

## Taxa of vascular plants endemic to the Carpathian Mts

### Endemické taxóny cievnatých rastlín v Karpatoch

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Dedicated to the memory of Ján Futák and Halina Piękoś-Mirkowa

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A briefly annotated survey of vascular plants endemic and subendemic to the Carpathians is presented based on a critical revision of published and unpublished data on contemporary taxonomic and chorological knowledge. The habitat preferences and ecological niche breadths of non-apomictic endemic and subendemic taxa were also evaluated. The area studied included the Carpathian Mts located mainly in Slovakia, Poland, Ukraine and Romania, reaching also Austria, Czech Republic, Hungary and Serbia. Five equivalent subunits were distinguished within the Carpathians: the Western Carpathians, Eastern Carpathians, Southern Carpathians, Apuseni Carpathians and the Transylvanian Basin. The final evaluation of endemic status was made for 631 taxa of vascular plants, including 420 taxa confirmed as endemic or subendemic to the Carpathians and their subunits, 67 taxa with unclear taxonomy or distribution, 69 taxa with a wider distribution outside the Carpathians, 58 taxa included in superior taxa with a wider non-endemic distribution and 17 hybrids. The final list of endemic and subendemic taxa includes 146 species, 104 subspecies and 170 microspecies of apomictic genera (including 83 taxa of *Alchemilla*, 64 taxa of *Hieracium*, 2 of *Pilosella*, 16 of *Sorbus* and 5 of *Taraxacum*). The overall number of endemic and subendemic taxa in individual Carpathian subunits is as follows (counts including apomictic genera are in parentheses): Western Carpathians: 89 (198) endemics, 19 (21) subendemics; Eastern Carpathians: 118 (152) endemics, 25 (27) subendemics; Southern Carpathians: 113 (149) endemics, 24 (24) subendemics; Apuseni Carpathians: 45 (49) endemics, 19 (19) subendemics; Transylvanian Basin: 5 (5) endemics, 12 (12) subendemics. Grassland habitats were the richest in endemic and subendemic taxa (containing 33% of all included taxa), followed by rocky habitats (22%), forests (16%) and shrublands (11%). Wetlands (7%), dwarf shrubs (6%) and human-made habitats (5%) hosted the lowest number of (sub)endemic taxa. The habitats with the highest frequency of taxa (sub)endemic to the Carpathian Mts are those with a calcareous bedrock and phytosociologically classified within the classes *Elyno-Seslerietea*, *Mulgedio-Aconitetea*, *Thlaspietea rotundifoliae*, *Asplenieta trichomanis*, *Carici rupestris-Kobresietea bellardii* and *Festuco-Brometea*. The niche breadth of the Carpathian (sub)endemic taxa is related to the sizes of their ranges (eurychoric taxa had the broadest niches and micro- and stenochoric taxa had the narrowest). About 60% of the (sub)endemic taxa are habitat specialists restricted to only 1–3 habitats within one or two habitat groups.

**Key words:** Apuseni Carpathians, Eastern Carpathians, endemic, habitat, Southern Carpathians, subendemic, Transylvanian Basin, Western Carpathians

## Introduction

Endemic species have always attracted the attention of biologists due to their rarity and extraordinary position regarding their chorology and evolution. From the conservation point of view, endemism is an important criterion for evaluating the diversity of a particular region. Therefore, the phenomenon of endemism is permanently focussed at various geographical and taxonomical levels.

The distribution of endemics is usually defined in terms of conspicuous topographic features, such as mountain ranges or islands, or other natural elements, such as relic habitats (Kaplan 2012). In Europe, mountainous regions are areas with the highest endemism and many European endemics are confined to alpine and subalpine habitats on the summits of mountain ranges (Favarger 1972, Hendrych 1982, Dullinger et al. 2000, Tribsch 2004, Krahulec 2006, Casazza et al. 2008, Kaplan 2012, Bruchman & Hobohm 2014). High environmental heterogeneity and habitat diversity, long-term climatic stability, especially during the Quaternary period, together with strong geographical isolation are the factors contributing most to the extraordinary richness of endemic taxa in European mountains (Hendrych 1982, Hewitt 1999, Körner 2000, Tribsch & Schönswetter 2003, Vanderplank et al. 2014).

The Carpathians, together with the Alps, Pyrenees and mountains of the Balkan Peninsula are mountainous regions with a high endemism of vascular plants in Europe (Vanderplank et al. 2014). The endemism of vascular plants in the Carpathians has been studied since the second half of the 19th century, when the term “Carpathian endemic” was first used by Borbás (1877) for *Arabis* [*Arabidopsis*] *neglecta*. The surveys of endemic vascular plants in the Carpathians and their subunits were gradually published by Simonkai (1887), Borbás (1896), Pax (1898), Soó (1930, 1933a, b), Balázs (1939), Kiss (1939), Szücs (1943), Pawłowski (1969a, b, 1970), Hendrych (1981a, b, 1982), Kliment (1999), Šeffler et al. (2010) and Tassenkevich (2011, 2014). Endemism of selected taxa was evaluated at the supranational level also by Tassenkevich (2002, 2010). Much more frequent were studies focussing on endemic taxa within a particular country or historical region, i.e. Czech Republic: Kaplan 2012; Slovakia: Domin 1928, Novacký 1943, Futák 1971, 1972, 1981, Kliment 1998; Poland: Pawłowska 1953, 1960, Piękoś-Mirkowa & Mirek 2003, Mirek & Piękoś-Mirkowa 2009; Ukraine: Stojko et al. 1982, Stojko & Tassenkevitch 1991, Stoyko & Tassenkevich 1993, Kricsfalusy & Budnikov 2002, Tassenkevych 2003b, Čornej 2006, 2011, Antosjak et al. 2009, Antosyak & Kozurak 2011, Tassenkevich 2013 (summary data only); Romania: Soó 1942 (Transylvania), Beldie 1967, Morariu & Beldie 1976, Heltmann 1985, Dihoru & Pârvu 1987, Negrean & Oltean 1989, Popescu et al. 2003 (Oltenia), Hurdu et al. 2012a, b. The area of individual Carpathian countries was covered by Hadač et al. (1991). Most common were studies summarizing the occurrence of endemic taxa in individual mountain ranges including simple lists of taxa as well as detailed critical evaluations (e.g. Borbás 1902, Pawłowski 1927, Piękoś-Mirkowa et al. 1996, Mirek & Piękoś-Mirkowa 2010). Several recent studies investigated endemism in the Carpathian mountain ranges in relation to altitude, geological bedrock and chorology/topography in order to indentify the centres of endemism in the Carpathians (e.g. Lengyelová 2007, Hurdu et al. 2012a).

Along with studies focussing on the inventory of endemics the investigations on biology, ecology and phytosociological affiliation of selected endemic taxa are of particular

importance (Hendrych 1965, Erdelská & Turis 1996, Negrea & Pricop 2009a, b, Turis 2009, Bahlej 2010, etc.). The recent molecular-taxonomic studies are also important as they elucidate the taxonomic position and justify the delimitation of traditionally recognized narrow endemic taxa (e.g. Šingliarová et al. 2008, 2011a, b, 2013, Kolarčík et al. 2010, Somogyi et al. 2012, Španiel et al. 2012, Şuteu 2012, Kučera et al. 2013, Şuteu et al. 2013, Fereira et al. 2015).

The ongoing research in taxonomy and plant distribution resulted in a greater knowledge of numerous taxa, which is reflected in changes in their endemic status. Following expert taxonomic reevaluations, some of the species and subspecies were included in other taxa with a broader (and so non-endemic) distribution area. Another group of taxa that were previously considered to be endemic were later excluded from the list of endemics due to new chorological data, or their endemic status was changed (from endemic to subendemic and vice versa) or specified. The main aim of this paper was to review our older results from Slovakia (Kliment 1999), complete the collection of data for the whole of the Carpathian Mts (including data from a further seven countries) and revise the information on distribution of endemic taxa in the Carpathians in the light of recently published knowledge.

The pattern of vascular plant endemism is not random but is structured by geographical, topographic and environmental factors. It is known that most endemics in temperate zones of Europe are confined to non-forest habitats, such as rocks, screes and grasslands (Hobohm 2008, Essl et al. 2009, Hobohm et al. 2014), while forest habitats harbour only a small number of endemic taxa (Vanderplank et al. 2014). For these regions, the striking preference of endemics for calcareous bedrock (Essl et al. 2009) is in line with the generally higher species richness of vascular plants on calcareous bedrock (Ewald 2003). In our study, we also investigated the affinity of the endemic and subendemic taxa studied for various habitats and geological bedrock in order to reveal specific patterns in Carpathian endemism. The ecological and phytosociological information obtained was used to estimate ecological niche breadth of individual (sub)endemic taxa and its relation to their range size.

### **Delimitation and division of the Carpathians**

The area studied in this paper includes the Carpathian Mts with adjacent regions of central, eastern and south-eastern Europe. Most of the area of the Carpathians is located in Slovakia, Poland, Ukraine and Romania. However, the Carpathians are also in Austria (Hainburger Berge), the Czech Republic (the Moravian Carpathians, westward up to the Moravian Gate), Hungary (North Hungarian Mountains) and Serbia (amid the river valleys of Morava and Timok, southward up to Niš) (Fig. 1). Highlands in north-western Bulgaria can also be assigned to the Carpathians from the geological point of view (cf. Cankov 1974). An important biogeographical position of the Carpathians between the Balkan ranges in the south, the Alps and Sudeten in the west and the Scandinavian range in the north is reflected in an extraordinarily high diversity of plants of various origins (Kliment 1999, Webster et al. 2001, Ruffini et al. 2006, Mráz et al. 2007, Ronikier 2011). The delimitation and particularly the inner zonation of the Carpathians has been permanently modified and it is still not settled (cf. Pax 1898, Soó 1930, 1933a, b, Balázs 1939,

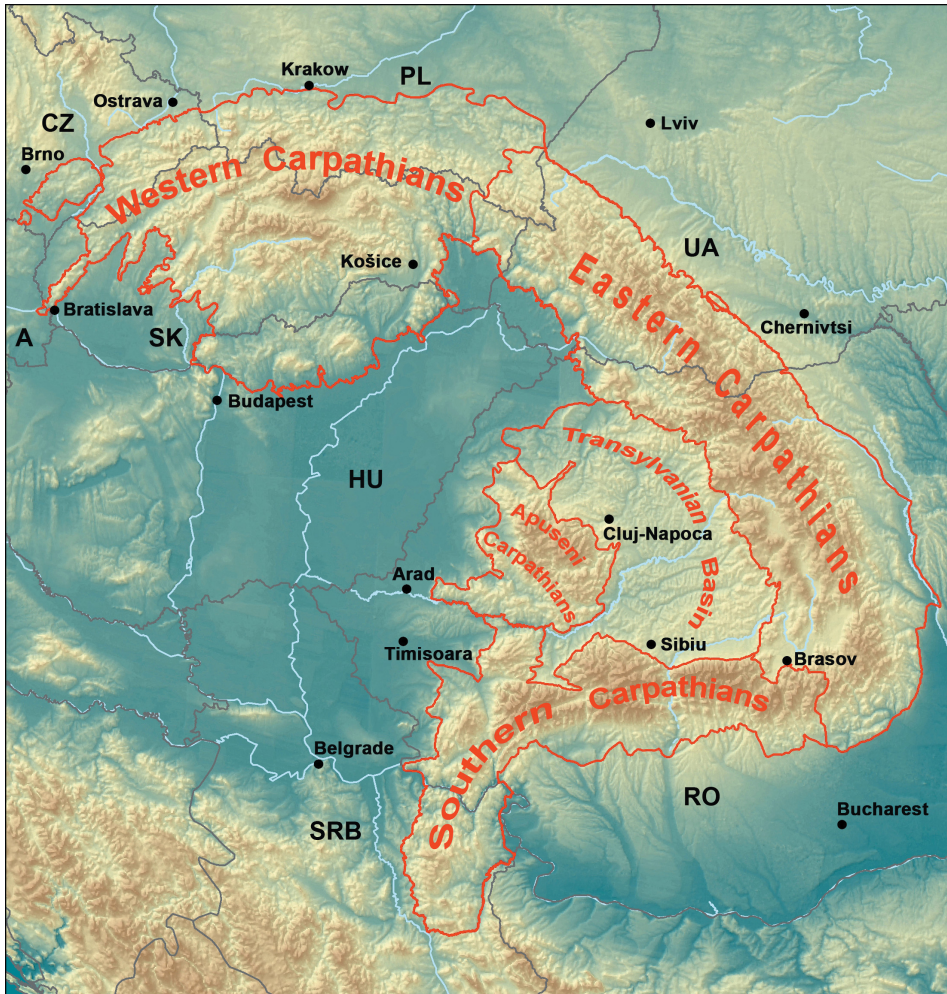


Fig. 1. – Map showing the location and divisions of the Carpathians and their subunits.

