. Primeval Beech Forests of the Carpathians, lying on Slovakia and Ukraine, is declared a world natural heritage by UNESCO. The main forests is stretched about 185km long and the area is nearly 30,000ha (UNESCO, 2007; Huziy, 1988).

The study of Carpathians have been mainly performed on fauna and animal ecology in the Beech (*Fagus sylvatica*) Forests (Abelentsev and Popov, 1956; Baidashnikov, 1998; Naukova, 2000; Huziy, 1988; Hodovanets, 2000). Several studies on flora and vegetation have been carried out in partial area

focusing mainly on ecological characteristics and growth of *Fagus sylvatica* (Piovesa et al., 2005; Volossccuk, 2003).

The Carpathians is located at nearly same latitude as of Korea, and we can get a valuable and original information on natural resources including endemic species occurring in the protected area. This would also help comparing the flora and economical values of the plants.

This study aims to give an outline of the Carpathian mountains flora in Ukraine, to provide the information of economic plants and to discuss the possibility of application as the natural resources.

Materials and Method

We performed investigation surveys of the flora six times from April in 2008 till October in 2009. We designated eight important areas to investigate in Ukraine Carpathians to improve the efficiency on plant diversity as follows : Svydovets, Chornohora, Kuziy-Trybushany, Maramorosh, Uholka-Shyrokyi Luh, Narcissi Valley, Chorna Hora, and Yulivska Hora (Table 1, Fig. 1).

Collected specimens were prepared and deposited in the herbaria of Ukraine National arboretum (UNBG), Korea National Arboretum (KH) and Kyungwon University (KWU).

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Specimen identification and determination were executed with the help of Ukraine plant experts. Identification and classification were performed following Naukova (1965), Mosyakin and Fedoronchuk (1999), Diduch (2004). The plant list was prepared following Engler's classification (Melchior, 1964) arranging systematically, and recorded by alphabetical orders below. The plant list is available from the corresponding author (kimjh2009@kyungwon.ac.kr) and website of Plant Resources Society of Korea (<http://www.prsk.com>).

Table 1. The eight main important investigation areas in Ukraine Carpathians

No.	Site	representative GPS point	
		N	E
1	Sydvovets Carpathian Region	48° 11'21"	24° 13'37"
2	Chornohora Carpathian Region	48° 07'36"	24° 29'15"
3	Kuziy-Trybushany Carpathian Region	47° 56'21"	24° 08'26"
4	Maramorosh Carpathian Region	47° 56'12"	24° 19'35"
5	Uholka-Shyrokyi Luh Carpathian Region	48° 16'25"	23° 42'10"
6	Narcissi Valley Carpathian Region	48° 11'00"	23° 22'05"
7	Chorna Hora Carpathian Region	48° 09'35"	23° 05'30"
8	Yulivska Hora Carpathian Region	48° 01'40"	23° 06'30"

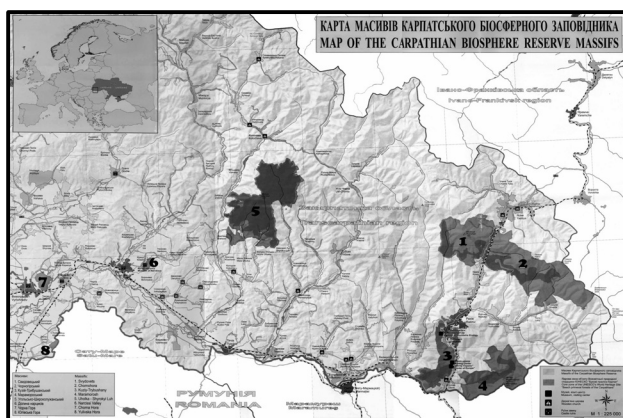


Fig. 1. Map showing the study area in Carpathian (1: Sydvovets, 2: Chornohora, 3: Kuziy-Trybushany, 4: Maramorosh, 5: Uholka-Shyrokyi Luh, 6: Narcissi Valley, 7: Chorna Hora, 8: Yulivska Hora).

Result and Discussion

Main species composition

The vegetation of Carpathians in Ukraine is composed of five representative types as (1) *Fagus sylvatica* forest (500-1,200 m), (2) *Fagus sylvatica* - *Abies holophylla* forest (1,100-1,200 m), (3) rocky area, (4) sub-alpine area, and (5) alpine area. The annual average temperature at 500 m where *Fagus sylvatica* grows typically is about 9.5°C and that of 1,000m is about 5°C. Primeval Beech Forests of the Carpathians is representative and typical temperate forests of *Fagus sylvatica* which has never disturbed by human being. The site was designated as world natural heritage by UNESCO in 1998 (Fig. 1). *Fagus sylvatica* is distributed in the range of 210-1,700 m, and maximum wood age is 300-350 with 1.3-1.8 m in DBH. Especially Primeval Beech Forests of the Carpathians shows the recovery and development process in earth ecology after Ice Age (UNESCO, 2007).

