Mountain species in the flora of the Sopotnia Wielka creek (Western Beskids, Poland)

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Abstract: The paper presents an analysis of mountain species occurrence in the Sopotnia Wielka creek, in the Beskid Żywiecki Mts (Western Carpathians, Poland). The list contains 55 plant species, which represent the whole altitudinal spectrum from piedmont to alpine zones (*Viola biflora*, *Mutellina purpurea*). The species inhabit mostly moist and wet communities along creek. They represent mainly the Alpic-Central-European distributional type. Three species are endemics for the Carpathians: *Aconitum firmum* subsp. *firmum*, *Crocus scepusiensis*, *Dentaria glandulosa*.

Key words: species distribution, geographical elements, endemics, mountains, Carpathians

Introduction

Analysis of regional floras underlies plant geography and geobotany. Its results provide valuable information about diversity of flora of the area, its uniqueness and links with other regions. They are the base for considering histories of floras, their origin, migrations and transformations both in the past and the present (Kornaś & Medwecka-Kornaś 2002). The presence of mountain species plays an important role in the geobotanical regionalization, especially of mountain areas and foothills. It can also be an indicator in assessing the natural habitat of the area (Towpasz & Zemanek 1995; Zajac 1996; Stachurska-Swakoń 2009).

The aim of the paper is an analysis of mountains species of the Sopotnia Wielka creek, situated in the northern part of the Pilsko mountain group in the Beskid Żywiecki Mts. The Beskid Żywiecki Mts. is a vast and diverse outer part of the Western Carpathians with the highest peak of the Babia Góra Mt (1725 m a.s.l.). The flora of this part of the Beskidy Mts was investigated with uneven intensity. Besides the Babia Góra Mt, only the flora of the Pilsko group has been described in a publication (Bialecka 1982) and some floristical notes (e.g. Ciepał *et al.* 1983; Mitka 2008; Piękoś-Mirkowa *et al.* 2008a, 2008b) have been published.

Materials and methods

Field investigation was carried out in the valley of the Sopotnia Wielka creek (Pilsko mountain group, Beskid Żywiecki Mts, Western Carpathians, Poland) in the years 2011-2013. The Sopotnia Wielka creates a deep valley in the range of 900 m to 475 m a.s.l. across ca. 10 km. The basic research method was floristic inventories in a grid of squares 2km x 2km according to the ATPOL methodology (Zajac 1978). Classification of the group of mountain species was made after Pawłowska 1972 and other authors that considered phytogeography of the Carpathian flora e.g. Bialecka 1982, Towpasz & Zemanek 1995, Zajac 1996. The group of mountain species was also analyzed in terms of geographic affiliations (Zajac & Zajac 2011) and plant communities (Matuszkiewicz 2005).

Results and discussion

Total of 55 mountain plant species were found (Tab. 1) in valley of the Sopotnia Wielka creek. The most numerous subgroup form montane species – 31 and multizonal mountain species – 12. Next subgroups are formed by small number of taxa: submontane species – 2,

subalpine species – 8, alpine species – 2. The most interesting findings are the alpine species, which include *Viola biflora* and *Mutellina purpurea* (Fig. 1). Both species occur there, outside their optimum altitude. *Mutellina purpurea* was found in the meadows adjacent to the creek. One location seems to be endangered as it was found on the overgrown meadow. *Mutellina purpurea* is a species of hills and mountain grasslands. It is believed that its occurrence outside of high mountain meadows is associated with sheep grazing (Białecka 1982). *Viola biflora* was found only at one location at an altitude of approx. 850 m a.s.l. The plant is common in high mountains in humid and shady places. It is one of a rare species in the lower part of the Beskidy Mts.

The mountain species inhabit mostly moist and wet communities along creek, belonging to tall-herb communities. They form a group of 18 species. Other occurs in forest communities: 12 species grow in beech forest (*Fagetalia* alliance) and 13 in mountain spruce forest (*Vaccinio-Piceion* alliance).

An interesting group is tall-herb species group forming often rich communities developed along mountain streams in specific, moist and fertile, microhabitat conditions (Stachurska-Swakoń 2011). Mountain character of the Sopotnia Wielka creek, as well as low anthropogenic impact caused that communities representing alliance *Adenostylion alliariae* evolved on upper part of the creek. The species are: *Aconitum firmum*, *Cicerbita alpina*, *Ranunculus platanifolius*, *Veratrum lobelianum*, *Senecio subalpinus*. All of them represent subalpine species. *Aconitum firmum* has only one location there, with the population of just a few shoots. Other plants are also found in few locations, but their populations are more numerous.

To the interesting findings belong some montane species: *Calamagrostis pseudophragmites*, *Cardamine trifolia*, *Crocus scepusiensis*, *Galium rotundifolium*, and multizonal species: *Cirsium erisithales*, *Homogyne alpina*, *Valeriana sambucifolia*, *V. tripteris*. *Calamagrostis pseudophragmites* occurs in the communities of riverside gravel. The number of its locations in the Carpathians declines due to devastation of the habitat. In the research area it was found in three locations. *Crocus scepusiensis* was noted only in one location (c.a. 200 shoots) on poor *Gladiolo-Agrostietum* meadow. There is observed decline of the species due to cessation of pastoralism in the Carpathians. *Galium rotundifolium* was noted only in one location in the spruce forest. The species was formerly common, now it persists because of degradation of habitat. *Cirsium erisithales* occurs in the area only in two locations in the carrs *Alnetum incanae*.