Pawłowski 1969a, 1970, Starmühler 1995, Starmühler & Mitka 2001, Ruffini et al. 2006, Hurdu 2012). Traditionally, the Carpathians are divided into the Western Carpathians (Austria, Czech Republic, Hungary, Slovakia, Poland), Eastern Carpathians (Poland, Slovakia, Ukraine, Romania), Southern Carpathians (Romania, Serbia), Apuseni Carpathians (Romania) and the Transylvanian Basin (Romania) (Kliment 1999, Mráz 2005). In some phytogeographical and phylogeographical literature they are divided to two basic units – the Western (in older studies referred to as Northern) Carpathians and the South-Eastern (in older studies referred to as Eastern) Carpathians (Ronikier 2011, Hurdu et al. 2012a), while the South-Eastern Carpathians are further divided into the above mentioned subunits.

The Carpathians constitute, beside the Alps and the Pyrenees, one of the main large mountain chains forming the European Alpine System (Ozenda 1985) uplifted during the Alp-Himalayan orogeny, which started in the Late Mesozoic. They form an arch extending into Central Europe over about 1300 km, reaching a width of 100–350 km and covering a total surface of 209,000 km<sup>2</sup> (Kondracki 1989). In comparison to the Alps, which have a similar surface area and length, the Carpathians are significantly lower and their alpine zone covers much smaller areas that occur as isolated habitat islands in the highest ranges (Pawłowski 1970). The highest Carpathian range, the Tatra Mts, are located in the Western Carpathians and reach 2655 m a.s.l. (Gerlachovský štít Peak). Geologically the Carpathians consists of mainly flysch in the outer zone, crystalline and metamorphic rocks in the central zone, limestone belts manifested discontinuously across the chain and volcanic rocks covering some areas. Overall, silicate habitats are more widespread than calcareous habitats (Ronikier 2011).

The phytogeographical division of the whole Carpathians was studied by Tassenkevich (2004, 2005; cf. Tassenkevich 2011, 2014), who summarized the national phytogeographical classifications of individual Carpathian countries. Her phytogeographical division was followed also in our study. However, in contrast to her opinion and to the approach of several other authors (e.g. Pawłowski 1969a, Webster et al. 2001, Ruffini et al. 2006, Tassenkevich 2011) the Serbian part south of the Danube river was also included in the area studied (cf. Negrean & Oltean 1989, Coldea 1991, Kliment 1999, Hurdu et al. 2012b). With regards to a similar evolution of flora and vegetation, the peri-Carpathian ranges and basins assigned to the Matricum phytochorological unit (Futák 1980, 1984) and containing the North Hungarian Mountains were also included in the Western Carpathians in our evaluation of the distribution of endemics. In contrast to the phytogeographical division (Futák 1980, 1984), the North Hungarian Mts located in a broad transition zone between the Western Carpathians and Pannonian Basin (for details see Kliment 1999, 2003) are also regarded as part of the Carpathians by geographers (e.g. Mazúr & Lukniš 1980, Kondracki 1989, Král 1999). Partial modifications were made also to the delimitations of the boundaries of particular subunits.

The border line between the Western and Eastern (South-Eastern) Carpathians is considered to be the most important vegetation boundary in the Carpathians and, therefore, studied reasonably well since the second half of the 19th century (Zemanek 1991a, b, 1992, Kliment 1999, 2003). Individual authors shifted the border between both subunits from the Kurovské (Tyličské) sedlo saddle (683 m a.s.l.) on the Slovak-Polish border up to the Jablonické sedlo saddle (912 m a.s.l.), forming an eastern border of so-called Forest Carpathians) between the Ukrainian ranges Horhany and Čornohora. In accordance with recent opinion (Krippel 1983, Soják 1983, Zemanek 1991b, 1992, Kliment 1999, 2003, Mráz et al. 2007), we place the border between the Western and Eastern Carpathians in the Lupkov (Łupków) Pass. The Bieszczady Mts in Poland, and the Bukovské vrchy Mts (or widely delimited Nízke Poloniny Mts; cf. Soják 1983) and Vihorlat Mts in Slovakia (except the limestone hills at Humenné, Michalko 1957) are placed in the Eastern Carpathians. The area between the Kurovské sedlo saddle and the Lupkov Pass at markedly lower altitudes, including the Beskid Niski Mts and Nízke Beskydy Mts, is considered to be a broad transition zone (cf. Kliment 1999, Tassenkevich 2005), or an area between the outer and inner (s. str.) borders of both phytochorions (see Holub 1977 for details), where characteristic elements of both the Eastern and the Western Carpathians

are gradually disappearing. The altitude in this zone decreases down to 500 m forming a strong landscape barrier, so that migration of alpine plants and the gene flow between their populations is prevented (Mráz et al. 2007, Ronikier 2011). The lowest part of the Nízke Beskydy Mts, between the river valleys of Laborec and Topľa, the Ondava disjunction (see Hendrych & Hendrychová 1979 for details), is open to the south and has a drier and warmer climate than the surrounding regions, which makes this barrier even more significant.

The delimitation of the Southern and Eastern Carpathians is also ambiguous. The Predeal Saddle and the valley of the Prahova river between the Bucegi Mts and Baiului (Gârbova) Mts are considered to form a boundary between the Romanian Eastern and Southern Carpathians. The Bârsei Mts, including the massifs of Postăvaru and Piatra Mare, are considered to be a part of the Southern Carpathians (Georgescu & Doniță 1965, Beldie 1967, Sanda et al. 1980, Kliment 1999, Tassenkevich 2005). The Gârbova Mts were placed in the Southern Carpathians by Sanda et al. (1980). According to B. I. Hurdu (personal communication, 2014), the Ciucaș Mts are also in the Southern Carpathians based on their floristic composition, although other authors (Georgescu & Doniță 1965) place them in the Eastern Carpathians. The placing of the Ciucaș Mts in the Southern Carpathians is also supported by Negrean & Oltean (1989), who reveal the close floristic relationships of the Ciucaș Mts with the Bârsei Mts, Piatra Craiului Mts and Bucegi Mts, as does Mráz et al. (2007) phylogeographical study of *Hypochaeris uniflora*. Hurdu et al. (2012a) report that the complex Piatra Craiului – Bucegi – Bârsei – Ciucaș is an endemism hotspot with the highest diversity of endemic taxa in the South-Eastern Carpathians. Based on this knowledge we included the Baiului and Ciucaș Mts in the Southern Carpathians and placed the phytogeographical boundary between the Eastern and Southern Carpathians between the Ciucaș and Siriu Mts (Fig. 1).

The delimitation of the western border of the Southern Carpathians is also ambiguous. According to Georgescu & Doniță (1965) it extends as far as the Mehedinți Mts, while Beldie (1967) and Hurdu et al. (2012a) include also the lower Banat Mts. In our study, Banat Mts were included in the Southern Carpathians (cf. Kliment 1999).

The delimitation of the Apuseni Carpathians (Carpații Apuseni sensu Beldie (1967); Siebenbürgischen Westgebirge sensu Heltmann 1985) against the Southern Carpathians (and the Banat Mts) is not clear. The wide mountain range Poiana Ruscă delimited by the valleys of the Mureș, Timiș and Bistra rivers, which is a transition zone between the Apuseni and Banat Mts and the Southern Carpathians s. str. is part of the Apuseni Carpathians according to Georgescu & Doniță (1965) and Tassenkevich (2005). However, Negrean & Oltean (1989), Starmühler (1995) and Ciocârlan (2009) consider it to be part of the Southern Carpathians and several other authors (Beldie 1967, Sanda et al. 1980, Heltmann 1985, Bartha & Bartók 2013) also do not consider it to be part of the Apuseni Carpathians. In accordance with the majority opinion (cf. Beldie (1967), Kliment 1999, Tassenkevich 2005), the southern border of the Apuseni Carpathians is in the valley of Mureș river and the subunit of the Apuseni Carpathians is equivalent to subunits of the Western, Eastern and Southern Carpathians.

A vast area of upland in central Romania surrounded by mountain chains of the Eastern, Southern and Apuseni Carpathians gradually merges into the Pannonian Basin. It differs from the surrounding Carpathians in its geological bedrock and lower altitude, and is called the Transylvanian Basin (Transylvanian Plateau, Podișul Transilvaniei).

The uplands at lower altitudes (up to 650 m) widespread amid the promontories of the Apuseni Carpathians and Southern Carpathians enable contact between floras of both mountain ranges as well as separating the Transylvanian Basin from the Pannonian Basin (cf. Geacu & Dumitrașcu 2013). In accordance with numerous geographical (e.g. Kondracki 1989, Král 1999, Posea 2006) and biogeographical studies (Kliment 1999, Webster et al. 2001, Tassenkevich 2004, 2005, 2011, 2014, Kucharzyk 2009, and others) this large intermontane basin is considered to be a component of the Carpathians.

Based on the above-mentioned facts we distinguished five equivalent subunits within the Carpathians: the Western Carpathians, Eastern Carpathians, Southern Carpathians, Apuseni Carpathians and Transylvanian Basin (Fig. 1).

## Methods

### *Delimitation of endemic and subendemic taxa and evaluation of endemism*

In terms of endemism as a function of a spatial scale, endemic taxa are those restricted in their distribution to a particular geographical region or habitat (Hobohm & Tucker 2014). In this respect Holub & Jirásek (1967, 1971) emphasize a naturally delimited area, while Holub (1981) places particular emphasis on a phytogeographically delimited area. In this paper we considered both approaches, both endemic taxa with distributions restricted to naturally delimited areas of mountain range systems (the Alps, Carpathians, Sudeten, etc.) as well as those surrounded by large basins (the Pannonian Basin) and lower phytogeographical units (cf. Kliment 1999, Mirek & Piękoś-Mirkowa 2009). In addition, this approach corresponds to the traditional concept of endemism in the Carpathian region. The geographical delimitation does not exclude endemic taxa restricted to a particular habitat or “habitat islands”, e.g. to isolated outcrops of different types of bedrock, sand complexes, etc. (Kliment 1999, Hobohm & Tucker 2014).

Based on the size of the distribution area, we distinguished four basic categories of endemic taxa in the Carpathians (cf. Mirek & Piękoś-Mirkowa 2009): eurychoric endemics distributed rather evenly throughout the whole Carpathians (pan-Carpathian) or in their major part (West-East-South-Carpathian endemics); mesochoric endemics with distributions restricted to the individual Carpathian subunits; stenochoric endemics distributed only in a particular mountain range and microchoric endemics restricted to a particular mountain massif, peak or gorge. For steno- and microchoric endemic taxa the particular area of distribution is also mentioned in our survey (Appendix 1), e.g. endemic to the Southern Carpathians (Retezat Mts), endemic to Západné Tatry Mts (Mt. Osobitá). In stenochoric endemics we placed also several taxa restricted in their distribution to two adjacent mountain ranges. With regard to numerous taxa endemic in two (three) Carpathian subunits, we distinguished an additional transitional category of meso-eurychoric endemics (see Kliment 1999 for details). The Pannonian-Carpathian and Balkan-Carpathian (sub)species were not considered to be endemic or subendemic to the Carpathians even if they are evaluated so in the literature.

As pan-Carpathian endemics, taxa distributed in the Western, Eastern and Southern Carpathians are usually considered (for details see Kliment 1999). However, Ukrainian authors place in this category only taxa occurring also in the Ukrainian Carpathians (Čopyk 1976). Tassenkevich (2011) limits this term to taxa present in the whole

Carpathians including the Transylvanian Basin. In contrast to her approach, we use the term pan-Carpathian (sub)endemic for taxa that occur only in the Western, Eastern, Southern and Apuseni Carpathians.