The number of vascular plants in the investigated area was 1,349 belonging to 502 genera and 112 families (Table 2). *Asplenium trichomanes*, *Polypodium vulgare*, *Sedum maximum*, *Sedum telepium*, and *Allium montanum* were mainly observed in the herbaceous region of rocky area.

Abies alba and *Larix decidua* were observed on tree region in alpine area; *Vaccinium vitis* were observed on shrub region in alpine area; *Achyroperus uniflorus*, *Luzula sylvatica*, *Pulsatilla alba*, *Anemonoides nemorosa*, *Gentiana asclepiadea*, *Crocus banaticus*, *Geum urbarnum*, *Gentiana punctata* were observed on herbaceous region in alpine area.

Fagus sylvatica, *Acer negundo*, *Cornus sanguinea*, etc. were observed in tree region of the valley. *Rosa pendulina*, *Spiraea ulmifolia* were observed in shrub region of valley; *Senecio carpathicus*, *Aconitum moldavicum*, *Impatiens noli-tangere*, *Aruncus vulgaris*, *Chamerion angustifolium*, *Sambucus racemosa* etc. were observed in herbaceous region of the valley.

Along the slopes in the ridges, *Fagus sylvatica*, *Quercus robur*, *Fraxinus ornus* were observed; *Dentaria bulbifera* and *Veronica austriaca* were observed in shrub region of slopes in ridge; *Hypopitys monotropa*, *Orobancha caryophyllacea*, *Geranium sanguineum*, *Melampyrum nemorosum*, *Daphne mezereum*, *Streptopus amplexifolius*, *Achillea mille-*

Table 2. The numbers of plants distributed in the investigated area

	Fam.	Gen.	Sp.	Sites							
				1	2	3	4	5	6	7	8
Lycophyta	3	4	6	5	5	3	3	4	0	1	1
Pteridophyta	10	18	43	25	29	29	26	33	5	8	11
Gymnospermae	3	6	10	5	5	8	5	6	0	0	0
Angiospermae	96	474	1290	415	558	576	459	659	499	379	421
Dicotyledons	81	377	1017	329	435	463	362	540	373	317	357
Monocotyledons	15	97	273	86	123	113	97	155	126	62	64
Total	112	502	1349	450	597	616	493	738	504	388	433

1: Svydovets, 2: Chomohora, 3: Kuziy-Trybushany, 4: Maramorosh, 5: Uholka-Shyrokyi Luh, 6: Narcissi Valley, 7: Choma Hora, 8: Yulivska Hora