According to geographical affiliation, they represent mainly the Alpic-Central-European distributional type: 23 species. *Petasites kablikianus* and *Salix silesiaca* belong to the Carpatho-Balkan distributional type. Three species are endemics for the Carpathians: *Aconitum firmum* subsp. *firmum*, *Crocus scepusiensis*, and *Dentaria glandulosa*.

Although habitat conditions – the nature of a mountain stream, in places deeply indented, with a high percentage of forest cover (60%) – should encourage the presence of mountain species, they make up about 13% in the creek flora. The reasons should be sought in the former agricultural use of the site, as well as its topogeographical position. An interesting issue is the origin of some mountain species here. Analysis of genetic diversity of *Cicerbita alpina* population (AFLP markers) collected from the Cebulowy creek, a tributary creek of the Sopotnia Wielka, has pointed out a similarity of specimens from this population to population from the Babia Góra Mt (Stachurska-Swakoń *et al.* 2012). The Babia Góra Mt is the highest mountain massif in the Western Beskids Mts, the only one in the Beskids of developed alpine zone. The flora of the Babia Góra Mt could serve as a source of diaspores for regions with lower altitudes. Considerations of this hypothesis have been carried out for the some species in the Beskid Mały Mts (Stachurska-Swakoń *et al.* 2009). *Ranunculus platanifolius* from the Cebulowy creek has shown other genetic pattern, indicating a greater

similarity to the population of Tatra Mts (Stachurska-Swakoń *et al.* 2013). Additionally, it has shown a relatively high rate of proportion of rare AFLP markers (DW), which may indicate a decreased potential for gene flow between modern populations.

Fig 1: Location of selected mountain species in the valley of the Sopotnia Wielka Creek (Beskid Żywiecki Mts, Western Carpathians, Poland). ATPOL grid of 2 km x 2 km. 1 – *Aconitum firmum*, 2 – *Cardamine trifolia*, 3 – *Cirsium erisithales*, 4 – *Crocus scepusiensis*, 5 – *Galium rotundifolium*, 6 – *Mutellina purpurea*, 7 – *Valeriana tripteris*, 8 – *Viola biflora*.

Conclusion

Modern distribution of mountain species is a result of historical factors, the biology of the species, current habitat conditions and human impact. Social and economic changes, which took place in mountainous regions in Poland at the end of the twentieth century in the study area, have decreased direct economic pressure. However, recently there is observed an increase in single-family housing that may affect the nature of the studied valley.

Tab 1: List of mountain species of the Sopotnia Wielka creek (Western Carpathians, Poland)

<i>Abies alba</i>	<i>Matteucia struthiopteris</i>
<i>Aconitum firmum</i>	<i>Mutellina purpurea</i>
<i>Alchemilla crinita</i>	<i>Oreopteris limbosperma</i>
<i>Alchemilla glabra</i>	<i>Orobanche flava</i>
<i>Alchemilla walasii</i>	<i>Petasites albus</i>
<i>Allium ursinum</i>	<i>Petasites kablikianus</i>
<i>Alnus incana</i>	<i>Picea abies</i>
<i>Aruncus sylvestris</i>	<i>Polygonatum verticillatum</i>
<i>Calamagrostis pseudophragmites</i>	<i>Polystichum aculeatum</i>
<i>Cardamine trifolia</i>	<i>Prenanthes purpurea</i>
<i>Cardaminopsis halleri</i>	<i>Ranunculus platanifolius</i>
<i>Carduus personata</i>	<i>Ribes alpinum</i>
<i>Centaurea oxylepis</i>	<i>Rosa pendulina</i>
<i>Chaerophyllum hirsutum</i>	<i>Rumex alpestris</i>
<i>Cicerbita alpina</i>	<i>Rumex alpinus</i>
<i>Cirsium erisithales</i>	<i>Salix eleagnos</i>
<i>Crocus scepusiensis</i>	<i>Salix silesiaca</i>
<i>Dentaria glandulosa</i>	<i>Salvia glutinosa</i>
<i>Dryopteris dilatata</i>	<i>Sambucus racemosa</i>
<i>Euphorbia serrulata</i>	<i>Scrophularia scopolii</i>
<i>Galium rotundifolium</i>	<i>Sedum fabaria</i>
<i>Gentiana asclepiadea</i>	<i>Senecio ovatus</i>
<i>Gymnocarpium robertianum</i>	<i>Senecio subalpinus</i>
<i>Homogyne alpina</i>	<i>Valeriana sambucifolia</i>
<i>Lonicera nigra</i>	<i>Valeriana tripteris</i>
<i>Luzula luzulina</i>	<i>Veratrum lobelianum</i>
<i>Luzula sylvatica</i>	<i>Viola biflora</i>
<i>Lysimachia nemorum</i>	

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