As subendemic we considered taxa almost exclusively found only in a certain region, but with a limited occurrence also outside this region (Hendrych 1984, Kliment 1999). It concerns the occurrence beyond the given phytogeographical unit, exclave occurrence, or a combination of both. Taxa with very limited occurrence outside a given region, e.g. taxa with a single population close to the main distribution area or taxa occurring in a transition zone between two adjacent phytochorions, were evaluated as endemic to the given region (e.g. endemic to the Eastern Carpathians with a single occurrence in the Beskid Niski Mts within the Western Carpathians). On the other hand, taxa with frequent occurrence in neighbouring regions were not considered to be subendemic.

In our evaluation of endemism, only recently recorded distributions are considered, the areas of former occurrence of recently extinct taxa (category RE) or taxa missing for a long time (category RE?) were not considered. For example, *Antennaria carpatica* subsp. *carpatica* in Romania is mentioned only in old literature and there are no recent records. The Romanian authors consider this taxon to be extinct (Oltean et al. 1994) or probably extinct (Oprea 2005). Therefore, we changed its endemic status (Carpathian endemic) to West-East-Carpathian endemic. In Appendix 1 such cases are indicated by the symbol † (e.g. †RO). If all subspecies of a particular species are evaluated as endemic, we mention the species also separately in our survey, e.g. *Aconitum firmum*, *Cyanus dominii*, *Thymus pulcherrimus*, etc., but we did not include these species (11 cases) in the statistical evaluations.

In contrast to some literature, hybrids (e.g. *Aconitum* × *natum*) were not evaluated as endemic. As the taxonomic status of several hybrids is ambiguous, it is possible they will be reevaluated in the future. Therefore, we listed the hybrid taxa together with references to important taxonomic and chorological literature. Stabilized hybridogenous populations evaluated as hybridogeneous taxa (e.g. several species of the genus *Sorbus*) were considered as endemic.

#### *Taxa selection and their evaluation*

With respect to constantly accumulating taxonomic and chorological knowledge we restricted our selection of revised literature to start in 1970 when Pawłowski published his survey of Carpathian endemics. Our evaluation includes endemic and subendemic taxa reported from the Carpathians and their subunits in supranational (Pawłowski 1970, Šeffler et al. 2010, Tassenkevich 2011, 2014, see also Carpathian Biodiversity Information System 2008: <http://www.carpat.es.org/cbis.html>), national or important regional overviews from the Czech Republic (Kaplan 2012), Poland (Piękoś-Mirkowa et al. 1996, Piękoś-Mirkowa & Mirek 2003, Mirek & Piękoś-Mirkowa 2009, 2010), Slovakia (Kliment 1999, Kliment et al. 2011), Ukraine (Stojko & Tassenkewitsch 1991, Stoyko & Tassenkevich 1993, Kricsfalusy 1999, Kricsfalusy & Budnikov 2002, Tassenkevych 2003b, Antosyak & Kozurak 2011, Čornej 2011) and Romania (Morariu & Beldie 1976, Heltmann 1985, Dihoru & Pârvu 1987, Negrean & Oltean 1989, Hurdu et al. 2012a, b). Attention was paid also to taxonomic and chorological publications containing current information on endemic taxa of vascular plants. Among the taxonomically difficult,



mainly apomictic taxa (*Alchemilla*, *Hieracium*, *Pilosella*, *Sorbus*, *Taraxacum*), we listed only those with existing relevant information in recent taxonomic literature or those commented on by competent experts. The third group of sources were national overviews of taxa important from the nature conservation point of view (red books, red lists, floras and determination keys) including reliable chorological data (Čopyk 1976, Beldie 1977, 1979, Čeřovský et al. 1999, Malynov's'kyj et al. 2002, Mirek & Piękoś-Mirkowa 2008, Ciocârlan 2009, Coldea et al. 2009, Diduch 2009, Dihoru & Negrean 2009, Sârbu et al. 2013). In spite of a large quantity of data we disregarded compilation publications (table overviews of endemics) without clear final evaluation of endemism in the reported area (Čornej 2006, Antosjak et al. 2009). Publications focussing on the Carpathian region but containing only general information on endemism were also excluded from our evaluation (Tasenkevich 2003a, Turis et al. 2014). From our survey we also excluded the taxa regarded as (sub)endemics in the source literature, which occur predominantly or completely outside the Carpathians (e.g. Pannonian subendemics, endemics of Dobrogea, etc.).

For evaluation of endemism and classification of endemic taxa within respective spatial categories we preferred current critical overviews of endemics, the national floras and comprehensive taxonomic and chorological studies. The taxonomic and chorological publications, on which our evaluation of endemism was based, are listed in respective tables in the column 'References'.

#### *Habitat preferences of (sub)endemic taxa*

We considered the occurrence of endemic taxa in various habitat groups, habitats and vegetation segments in order to estimate the breadth of their niches (e.g. Piękoś-Mirkowa et al. 1996, Fridley et al. 2007). Apomictic and mainly apomictic genera (*Alchemilla*, *Hieracium*, *Pilosella*, *Sorbus*, *Taraxacum*) were omitted from the analyses as the realized ecological and phytosociological niches of most of their representatives are currently insufficiently known.

The following basic habitat groups were distinguished: (i) springs, fens, bogs, other wetland communities (W); (ii) rock fissures, rock shelters, screes, riverine gravel terraces and primitive shallow rocky soils (R); (iii) grasslands s. lat. (semi-natural grasslands, fringes, high-mountain swards, tall-herbaceous plant and snow-bed vegetation) (G); (iv) dwarf shrublands (heathlands) (D); (v) scrubs (S); (vi) forests (F) and (vii) human-made habitats (H). The categories i–v were divided according to their vertical distribution into submontane-montane communities and subalpine-alpine communities. Forest habitats were divided into deciduous and mixed forests, natural pine forests and montane spruce and fir-spruce forests. We also regarded the relation to geological bedrock (in the wetland, mainly spring communities, also the water properties): vegetation on calcareous bedrock; vegetation on silicate (non-calcareous) bedrock including effusive rocks, mylonites, schists, etc.; vegetation indifferent to the bedrock (unclear cases were also included in this category). Based on their specific synecology the dwarf shrub communities were not further divided; within the same category we included the dwarf shrubs on silicate substrates, decalcified soil and/or on soils with a thick layer of raw humus.

The affinity of individual endemic taxa to habitats and habitat groups was evaluated according to the ecological and phytosociological data published in national and suprana-

tional overviews (partly also in regional studies), comprehensive studies of selected genera and species, or based on our own knowledge.

### *Taxa nomenclature*

The majority of plant names were unified according to The Euro+Med PlantBase (<http://ww2.bgbm.org/EuroPlusMed/query.asp>), the remaining names are used according to the current taxonomic literature. The validity of plant names and their taxonomic status were checked also in supranational databases The Plant List (<http://www.theplantlist.org>), Tropicos (<http://www.tropicos.org>), World Checklist of Selected Plant Families (<http://apps.kew.org>), Catalogue of Life (<http://www.catalogueoflife.org>) and The International Plant Names Index (<http://www.ipni.org>). We also considered authors' opinions published in *Flora Europaea*, *Atlas Florae Europaeae* and current national floras and checklists. Valid plant names published in the included literature and names from the Euro+Med database, which were not used as valid due to the above mentioned facts were listed as synonyms in tables (overviews of taxa) in Electronic Appendices 1–5. Other names, including invalid (nom. inval.) and illegitimate names (nom. illeg.), and more numerous taxonomic synonyms published in individual overviews of endemic taxa were listed only in notes in order to keep the tables uncluttered and clear. Due to the many and various nomenclatoric sources all plant names are listed with the authors' names. If the genus name is repeated in the synonyms, it is abbreviated to its first capital letter; in subspecies the species name is replaced by an asterisk (\*).

### *Geographical names*

The geographical names (e.g. names of mounts and mountain ranges) adopted from the older botanical sources were left in their original form but their current valid name (with eventual closer localization) is given in parentheses; e.g. Pietrosz (Černohora Mts, Mt. Pietros). The Ukrainian geographical names were transliterated into the Latin alphabet (e.g. Čyvčyny Mts, Mt. Blyzncycja). Other geographical names (Polish, Romanian, etc.) were left unchanged.

## **Results**

The final evaluation of endemic status was made for 631 taxa of vascular plants, considered to be endemic or subendemic to the Carpathians or their parts in the included literature. After the revision of their distribution area and endemic status we divided these taxa into the following categories: (i) taxa endemic or subendemic to the Carpathians and their subunits (Appendix 1, Electronic Appendix 1); (ii) "critical" endemic taxa with unclear taxonomy or distribution (Electronic Appendix 2); (iii) taxa with a wider distribution outside the Carpathians (Electronic Appendix 3); (iv) taxa included in other taxa with a wider non-endemic distribution area (Electronic Appendix 4); (v) hybrids considered to be endemic to the Carpathians and their subunits (Electronic Appendix 5).

Table 1. – Occurrence of endemic and subendemic taxa grouped according to the size of their distribution area in individual Carpathian subunits (counts including apomictic genera are in parentheses). Abbreviations: AC – Apuseni Carpathians, EC – Eastern Carpathians, SC – Southern Carpathians, Tr – Transylvanian Basin, WC – Western Carpathians.

Chorological category		Carpathian subunit	Number of taxa		
Eurychoric	endemic	WC-EC-SC-AC	7 (7)	21 (22)	32 (33)
		WC-EC-SC	14 (15)		
	subendemic	WC-EC-SC-AC-Tr	6 (6)	11 (11)	
		WC-EC-SC-AC	3 (3)		
		WC-EC-SC	2 (2)		
Mesoeurychoric	endemic	WC-SC-AC-Tr	1 (1)	74 (87)	89 (102)
		EC-SC-AC-Tr	1 (1)		
		EC-SC-Tr	1 (1)		
		EC-SC-AC	28 (30)		
		WC-EC	7 (12)		
		WC-SC	1 (2)		
		EC-SC	30 (34)		
		EC-AC	3 (3)		
	SC-AC	2 (3)			
	subendemic	EC-SC-AC-Tr	1 (1)	15 (15)	
		WC-EC-Tr	1 (1)		
		EC-SC-AC	8 (8)		
		WC-EC	2 (2)		
		WC-AC	1 (1)		
EC-SC		2 (2)			
Mesochoric	endemic	WC	36 (56)	80 (122)	90 (136)
		EC	18 (36)		
		SC	21 (25)		
		AC	3 (3)		
		Tr	2 (2)		
	subendemic	WC	4 (6)	10 (14)	
		EC	0 (2)		
		SC	2 (2)		
		Tr	4 (4)		
Stenochoric	endemic	WC	19 (76)	32 (115)	
		EC	7 (11)		
		SC	6 (27)		
		AC	0 (1)		
Microchoric	endemic	WC	4 (29)	7 (34)	
		EC	2 (2)		
		SC	1 (3)		

### *Taxa endemic or subendemic to the Carpathians and their subunits*

Based on current taxonomic literature and consulting with local experts we identified 250 (420 with apomicts) taxa endemic or subendemic to the Carpathians and their subunits (Appendix 1). Among the endemics, 166 out of 381 were apomicts. Among the subendemics, 4 out of 39 taxa were apomicts. The endemic and subendemic taxa can be divided to 36 chorological categories (Table 1; Tassenkevich 2011, 2014).

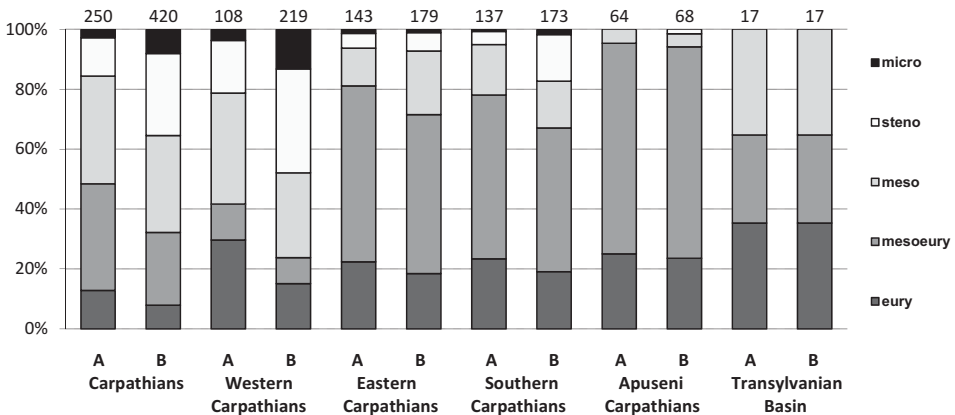


Fig. 2. – Proportion of (sub)endemic taxa with different distribution ranges (from the chorologically narrowest microchoric taxa to eurychoric taxa with the widest geographical ranges) in the Carpathians and individual Carpathian subunits. For each subunit, calculations were made omitting (column A) and including (column B) apomictic genera.