Table 3. The list of the Endemic plants in the investigated area

Family Name	Scientific Name
Apiaceae	<i>Heracleum carpaticum</i>
Asteraceae	<i>Achillea schurii</i> , <i>Antennaria carpatica</i> , <i>Centaurea carpatica</i> , <i>Centaurea marmarosiensis</i> , <i>Doronicum carpaticum</i> , <i>Hieracium caesiogenum</i> , <i>Leontodon gutzlorum</i> , <i>L. pseudotaraxaci</i> , <i>L. repens</i> , <i>Leucanthemum subalpinum</i> , <i>L. waldsteinii</i> , <i>Petasites kablikianus</i> , <i>Saussurea porcii</i> , <i>Senecio carpathicus</i> , <i>Tragopogon transcarpaticus</i>
Boraginaceae	<i>Pulmonaria filarszkyana</i> , <i>Pulmonaria rubra</i> , <i>Symphytum cordatum</i>
Brassicaceae	<i>Cardaminopsis neglecta</i>
Campanulaceae	<i>Campanula carpatica</i> , <i>C. tatrae</i> , <i>Phyteuma tetramerum</i> , <i>Phyteuma vagneri</i>
Caryophyllaceae	<i>Dianthus carpaticus</i> , <i>Minuartia zarezchnyi</i> , <i>Oberna carpatica</i> , <i>Silene dubia</i>
Crassulaceae	<i>Jovibarba preissiana</i> , <i>Sedum carpaticum</i>
Dipsacaceae	<i>Scabiosa lucida</i>
Euphorbiaceae	<i>Euphorbia carpatica</i>
Fabaceae	<i>Astragalus krajinae</i> , <i>Genista oligosperma</i> , <i>Oxytropis carpathica</i>
Gentianaceae	<i>Gentiana laciniata</i> , <i>Swertia alpestris</i>
Geraniaceae	<i>Geranium alpestre</i>
Grossulariaceae	<i>Ribes carpaticum</i>
Lamiaceae	<i>Acinos alpinus</i> , <i>Melittis carpatica</i> , <i>Thymus alpestris</i> , <i>Thymus alternans</i> , <i>Thymus pulcherrimus</i>
Poaceae	<i>Festuca carpatica</i> , <i>F. porcii</i> , <i>Poa deyllii</i> , <i>Trisetum ciliare</i>
Polygonaceae	<i>Rumex rugosus</i>
Primulaceae	<i>Primula poloninensis</i>
Ranunculaceae	<i>Aconitum bucovinense</i> , <i>A. hosteanum</i> , <i>A. jacquinii</i> , <i>A. nanum</i> , <i>A. romanicum</i> , <i>Ranunculus carpaticus</i> , <i>Ranunculus kladnii</i>
Rosaceae	<i>Alchemilla turkulensis</i>
Rubiaceae	<i>Galium bellatulum</i>
Salicaceae	<i>Salix retusa</i>
Saxifragaceae	<i>Chrysosplenium alpinum</i>
Scrophullariaceae	<i>Melampyrum herbichii</i> , <i>M. saxosum</i> , <i>Tozzia carpatica</i>
Violaceae	<i>Viola declinata</i>

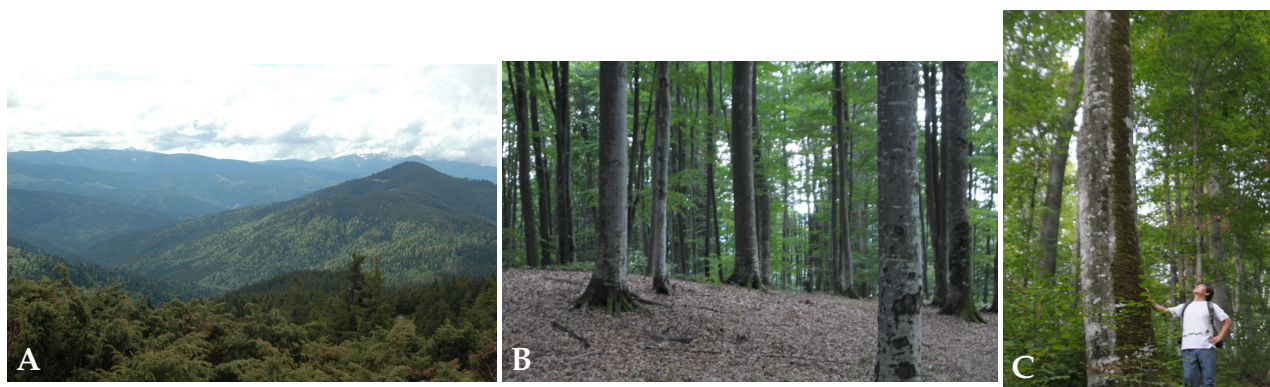


Fig. 2. The Primeval Beech Forests of the Carpathians.