The overall number of endemic and subendemic taxa in individual Carpathian subunits is as follows (counts including apomictic genera are in parentheses): Western Carpathians: 89 (198) endemics, 19 (21) subendemics; Eastern Carpathians: 118 (152) endemics, 25 (27) subendemics; Southern Carpathians: 113 (149) endemics, 24 (24) subendemics; Apuseni Carpathians: 45 (49) endemics, 19 (19) subendemics; Transylvanian Basin: 5 (5) endemics, 12 (12) subendemics.

Among the Carpathian subunits, the Western Carpathians are the richest in (sub)-endemic taxa with the narrowest distribution ranges (micro- and stenochoric taxa). The taxa with narrow distribution areas (micro-, steno- and mesochoric taxa) are mainly in this subunit, while in the remaining Carpathian subunits, there are mainly (sub)endemic taxa with wider distribution areas (mesoeury- and eurychoric taxa). With inclusion of apomictic genera these differences are even more obvious (Fig. 2). The majority of micro- and stenochoric species occur in the mountain ranges Belianske Tatry Mts (21), Západné (Zachodnie) Tatry Mts (16), Vysoké (Wysokie) Tatry Mts (14), Nízke Tatry Mts (13) and Veľká Fatra Mts (9) within the Western Carpathians; Rodna Mts (5) within the Eastern Carpathians and Retezat Mts (18) and Almajului Mts (5) within the Southern Carpathians (Appendix 1).

#### “Critical” (unclear) endemic taxa

In terms of current knowledge, 67 species and subspecies with unclear taxonomic status (based on ambiguous and often contradictory opinions of various authors) and/or insufficiently known distribution areas were listed separately as “critical” endemic taxa. The lack of knowledge on the distribution of taxa may be a consequence of unresolved taxonomy or it concerns well accepted taxa that lack current chorological information (e.g. several species of the genus *Hieracium*). We only list these taxa alphabetically with relevant references to the most important literature while the more detailed information is cited in the form of notes below the list (Electronic Appendix 2).

### *Taxa with a wider non-endemic distribution*

The overall area of distribution of the taxa within this group (Electronic Appendix 3) is often similar to that of the Carpathians subendemics, however, their occurrence outside the Carpathians is much more extensive than it is for the subendemic taxa. The taxa with a non-endemic distribution can be divided into several groups, the most abundant of them being a group of Carpathian-Balkan (Balkan-Carpathian) species and subspecies, which in the included literature are evaluated mostly as Carpathian-Balkan endemics or sub-endemics: *Alchemilla gorcensis*, *Arabis hornungiana*, *Campanula abietina*, *C. transsilvanica*, *Centaurea degeniana*, *C. kotschyana*, *Cirsium grecescui*, *Colchicum haynaldii*, *Dactylorhiza maculata* subsp. *transsilvanica*, *Erythronium dens-canis* var. *niveum*, *Festuca xanthina*, *Galium pseudaristatum*, *Geranium caeruleatum*, *Jacobaea abrotanifolia* subsp. *carpathica*, *Minuartia frutescens*, *Noccaea kovatsii*, *Poa cenisia* subsp. *contracta*, *Polygala supina* subsp. *hospita*, *Primula halleri* subsp. *platyphylla*, *Pulmonaria rubra* subsp. *rubra*, *Rhinanthus gracilis*, *Rhododendron myrtifolium*, *Satureja kitaibelii*, *Saxifraga luteoviridis*, *S. pedemontana* subsp. *cymosa*, *Scorzoneroides rilaensis*, *Silene heuffelii*, *Tephrosia papposa*, *Tozzia carpathica*, *Trifolium repens* var. *ochranthum*, *Verbascum glabratum* subsp. *brandzae*, *Veronica baumgartenii*, *V. spicata* subsp. *crassifolia*.

*Cirsium boujartii* subsp. *boujartii*, *Dactylorhiza fuchsii* subsp. *sooana*, *Jovibarba globifera* subsp. *glabrescens* and *Muscari transsilvanicum* belong to the Carpathian-Pannonian (Pannonian-Carpathian) taxa.

Several evaluated species and subspecies are common to the Carpathians and the Alps, or the Carpathians and the Sudeten (including the taxa occurring within a single subunit of some of these mountain systems). The following taxa are in the first-mentioned group: *Avenula pubescens* subsp. *laevigata*, *Trollius europaeus* subsp. *transsilvanicus* and *Waldsteinia teppneri*; while *Hieracium atrellum*, *H. stygium* and *H. wimmeri* are in the last-mentioned group. *Alyssum repens*, *Hypericum richeri* subsp. *grisebachii* and *Saxifraga carpatica* occur in the Alps, Carpathians and the Balkan mountains, while *Petasites kablikianus* occurs also in the Sudeten and the Balkan mountains beyond the Carpathians.

*Chrysanthemum zawadzki* is a continental taxon with a Eurasian distribution.

### *Species, subspecies and varieties of taxa with a wider non-endemic distribution*

The 58 taxa placed in this group were evaluated as endemic to a particular region within the Carpathians in the included literature, however, according to current taxonomic knowledge they belong to synonyms of taxa with a wider distribution. We list these taxa including their original and current taxonomic evaluation (including the synonyms) and references to relevant taxonomic studies. More detailed information is available in the form of notes (Electronic Appendix 4).

### *Hybrids*

Hybrids were not considered as Carpathian (sub)endemics, although they are reported so in the included literature. A clear opinion on taxonomic status of several hybrids is missing and we expect that (e.g. in the genus *Aconitum*) it will be reevaluated in the future.

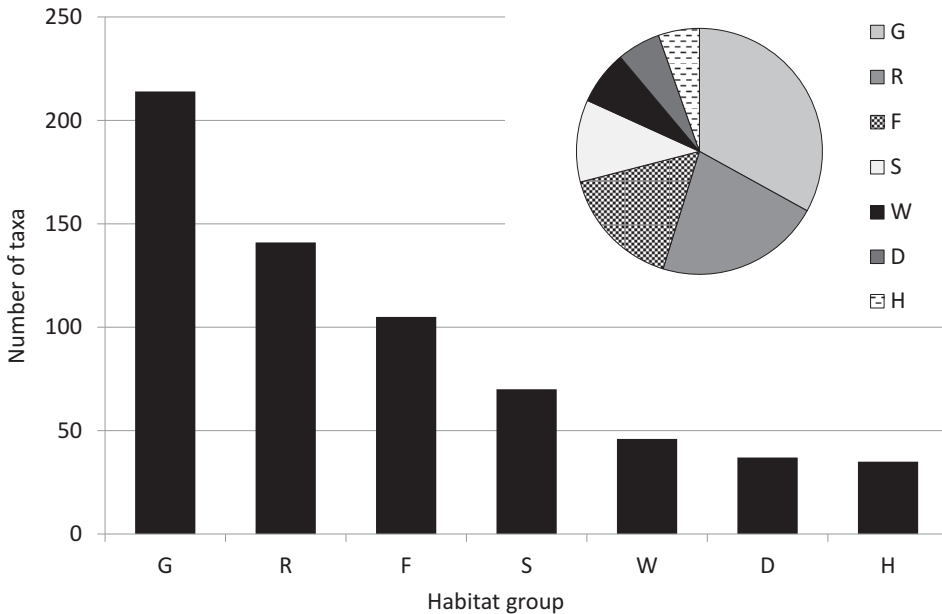


Fig. 3. – Number and proportion (pie-chart) of (sub)endemic taxa in seven habitat groups: G – grasslands, R – rocky habitats, F – forests, S – shrublands, W – wetlands, D – dwarf shrublands, H – human-made (anthropogenic) habitats.

Therefore, we list them with the references to relevant taxonomic and chorological literature (Electronic Appendix 5).

#### *Habitats and niche breadth*

Habitat affiliation and niche breadth was evaluated for 250 endemic and subendemic taxa (Electronic Appendix 6, 7; apomictic genera were omitted). Grassland habitats were the richest in endemic and subendemic taxa (containing 33% of all the included taxa), followed by rocky habitats (22%), forests (16%) and shrublands (11%). Wetlands (7%), dwarf shrublands (6%) and human-made habitats (5%) hosted the lowest number of (sub)endemic taxa (Fig. 3).

(Sub)alpine and (sub)montane calcareous grasslands were the two habitats with the highest number of endemic and subendemic taxa (123 and 105, respectively). In addition, (sub)montane and (sub)alpine calcareous rocks and screes together with (sub)alpine silicate grasslands hosted a very high number of endemic and subendemic taxa (92, 73 and 75, respectively). Human-made habitats and (sub)montane shrubland (hosting only one endemic or subendemic taxon) together with natural pine forests on silicate bedrock (hosting two endemic species) are the habitats poorest in (sub)endemic species (Fig. 4).

Plant communities on calcareous bedrock hosted about twice as many (sub)endemic taxa (206; representing 50%) as plant communities on silicate bedrock (113; 28%) and plant communities indifferent to bedrock type (89; 22%) (Fig. 5A). Plant communities distributed in the subalpine and alpine altitudinal belts contained more (sub)endemic taxa (200) than plant communities in the submontane and montane belts (158) (Fig. 5B).

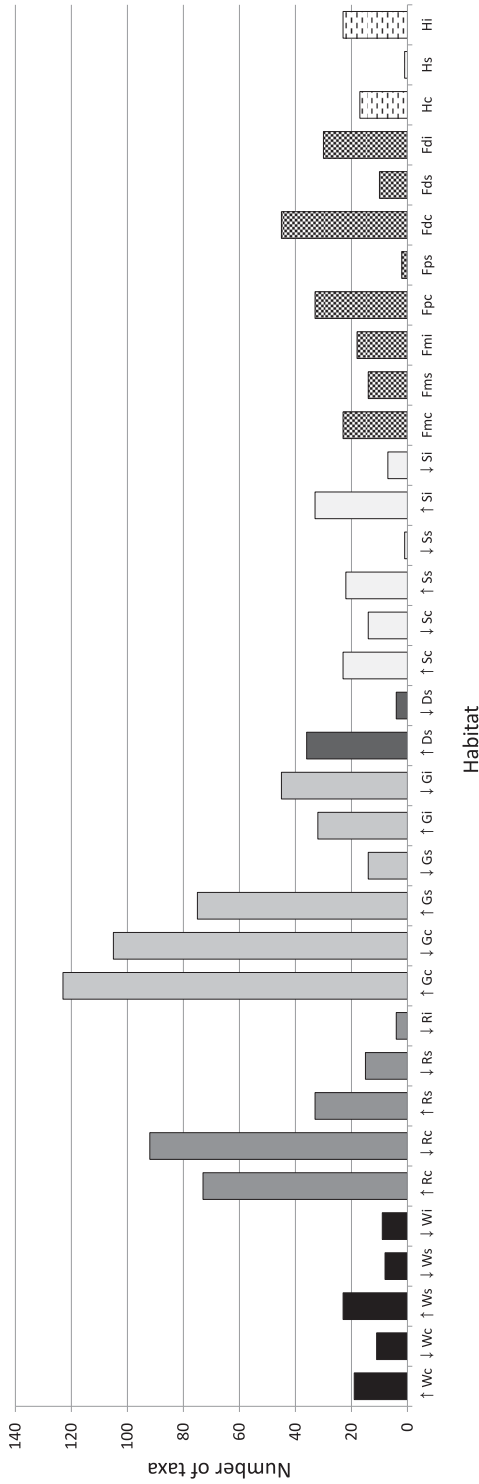


Fig. 4. – Number of (sub)endemic taxa in 35 habitats: W – wetlands, R – rocky habitats, G – grasslands, D – dwarf shrublands, S – shrublands, F – forests, H – human-made (anthropogenic) habitats; ↓ – submontane and montane vegetation, ↑ – subalpine and alpine vegetation, c – vegetation on calcareous bedrock, s – vegetation on silicate bedrock, i – vegetation indifferent to bedrock type, Fm – montane spruce forests, Fp – pine forests, Fd – deciduous and mixed forests.

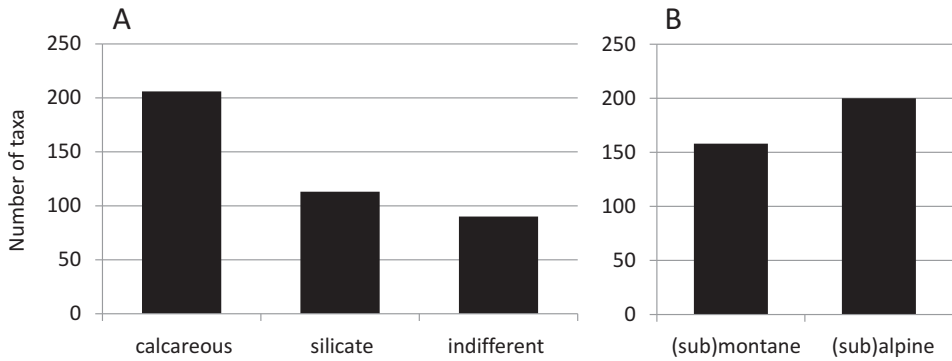


Fig. 5. – Number of (sub)endemic taxa in plant communities on different bedrock types (A) and in different altitudinal belts (B).

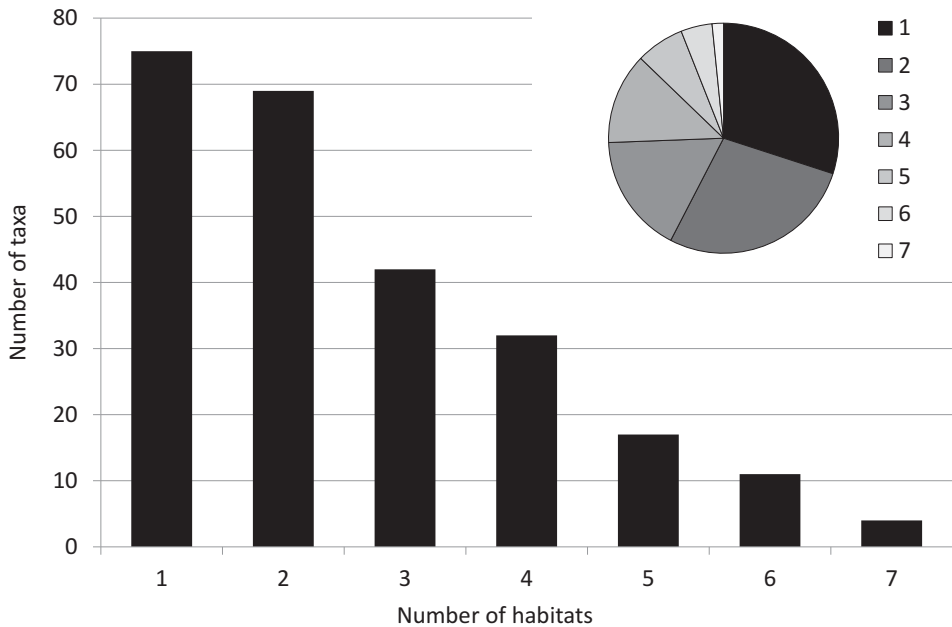


Fig. 6. – Number and proportion (pie-chart) of (sub)endemic taxa occurring in different number of broad habitat groups.

Based on our results, the four habitats with the highest frequency of (sub)endemic taxa in the Carpathian Mts are on calcareous bedrock. Phytosociologically, they represent mainly communities of the classes *Elyno-Seslerietea* and *Mulgedio-Aconitetea* (subalpine and alpine calcareous grasslands), *Carici rupestris-Kobresietea bellardii* (subalpine and alpine calcareous and acidophilous grasslands), *Festuco-Brometea* (submontane and montane calcareous grasslands), *Asplenietea trichomanis* and *Thlaspietea rotundifolii* ((sub)montane



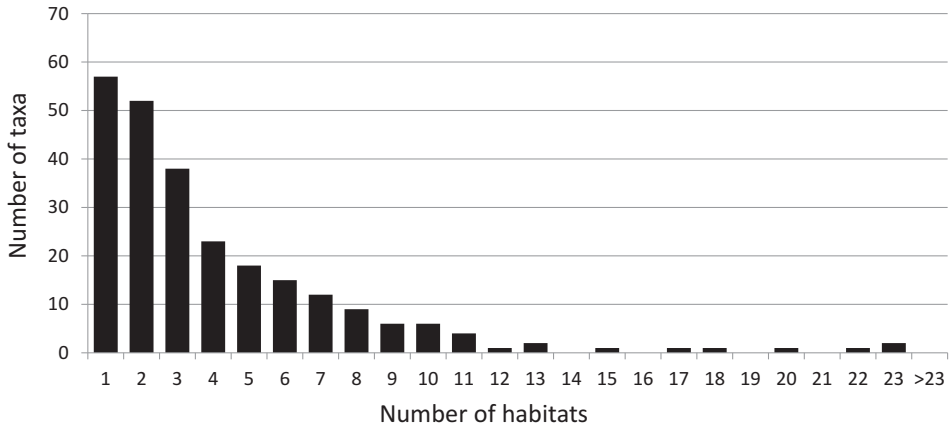


Fig. 7. – Number of (sub)endemic taxa occurring in different number of particular habitats.

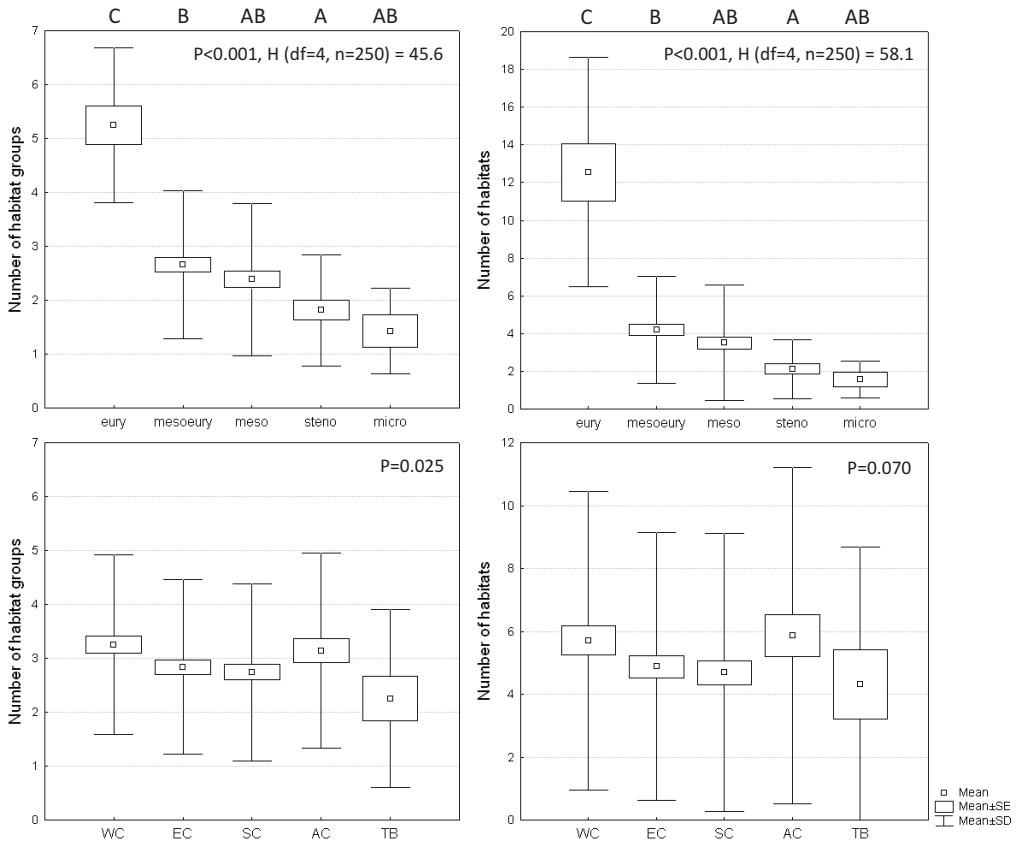


Fig. 8. – Differences in the niche breadth expressed as number of habitat groups (left pictures) and habitats (right pictures) among the taxa with decreasing geographical range (upper pictures) and among the Carpathian subunits (lower pictures). Differences were tested using Kruskal-Wallis and multiple comparison tests.

and (sub)alpine calcareous rocks and screens). These phytosociological classes are the richest in endemic and subendemic taxa in the Carpathian Mts (Electronic Appendix 6, 7).

About 60% of (sub)endemic taxa were restricted to only one, two or three habitats within one or two habitat groups (Figs 6, 7). Niche breadth of (sub)endemic taxa was positively correlated with the geographical range and did not differ among the Carpathian subunits (Fig. 8). The pan-Carpathian endemic and subendemic taxa (number of habitat groups/habitats is shown in parentheses): *Campanula serrata* (7/23), *Leucanthemum rotundifolium* (7/23), *Aconitum moldavicum* subsp. *moldavicum* (7/13), *A. firmum* subsp. *firmum* (6/20), *Hylotelephium argutum* (6/18), *Cardamine glanduligera* (6/17) and the West-Carpathian endemic *Soldanella carpatica* (7/22) are the taxa with the broadest habitat niches. On the other hand, 23% of the (sub)endemic taxa are ecologically restricted to a single habitat; 40 of these 57 taxa belong to microchoric (5), stenochoric (14) or mesochoric (21) taxa and occur on a single mountain, mountain range or a single Carpathian subunit, respectively. The rest of these taxa (17) are mesoeurychoric (recorded in two or three Carpathian subunits). Among them, several taxa occur in relatively large areas (including three subunits) although their habitat requirements are very specific (they occupy single habitat), e.g. *Festuca amethystina* subsp. *orientalis*, *Oxytropis campestris* subsp. *tatrae* and *Salvia transsylvanica*. For another three taxa with seemingly very specific habitat requirements (*Aconitum firmum* subsp. *fissurae*, *Dactylorhiza maculata* subsp. *schurii* and *Thymus dacicus*) we failed to find sufficient phytosociological and habitat data, thus the evaluation of their niche breadths should be interpreted with caution.

## Discussion

### *Differences in number of (sub)endemic taxa reported in the Carpathian Mts and their subunits in contemporary studies*

For the whole Carpathians, our revised list of endemic and subendemic taxa contains slightly more species (160 taxa distinguished at the species level not including apomictic species, 142 of which are endemic and 18 subendemic) than the survey of Pawłowski (1970), who reported 100–120 endemic and 30 subendemic species. Comparison with a more recent survey by Tassenkevich (2014) reveals a more profound differences. She recognized 504 (468 endemic and 36 subendemic) taxa at both species and subspecies levels, including apomictic genera (83 taxa of *Alchemilla*, 74 of *Hieracium*, 23 of *Rubus*, 29 of *Sorbus* and 11 of *Taraxacum*) compared to 420 (381 endemic and 39 subendemic) taxa recognized in this study (including 83 taxa of *Alchemilla*, 64 of *Hieracium*, 2 of *Pilosella*, 16 of *Sorbus* and 5 of *Taraxacum*).

Significant differences between our results and those of Tassenkevich (2014) can be found also in the number of taxa (sub)endemic to individual Carpathian subunits (however, from the Tassenkevich's study it is not clear whether apomictic genera were included or not). For the Western Carpathians we reported 108 (219 including apomicts) compared to 82 taxa; for the Eastern Carpathians 143 (179) compared to 142; for the Southern Carpathians 137 (173) compared to 121; for the Apuseni Carpathians 64 (68) compared to 41 and for the Transylvanian Basin 16 (16) compared to the 8 reported by Tassenkevich (2014). These differences result mainly from the fact that Tassenkevich (2014) based her

counts merely on Flora Europaea (Tutin et al. 1964–1980) without critical evaluation or considering more current taxonomic and chorological studies.