A. a panoramic view from the Mt. Kuziy-Trybushany. B, C. *Fagus sylvatica* forest

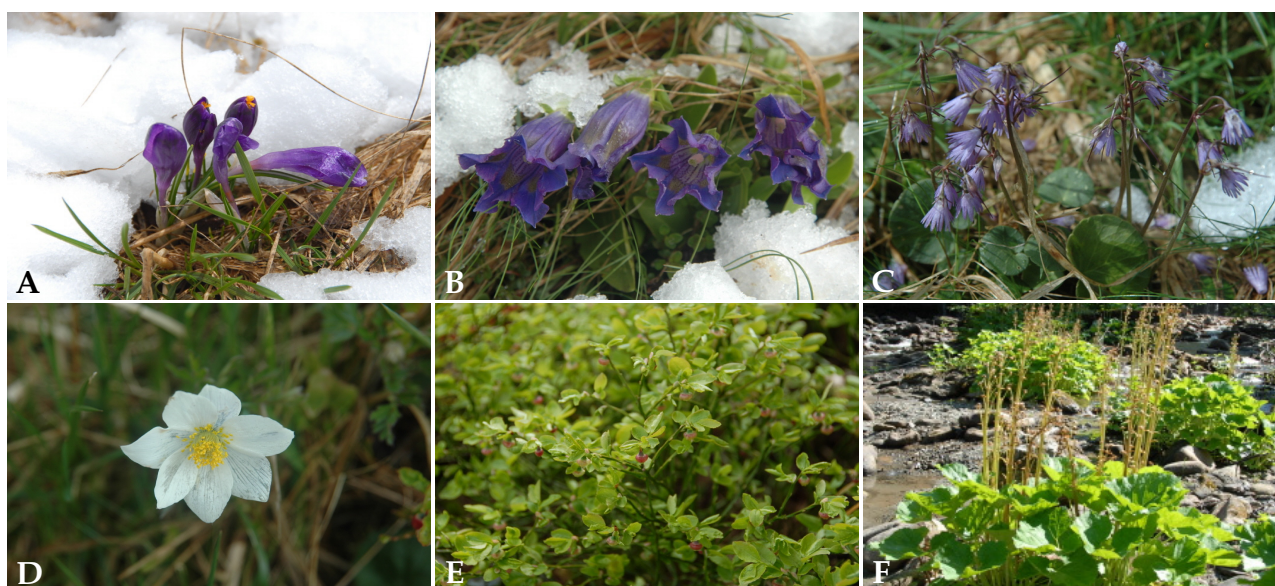


Fig. 3. Several remarkable economic plants from Ukraine Carpathians.

A. *Crocus banaticus* B. *Gentiana acaulis* C. *Soldanella montana* D. *Pulsatilla alba* E. *Vaccinium vitis* F. *Petasites kablikianus*

folium, *Vincetoxicum hirsutinaria* etc. were observed in herbaceous region of slopes in ridge.

Endemic species to Ukrainian Carpathians

The number of endemic species to Carpathians in Ukraine was 65 from 49 genera belonging to 24 families. The rate of endemic plants was 4.8% among a total of 1,349 species in investigated area (Table 3). The percentage of endemic plants in this area was slightly lower because of the stability in vegetation and continuous human disturbance by war and land use.

The major families holding more numbers of endemic species were Asteraceae (15 species), Ranunculaceae (7 sp.),

Boraginaceae (3 sp.), Campanulaceae (4 sp.), Caryophyllaceae (4 sp.), Fabaceae (3 sp.), Lamiaceae (5 sp.), Poaceae (4 sp.) and Scrophulariaceae (3 sp.).

Remarkable plants on economic value

Approximately 5,000 species are distributed in Ukraine. It is reported that ca. 2,000 species have potentially high economic values as medicinals and ornamentals. For ornamental resources, *Rhododendron*, *Syringa*, *Magnolia* and etc. are promising candidates even they have been widely used. For medicinal resources, ca. 1,100 species are known, and 250 species are used for commercial purpose already.

We suggest that most of endemic and useful plants have

high values as ornamentals, bio-energy resources, medicinals and foods, and they could be applied as economic resources easily (Fig. 3).

(1) *Crocus banaticus*

This species is Ukraine endemic plant which gives spring news firstly. It is designated as an endangered plant in Red databook. It belongs to Iridaceae having high values in ornamental use. This plant grows up to 10-20 cm in wet area of the mountain slope.

(2) *Gentiana acaulis*

This species is endemic to Ukraine and belongs to Gentianaceae with high values in ornamental use. This plant grows up to 15-25 cm in dry area of the high mountains.

(3) *Soldanella montana*

This species is endemic to Ukraine and belongs to Primulaceae with high values in ornamental use. This plant grows up to 15-20 cm in dry area of the high mountains slope.

(4) *Pulsatilla alba*

This species is endemic to Ukraine and is designated as rare plant in Ukrainian red databook. It is included in Ranunculaceae with high values in ornamental use. This plant grows up to 15-20 cm in dry area of the high mountains slope.

(5) *Vaccinium vitis*

This species is endemic to Carpathian included in Ericaceae with high values in ornamental and medicinal use. This shrub grows up to 30-50 cm in dry area of the high mountains slope.

(6) *Petasites kablikianus*

This species is endemic to Carpathian included in Asteraceae with high values in ornamental and medicinal use. This plant grows approximately 50-100 cm in the valley and low land area in mountains.

Ukrainian culture has long history for using plants, and lots of plants resources are very attractive for us to use in economic fields. And, we are sure that useful plants from Ukra-

ine Carpathians endemic species will be applied as high value products in research and practice. Also, the flora of Carpathian mountains is very useful to perform the comparative floristic study with Korean flora.

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