In addition, the number of (sub)endemic taxa in the national lists of the included countries should be updated as according to our revision the endemic status of many of the evaluated taxa has changed. The most striking differences in the number of (sub)endemic taxa were recorded for the Romanian Carpathians. In comparison to 164 non-apomictic (sub)endemic taxa confirmed by our study, Hurdu et al. (2012a, b) report only 130 taxa endemic or subendemic to the Romanian part of the Carpathians. Moreover, in our study, a high number of (sub)endemic apomictic taxa is reported as endemic for the first time from this region, including mainly 35 taxa of *Hieracium/Pilosella* (apart from *H. pojoritense* and *Pilosella ullepitschii* previously reported by Negrean & Oltean 1989 and Beldie 1967, respectively). On the other hand, for the Polish Carpathians, the number of (sub)endemic taxa indicated in our revision (76 non-apomictic and 41 apomictic taxa) is very similar to the number reported in recently published literature (76 or 74 non-apomictic and 34 apomictic taxa according to Piękoś-Mirkowa & Mirek 2003 and 2009, respectively). For the Slovak Carpathians, the main difference between the previously published (Kliment 1999) and the updated numbers of (sub)endemic taxa is the increase in the number of apomictic taxa of *Hieracium* (by 10 taxa) and *Sorbus* (by 8 taxa), resulting from current taxonomic research on these genera. For the Ukrainian Carpathians, our study confirmed a higher number of non-apomictic (88 compared to 72) and lower number of apomictic (26 compared to 44) taxa than the recent survey by Čornej (2011). For the remaining countries, Austria, Czech Republic, Hungary and Serbia, the numbers of non-apomictic+apomictic taxa confirmed by our revision were 2+0, 9+2, 18+2 and 9+0, respectively. As in these countries the numbers of (sub)endemic taxa were not published separately for regions belonging to the Carpathians, comparison with our results was not possible.

The number of endemic and subendemic species in the Alps, which is a mountain system of similar surface area and length, seems to be higher (350–400 endemic and 50 subendemic species; subspecies are not included) according to Pawłowski (1969b), whereas in our study we confirmed 142 endemic and 18 subendemic species (subspecies are not included) occurring in the Carpathians. This is probably a result of a significantly larger area of the alpine belt in the Alps than in the Carpathians (Pawłowski 1970, Ronikier 2011). According to our GIS-derived estimates, the Carpathians have an almost fifteen-times smaller surface area above 1500 m a.s.l. (4550 km<sup>2</sup> compared to 66,738 km<sup>2</sup> in the Alps) and almost eighty-times smaller surface area above 2000 m a.s.l. (446 km<sup>2</sup> compared to 35,424 km<sup>2</sup> in the Alps; E. Ravazolli in lit.). On the other hand, the number of species (sub)endemic to the Carpathians is comparable to the counts reported by Davis et al. (1994) for other European mountain systems with smaller surfaces, e.g. Pyrenees (120–200 endemic species) and South Crimean Mountains (about 220 endemic species).

Based on our results, the proportion of micro- and stenochoric taxa (with the narrowest ranges, which do not exceed a single mountain range) is the highest in the Western Carpathians. As more than half (12 out of 23) of these taxa (if apomicts are not included) occur in (sub)alpine rocky and grassland habitats, we suppose that it might be due to the higher altitude of the Western Carpathians among the Carpathian subunits. The higher altitudinal range may provide increased habitat heterogeneity as well as increased chance to survive in refuges with suitable microclimatic conditions during climatically distinct

historical periods (Pawłowski 1969b, Hobohm 2008). On the other hand, two subunits (the Apuseni Carpathians and the Transylvanian Basin) have neither steno- nor microchoric taxa (if apomicts are not included), which could be related to these subunits being at lower altitudes than other Carpathian subunits, and consequently their lower geomorphological and habitat heterogeneities. This coincidence of endemic hotspots with mountain relief is referred to by Rikli (1946) and is repeatedly reported by many authors (e.g. Hendrych 1982, Hobohm 2008, Hobohm et al. 2014).

#### *Habitat preferences and ecological niche breadths of endemic and subendemic taxa*

In Europe, taxa with a narrow geographical ranges usually occur only in open habitats with the highest concentration on rocks and screes or in grasslands and shrublands, which together cover a much smaller area than forest, agricultural or urban habitats (Rikli 1946, Pawłowski 1969b, Hendrych 1982, Davis et al. 1994, Hobohm 2008, Essl et al. 2009, Piękoś-Mirkowa & Mirek 2009, Hobohm et al. 2014). In accordance with this, we recorded 73% of the (sub)endemic taxa occurring in open habitats (including dwarf shrub communities), 11% in shrublands and 16% in forest habitats. In comparison with the Alps, (sub)endemic species in the Carpathian are not so frequently recorded in rocky habitats (22% of these species in the Carpathians compared to 35–60% of Alpine endemic taxa reported by Pawłowski 1969b, or 39% of Austrian endemic taxa reported by Essl et al. 2009).

The altitudinal distribution of the Carpathian (sub)endemic taxa is, similarly to that of the narrow-range taxa in the Alps, in contrast to altitudinal distribution of vascular plants in general. The highest species richness in most European mountain ranges is recorded at intermediate altitudes, while the occurrence of endemic and subendemic taxa is concentrated at higher altitudes (Essl et al. 2009). This was also confirmed by our finding that the majority of the Carpathian (sub)endemics occur in the alpine and subalpine belts. Similar results are reported by Piękoś-Mirkowa et al. (1996) and Piękoś-Mirkowa & Mirek (2009) in the Polish Carpathians, where most of the (sub)endemic taxa occur at altitudes between 1400 m and 2000 m, where their percentage in the total flora increases with altitude, reaching about 12% in the highest (subnival) belt.

Although habitats for acidophilous plants are more widespread than calcareous habitats in the Carpathians (Ronikier 2011), our study indicated twice as many (sub)endemic taxa occurring on calcareous bedrock than on silicate bedrock. The dominance of calciphilous over calciphobous endemics in Europe is frequently reported in both regional studies and larger-scale surveys, and is usually explained by the higher proportion of calciphilous taxa in the European species pool (Ewald 2003, Hobohm 2008) or attributed to the predominance of calcareous glacial refugia (Tribusch & Schönswetter 2003). The proportions of calciphilous and acidophilous (sub)endemics reported in the literature is similar [e.g. 59:29 reported for Austria by Essl et al. (2009)] or higher [e.g. 4–5:1 or 4–7:1 reported for Europe by Hobohm (2008) and Hobohm et al. (2014), respectively] than was indicated by our study. For the Carpathian Mts Tasenkevich (2014) reports 148 calciphilous and 13 obligate calciphobous taxa, while 58 taxa she considered as indifferent to substrate (these numbers were, however, not supported by specific data). The differences in the proportions of calciphilous and acidophilous endemics recorded in the literature and in our study might be partly caused by the different approach. While the above mentioned

studies evaluated species preferences for a particular type of substrate directly, our evaluation was based on types of habitats occupied by (sub)endemic species.

The extraordinary richness of calcareous grassland and rock-scrub habitats in terms of (sub)endemic taxa indicated by our study is also reported by authors of studies on the Carpathians (Piękoś-Mirkowa & Mirek 2009) and Alps (Essl et al. 2009). According to Piękoś-Mirkowa & Mirek (2009), the vegetation of the *Elyno-Seslerietea* (*Seslerietea varia*), *Mulgedio-Aconitetea* (*Betulo-Adenostyletea*) and *Thlaspietea rotundifolii* host most endemic and subendemic taxa in the Polish Carpathians. In the Western Carpathians (Mráz et al. 2016), the highest number of (sub)endemic taxa is in the three alliances within the *Elyno-Seslerietea* class (*Caricion firmae*, *Astero alpini-Seslerion calcariae* and *Seslerion tatrae*) and one alliance of the *Roso pendulinae-Pinetea mugo* class (*Pinion mugo*). The extraordinary representation of endemic and subendemic species in high-altitude habitats (vegetation of the *Carici rupestris-Kobresietea bellardii*, *Elyno-Seslerietea* and *Salicetea herbaceae*) is reported by Kliment et al. (2011).

Similar to other studies (e.g. Essl et al. 2009), niche breadths of the Carpathian (sub)endemic taxa was related to range size. The fact that eurychoric taxa had the broadest niches and micro- and stenochoric taxa had the narrowest niches is in accordance with the well known strong positive relationships between local frequency and regional occupancy by species (e.g. Gaston & Blackburn 2000) and between range size and niche breadth (e.g. Slatyer et al. 2013). Several ecological and evolutionary mechanisms are believed to explain range size (see Slatyer et al. 2013 for a review), dispersal ability, evolutionary age, historical events and the total area and distribution of the habitat colonized, being some of the most important. From this point of view, it is important to understand the ecological and evolutionary mechanisms that drive and cause deviations from this niche breadth–range size pattern, e.g. why the distribution of *Soldanella carpatica* adapted to a broad range of habitats in the Western Carpathians is restricted to a single Carpathian subunit, or why the occurrence of *Festuca amethystina* subsp. *orientalis* is restricted to a single grassland habitat although its distribution range is rather wide. Further research is necessary to explain these specific niche breadth–range size patterns.

See [www.preslia.cz](http://www.preslia.cz) for Electronic Appendices 1–7.

## Acknowledgement

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## Súhrn

Prezentovaný krátko komentovaný prehľad endemických a subendemických taxónov cievnatých rastlín Karpát vznikol na základe kritickej revízie publikovaných aj nepublikovaných údajov, so zohľadnením aktuálnych taxonomických a chorologických poznatkov. Referenčné územie reprezentuje horská sústava Karpát s priľahlou časťou strednej, východnej a juhovýchodnej Európy. Prevažná časť Karpát sa rozprestiera na teritóriu Slovenska, Poľska, Ukrajiny a najmä Rumunska. Zasahujú však aj na územie Rakúska, Českej republiky, Maďarska a Srbska. Členíme ich na 5 rovnocenných podcelkov: Západné Karpaty, Východné Karpaty, Južné Karpaty, Apusenské Karpaty a Transilvánsku (Sedmohradskú) kotlinu. Do výsledného hodnotenia bolo zaradených 631 taxónov cievnatých rastlín, ktoré boli v excerptovanej literatúre hodnotené ako endemity a subendemity Karpát a ich subregiónov. Po preštudovaní areálu a ujasnení si ich taxonomického statusu bol endemický status potvrdený pre 420 taxónov. Zostávajúce možno rozčleniť do nasledovných skupín: taxóny s nedoriešenou taxonomiou príp. chorológiou (67); taxóny so širším reálnym rozšírením, výrazne presahujúcim hranice Karpát (69); taxóny zahrnuté do synonymiky taxónov s väčším, nie endemickým rozšírením (58); krížence (17). Finálny zoznam endemických a subendemických taxónov zahŕňa 146 druhov, 104 poddruhov a 170 mikrospecies apomiktických rodov (*Alchemilla*: 83, *Hieracium*: 64, *Pilosella*: 2, *Sorbus*: 16, *Taraxacum*: 5). Ich zastúpenie v jednotlivých podcelkoch Karpát je nasledovné (v zátvorkách uvedené počty zahŕňajú aj druhy apomiktických rodov): Západné Karpaty: 89 (198) endemitov, 19 (21) subendemitov; Východné Karpaty: 118 (152) endemitov, 25 (27) subendemitov; Južné Karpaty: 113 (149) endemitov, 24 (24) subendemitov; Apusenské Karpaty: 45 (49) endemitov, 19 (19) subendemitov; Transilvánska kotlina: 5 (5) endemitov, 12 (12) subendemitov. Popri vlastnom rozšírení jednotlivých taxónov sme podrobnejšie študovali aj ich stanovištnú preferenciu a šírku ekologickej niky; z hodnotenia sme (vzhľadom na absenciu resp. nerovnomernú kvalitu dát) vynechali druhy vyššie zmienené apomiktických rodov. Ako najbohatšie na endemické a subendemické taxóny sa javia trávno-bylinné biotopy (33 % z 250 hodnotených taxónov); nasledujú ich skalné biotopy (22 %), lesy (16 %) a kroviny (11 %). Najnižší počet (sub)endemitov hostia mokrade (7 %), spoločenstvá nízkych kríčkov (6 %) a antropogénne biotopy (5 %). Biotopy s najvyšším zastúpením (sub)endemických taxónov sa v Karpatoch viažu na vápencový podklad; fytoecologicky sú zaradované do tried *Elyno-Seslerietea*, *Mulgedio-Aconitetea*, *Thlaspietea rotundifolii*, *Asplenieta trichomanis*, *Carici rupestris-Kobresietea* a *Festuco-Brometea*. Šírka niky karpatských (sub)endemitov koreluje s veľkosťou areálu (eurychórické taxóny majú najširšie niky, mikro- a stenochórické najužšie). Približne 60 % (sub)endemických taxónov patrí medzi stanovištných špecialistov viazaných len na 1–3 typy biotopov.

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Appendix 1. – Vascular plants endemic and subendemic to the Carpathians and their subunits. Apomictic taxa are marked (rows with a grey background; these taxa were omitted from the ecological analyses). If all subspecies of particular species are endemic, we mention the species also separately in the table (rows with dark grey background; these species were not included in the statistical evaluations). Abbreviations: AC – Apuseni Carpathians, EC – Eastern Carpathians, SC – Southern Carpathians, Tr – Transylvanian Basin, WC – Western Carpathians; A – Austria, CZ – Czech Republic, HU – Hungary, PL – Poland, RO – Romania, SK – Slovakia, SRB – Serbia, UA – Ukraine. Subunits with only scattered/sporadic occurrence of the evaluated taxon are listed at the end, separated by a slash, e.g. EC (PL, UA, RO), SC (RO), AC (RO)/WC (PL). See Electronic Appendix 1 for the full version of the Table that includes footnotes 1–199, and complete References.

<b>Taxon</b>	<b>Occurrence in the Carpathians</b>	<b>Category of endemism</b>	<b>References</b>
<i>Achillea oxyloba</i> subsp. <i>scharii</i> (Sch. Bip.) Heimert (Syn.: <i>A. scharii</i> Sch. Bip.; <i>Parnica tenuifolia</i> (Schur) Schur)	EC (UA, RO), SC (RO)	East-South-Carpathian endemic	Morariu & Beldie 1976; Oprea 2005; Ciocărlan 2009; Počynok & Prokopiv 2010; Sârbu et al. 2013; Ziman & Derbak 2013
<i>Aconitum bucovinense</i> Zapal. (Syn.: <i>A. callitryon</i> subsp. <i>bucovinense</i> (Zapat.) Grinț.; <i>A. firmum</i> subsp. <i>bucovinense</i> (Zapat.) Graebn. et P. Graebn.)	EC (PL, UA, RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Starmühler 1998a, b, 2000; Mitka 2001, 2002, 2003, 2012; Ilnicki & Mitka 2009; Boroi et al. 2011; Novikoff & Mitka 2011a, b
<i>Aconitum degenii</i> Gáyer subsp. <i>degenii</i> <sup>1</sup> (Syn.: <i>A. paniculatum</i> subsp. <i>degenii</i> (Degen) Graebn.)	WC (SK), EC (PL, UA, RO), SC (RO), AC (RO)	West-East-South-Apuseni-Carpathian (pan-Carpathian) endemic	Mucher 1993; Starmühler 1997, 1998a, b, 2000; Mitka 2001, 2003; Ilnicki & Mitka 2011; Novikoff & Mitka 2011a, b; Novikov 2013a; Eliáš jr. et al. 2015
<i>Aconitum firmum</i> Rchb.	WC (CZ, SK, PL), EC (UA, RO), SC (RO), AC (RO)	West-East-South-Apuseni-Carpathian (pan-Carpathian) subendemic	Starmühler 1997, 1998b, 2000; Mitka 2001, 2003; Starmühler & Mitka 2001; Mihok et al. 2005; Novikoff & Mitka 2011a, b
<i>Aconitum firmum</i> Rchb. subsp. <i>firmum</i> (Syn.: <i>A. napellus</i> subsp. <i>firmum</i> (Rchb.) Gáyer; <i>A. firmum</i> subsp. <i>palmatifidum</i> (Rchb.) Beldie)	WC (SK, PL), EC (UA, RO), SC (RO), AC (RO)	West-East-South-Apuseni-Carpathian (pan-Carpathian) endemic	Skalický 1990; Starmühler 1997, 1998b, 2000; Mitka 2001, 2003; Starmühler & Mitka 2001; Mitka et al. 2007; Novikoff & Mitka 2011a
<i>Aconitum firmum</i> subsp. <i>fissurae</i> Nyár. <sup>2,3</sup> (Syn.: <i>A. hunyadense</i> Degen; <i>A. romanicum</i> Wolf.)	EC (UA, RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian subendemic	Starmühler 1996a, 1997, 1998b, 1999, 2000; Mitka 2001, 2002; Starmühler & Mitka 2001; Ilnicki & Mitka 2009; Novikoff & Mitka 2011a
<i>Aconitum firmum</i> subsp. <i>maninense</i> (Skalický) Starm.	WC (SK, PL)	West-Carpathian endemic	Starmühler & Mitka 2001; Mitka 2003; Mitka et al. 2007; Ilnicki & Mitka 2009
(Syn.: <i>A. firmum</i> var. <i>maninense</i> Skalický)			
<i>Aconitum firmum</i> subsp. <i>moravicum</i> Skalický	WC (CZ, SK, PL)	West-Carpathian endemic	Skalický 1990; Mitka 2003; Mitka et al. 2007; Ilnicki & Mitka 2009
<i>Aconitum firmum</i> subsp. <i>skerisorae</i> (Gáyer) Starm. <sup>4</sup> (Syn.: <i>A. skerisorae</i> Gáyer; <i>A. napellus</i> subsp. <i>skerisorae</i> (Gáyer) Seitz)	AC (RO)	Apuseni-Carpathian endemic	Starmühler 2000; Mitka 2003

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Aconitum lasianthum</i> (Rehb.) Simonk. <sup>5</sup> (Syn.: <i>A. vulparia</i> subsp. <i>lasianthum</i> (Rehb.) Cioacărlan)	SC (RO)/EC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Griņtescu 1953; Morariu & Beldie 1976; Starmühler 1999; Oprea 2005
<i>Aconitum lasiocarpum</i> (Rehb.) Gáyer (Syn.: <i>A. paniculatum</i> subsp. <i>lasiocarpum</i> (Rehb.) Soó; <i>A. toxicum</i> subsp. <i>lasiocarpum</i> (Rehb.) Griņč.)	WC (SK, PL), EC (SK, PL, UA, RO), †SC (RO)	West-East-Carpathian subendemic	Joachimiak et al. 1999; Mitka & Starmühler 2000; Mitka 2001, 2003; Ilnicki & Mitka 2011; Novikoff & Mitka 2011a, b
<i>Aconitum lasiocarpum</i> (Rehb.) Gáyer subsp. <i>lasiocarpum</i> <sup>6</sup>	EC (SK, PL, UA, RO)	East-Carpathian endemic	Mitka & Starmühler 2000; Mitka 2001, 2003; Ilnicki & Mitka 2011; Novikoff & Mitka 2011a, b
<i>Aconitum lasiocarpum</i> subsp. <i>kotulae</i> (Pawł.) Starm. et Mitka <sup>7,8</sup> (Syn.: <i>A. variegatum</i> subsp. <i>kotulae</i> Pawł.)	WC (SK, PL), EC (SK, PL, UA, RO), †SC (RO)	West-East-Carpathian subendemic	Mitka & Starmühler 2000; Mitka 2001, 2003; Ilnicki & Mitka 2011; Novikoff & Mitka 2011a, b
<i>Aconitum moldavicum</i> Hacq. (Syn.: <i>A. lycocotum</i> subsp. <i>moldavicum</i> (Hacq.) Jalas)	WC (SK, PL, HU), EC (SK, PL, UA, RO), SC (RO), AC (RO)	West-East-South-Apuseni-Carpathian (pan-Carpathian) subendemic	Mitka 2003; Mihok et al. 2005; Novikoff & Mitka 2011a, b; Mitka et al. 2013
<i>Aconitum moldavicum</i> Hacq. subsp. <i>moldavicum</i> <sup>9</sup>	WC (SK, PL, HU), EC (SK, PL, UA, RO), SC (RO), AC (RO)	West-East-South-Apuseni-Carpathian (pan-Carpathian) subendemic	Mitka 2003, 2008; Novikoff & Mitka 2011a, b
<i>Aconitum moldavicum</i> subsp. <i>hosteanum</i> (Schur) Graebn. et P. Graebn. <sup>10</sup> (Syn.: <i>A. hosteanum</i> Schur; <i>A. moldavicum</i> subsp. <i>hosteanum</i> (Schur) Beldie, nom. illeg.)	EC (PL, UA, RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian subendemic	Mitka 2003, 2008; Čornej 2011; Novikoff & Mitka 2011a, b
<i>Aconitum toxicum</i> Rehb. subsp. <i>toxicum</i> <sup>11</sup>	EC (RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian subendemic	Mucher 1993; Mitka 2001; Ilnicki & Mitka 2011
<i>Aconitum toxicum</i> subsp. <i>bucegiense</i> (Nyar.) Mucher	EC (RO), SC (RO)	East-South-Carpathian endemic	Mucher 1993; Mitka 2001; Starmühler & Mitka 2001
<i>Aconitum toxicum</i> subsp. <i>crispulum</i> (Nyar.) Mucher	SC (RO)	South-Carpathian endemic	Mucher 1993; Starmühler & Mitka 2001
<i>Alchemilla acrostegia</i> Plocek	WC (SK)	West-Carpathian endemic (Západné Tatry Mts; Červené vrehy massif)	Plocek 1992; Kliment 1999; Kurtto et al. 2007
<i>Alchemilla aequidens</i> Pawl.	WC (SK; PL)	West-Carpathian endemic	Plocek 1992; Kliment 1999; Kurtto et al. 2007
<i>Alchemilla amauroptera</i> Plocek	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Plocek 1992; Kliment 1999; Kurtto et al. 2007

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Alchemilla ambyloides</i> Plocek	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla amicornum</i> Pawl.	WC (SK, PL)	West-Carpathian endemic (Západné Tatry Mts: Červené vrchy massif)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla anceps</i> Plocek	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla animosa</i> Plocek	WC (SK)	West-Carpathian endemic	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla aspera</i> Plocek	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla babiogorensis</i> Pawl.	WC (PL), EC (UA)	West-East-Carpathian endemic	Volgin & Syčák 1989a; Plocek 1992; Syčák 2002, 2011
<i>Alchemilla bogumili</i> Pawlus	WC (SK, PL)	West-Carpathian endemic	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla boleslai</i> Pawl. <sup>12</sup>	WC (SK, PL)	West-Carpathian endemic	Plocek 1983, 1992; Kliment 1999; Kurtto et al. 2007; Negrean 2011
<i>Alchemilla brachycodon</i> Plocek	WC (SK)	West-Carpathian endemic (Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla braun-blانquetii</i> Pawl.	WC (PL), EC (UA)	West-East-Carpathian endemic	Plocek 1992; Syčák 2002, 2011; Kurtto et al. 2007
<i>Alchemilla bucovinensis</i> Sytschak <sup>13</sup>	EC (UA, RO)	East-Carpathian endemic	Syčák 1992, 2002, 2011; Kurtto et al. 2007
<i>Alchemilla calviflora</i> Plocek	WC (PL)	West-Carpathian endemic (Tatry Zachodnie Mts: Czerwone Wierchy massif)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla chalarodesma</i> Plocek	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Plocek 1990; Kliment 1999; Kurtto et al. 2007
<i>Alchemilla chiliritricha</i> Plocek	WC (SK)	West-Carpathian endemic (Západné Tatry Mts: Sivý vrch Mt. group)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla contractilis</i> (Plocek) Fröhner	WC (SK), SC (RO)	West-South-Carpathian endemic	Plocek 1992; Kurtto et al. 2007; Negrean 2011
<i>Alchemilla crassa</i> Plocek	WC (SK)	West-Carpathian endemic	Plocek 1992; Kliment 1999; Kurtto et al. 2007
<i>Alchemilla curtischista</i> Plocek	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla czywczynensis</i> Pawl. <sup>14</sup>	EC (UA, RO)	East-Carpathian subendemic	Pawłowski 1952; Fröhner 1986; Syčák 2002, 2011; Kurtto et al. 2007, 2009
<i>Alchemilla decurrens</i> Plocek	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Plocek 1992; Kurtto et al. 2007

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<i>Alchemilla delitescens</i> Plocek	WC (SK)	West-Carpathian endemic (Oravské Beskydy Mts)	Plocek 1992; Kliment 1999; Kurtto et al. 2007
<i>Alchemilla deylii</i> Plocek ex Soják	EC (UA)	East-Carpathian endemic	Soják 1983; Syčák 2002, 2011; Kurtto et al. 2007
<i>Alchemilla dolichotoma</i> Plocek	EC (RO), SC (RO)	East-South-Carpathian endemic	Plocek 1985; Kurtto et al. 2007
<i>Alchemilla dostalii</i> Plocek	WC (SK)	West-Carpathian endemic (Západné Tatry Mts: Mt. Osobitá)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla echinogloba</i> Plocek	WC (SK)	West-Carpathian endemic (Oravské Beskydy Mts: Mt. Pilsko)	Plocek 1992; Kliment 1999; Kurtto et al. 2007
<i>Alchemilla erythropodoides</i> Pawl.	WC (SK)	West-Carpathian endemic (Tatry Mts)	Fröhner 1968, 1975; Kurtto et al. 2007
<i>Alchemilla eugenii</i> Pawl. <sup>15</sup>	WC (PL, ?SK)	West-Carpathian endemic (Tatry Zachodnie Mts: Czerwone Wierchy massif)	Pawłowski 1952; Plocek 1992; Kurtto et al. 2007
<i>Alchemilla exaperta</i> Plocek	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla fusoides</i> Plocek	WC (SK)	West-Carpathian endemic (Oravské Beskydy Mts: Mt. Pilsko)	Plocek 1992; Kliment 1999; Kurtto et al. 2007
<i>Alchemilla giewontica</i> Pawl.	WC (PL)	West-Carpathian endemic (Tatry Zachodnie Mts: Mt. Giewont)	Plocek 1992; Kurtto et al. 2007; Mirek & Piękoś-Mirkowa 2010
<i>Alchemilla grandiceps</i> Plocek	WC (SK)	West-Carpathian endemic (Oravské Beskydy Mts: Mt. Babia hora)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla gruneca</i> Plocek <sup>16</sup>	WC (CZ, SK)	West-Carpathian subendemic	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla gymnopoda</i> Plocek	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla hoverlensis</i> Pawlus et Lovelius	EC (UA)	East-Carpathian endemic (Cornohora Mts)	Pawlus 1988; Syčák 1992, 2011; Kurtto et al. 2007
<i>Alchemilla hyperpyrycha</i> Plocek	WC (SK)	West-Carpathian endemic (Vysoké Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla isodonta</i> Plocek	WC (SK)	West-Carpathian endemic (Nizke Beskydy Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla jasiewiczii</i> Pawl.	WC (PL)	West-Carpathian endemic (Tatry Wysokie Mts)	Plocek 1992; Kurtto et al. 2007; Mirek & Piękoś-Mirkowa 2010
<i>Alchemilla kornasiana</i> Pawl.	WC (PL), EC (UA)	West-East-Carpathian endemic	Plocek 1992; Syčák 2002, 2011; Kurtto et al. 2007



<b>Taxon</b>	<b>Occurrence in the Carpathians</b>	<b>Category of endemism</b>	<b>References</b>
<i>Alchemilla kostarensis</i> Plocek	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla kulczyiskii</i> Pawl.	WC (SK, PL)	West-Carpathian endemic (Západné Tatry Mts: Červené vrchy massif)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla ladislai</i> Pawl. <sup>17</sup>	WC (SK, PL)	West-Carpathian endemic (Západné Tatry Mts: Červené vrchy massif)	Plocek 1992; Syčák 2002, 2011; Kurtto et al. 2007
<i>Alchemilla laevipes</i> Plocek	WC (SK)	West-Carpathian endemic (Oravské Beskydy Mts: Mt. Babia hora)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla laxa</i> Plocek <sup>18</sup>	WC (SK)	West-Carpathian endemic (Oravské Beskydy Mts: Mt. Pilsko)	Plocek 1990, 1992; Kliment 1999; Kurtto et al. 2007
<i>Alchemilla longidens</i> Plocek	WC (SK)	West-Carpathian endemic (Oravské Beskydy Mts: Mt. Babia hora)	Plocek 1990, 1992; Kliment 1999; Kurtto et al. 2007
<i>Alchemilla lorata</i> Plocek	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla loxotropa</i> Plocek	WC (SK)	West-Carpathian endemic (Oravské Beskydy Mts: Mt. Babia hora)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla ludovittiana</i> Plocek	WC (SK)	West-Carpathian endemic (Branisko Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla marginata</i> Plocek <sup>19</sup>	WC (SK)	West-Carpathian endemic (Vysoké Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla megalodonta</i> Plocek	WC (SK)	West-Carpathian endemic (Vysoké Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla microsphaerica</i> Fröhner	WC (SK, PL)	West-Carpathian endemic	Plocek 1992; Kliment 1999; Kurtto et al. 2007
<i>Alchemilla moncophila</i> Plocek	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla multiloba</i> Plocek	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla obesa</i> Plocek	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Plocek 1992; Kurtto et al. 2007

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Alchemilla oculimarina</i> Pawl.	WC (SK, PL)	West-Carpathian endemic (Vysoké Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla patens</i> Plocek	WC (SK)	West-Carpathian endemic (Nizke Tatry Mts)	Plocek 1992; Šípošová et al. 2004b; Kurtto et al. 2007
<i>Alchemilla polonica</i> Pawl. (Syn.: <i>A. pseudincisa</i> var. <i>polonica</i> (Pawl.) Plocek)	WC (SK, PL)	West-Carpathian endemic	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla pseudincisa</i> Pawl.	WC (SK, PL), EC (UA)	West-East-Carpathian endemic	Volgim & Syčák 1989b; Plocek 1992; Syčák 2002, 2011; Kurtto et al. 2007
<i>Alchemilla pseudothamni</i> Pawl.	WC (PL)	West-Carpathian endemic (Tatry Zachodnie Mts: Czerwone Wierchy massif)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla reversantha</i> Plocek (Syn.: <i>A. inversa</i> Plocek non Juz., nom. illeg.)	WC (SK)	West-Carpathian endemic (Veľká Fatra Mts)	Plocek 1992; Šípošová et al. 2004a; Kurtto et al. 2007
<i>Alchemilla rhodobasis</i> Plocek	WC (SK)	West-Carpathian endemic (Západné Tatry Mts: Sivý vrch Mt. group)	Plocek 1986, 1992; Kliment 1999; Kurtto et al. 2007
<i>Alchemilla rhodocyela</i> Plocek	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla sejuncta</i> Plocek	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla sericoneuroides</i> Pawl.	WC (SK, PL)	West-Carpathian endemic (Tatry Mts)	Plocek 1992; Kliment 1999; Kurtto et al. 2007
<i>Alchemilla smaragdina</i> Plocek	WC (SK)	West-Carpathian endemic	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla smytimensis</i> Pawl.	WC (PL), EC (UA)	West-East Carpathian endemic	Syčák 1992, 2011; Kurtto et al. 2007
<i>Alchemilla sojakii</i> Plocek	WC (SK)	West-Carpathian endemic (Krivánska Fatra Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla sokolowskii</i> Pawl. <sup>20</sup>	WC (PL)	West-Carpathian endemic (Tatry Zachodnie Mts: Czerwone Wierchy massif)	Plocek 1992; Kurtto et al. 2007; Mirek & Piękoś-Mirkowa 2010
<i>Alchemilla stanistae</i> Pawl.	WC (SK, PL)	West-Carpathian endemic (Tatry Mts, Nizke Tatry Mts) <sup>21</sup>	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla stenoleuca</i> Plocek	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla suavis</i> Plocek <sup>22</sup>	WC (CZ, SK)	West-Carpathian endemic	Plocek 1973, 1992; Syčák 1992, 2011; Kurtto et al. 2007

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Alchemilla subsexsilis</i> Plocek	WC (SK)	West-Carpathian endemic (Oravské Beskydy Mts; Mt. Pilsko)	Plocek 1992; Kliment 1999; Kurtto et al. 2007
<i>Alchemilla superata</i> Plocek	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla saferi</i> Pawl.	EC (UA)	East-Carpathian endemic	Syčák 2002, 2011; Kurtto et al. 2007
<i>Alchemilla tacikii</i> Plocek	WC (SK, PL)	West-Carpathian endemic (Vysoké Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla thaumasia</i> Plocek	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla turkulensis</i> Pawl.	EC (PL, UA)	East-Carpathian endemic	Syčák 2002, 2011; Kurtto et al. 2007
<i>Alchemilla versipiloides</i> Pawl. <sup>23</sup>	WC (PL)	West-Carpathian endemic (Tatry Zachodnie Mts; Czerwone Wierchy massif)	Plocek 1992; Kurtto et al. 2007; Piękoś-Mirkowa & Mirek 2009; Mirek & Piękoś-Mirkowa 2010
<i>Alchemilla virginea</i> Plocek	WC (SK)	West-Carpathian endemic (Krivánska Fatra Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla wallischii</i> Pawl.	WC (SK, PL)	West-Carpathian endemic (Tatry Mts, Nízke Tatry Mts)	Plocek 1992; Kurtto et al. 2007
<i>Alchemilla zapalowiczii</i> Pawl. <sup>24</sup>	WC (†SK), EC (UA)	East-Carpathian subendemic	Walters & Pawłowski 1968; Plocek 1992; Kurtto et al. 2007, 2009; Negrean 2011
<i>Alchemilla zmudae</i> Pawl. <sup>25</sup>	WC (PL)	West-Carpathian endemic (Tatry Mts)	Plocek 1992; Kurtto et al. 2007; Mirek & Piękoś-Mirkowa 2009, 2010
<i>Allium fussii</i> A. Kern. <sup>26</sup> (Syn.: <i>A. fuscum</i> subsp. <i>fussii</i> (A. Kern.) Ciocărlan; <i>A. paniculatum</i> subsp. <i>fussii</i> (A. Kern.) Ciocărlan, nom. illeg.)	EC (RO), SC (RO)	East-South-Carpathian endemic	Brulló et al. 1996; Mráz 2005a; Oprea 2005; Ciocărlan 2009; Šafařová et al. 2011
<i>Alopecurus pratensis</i> subsp. <i>laguriformis</i> (Schur) Tzvelev (Syn.: <i>A. laguriformis</i> Schur)	EC (UA, RO), SC (RO)	East-South-Carpathian endemic	Morariu & Beldie 1976; Oprea 2005; Čornej 2011; Tassenkevich 2011
<i>Andryala laevitomentosa</i> (Nyár. ex Sennikov) P. D. Sell ex Greuter <sup>27, 28</sup> (Syn.: <i>Pietrostia laevitomentosa</i> Nyár. ex Sennikov)	EC (RO)	East-Carpathian endemic (Bistrița Mts; Mt. Pietrosul Broștenilor)	Morariu & Beldie 1976; Beldie 1979; Dihoru & Pârvu 1987; Sennikov 1999; Greuter 2003; Oprea 2005, 2007; Negrea & Pricop 2009a, b; Ferreira et al. 2015
<i>Antennaria carpatuca</i> (Wahlenb.) Bluff et Fingerh. subsp. <i>carpatuca</i> <sup>29</sup>	WC (SK, PL), EC (UA); †RO (EC, SC)	West-East-Carpathian endemic	Chrtěk & Pouzar 1985; Oltean et al. 1994; Kliment 1999; Oprea 2005; Ciocărlan 2009; Sárbu et al. 2013; Ziman & Derbak 2013

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Anthemis cretica</i> subsp. <i>pyrethroidiformis</i> (Schur) Govaerts <sup>30,31</sup> (Syn.: <i>A. carpatica</i> subsp. <i>pyrethroidiformis</i> (Schur) Prodan)	SC (RO)/EC (RO)	East-South-Carpathian endemic	Morariu & Beldie 1976; Beldie 1979; Oprea 2005; Sárbu et al. 2013
<i>Anthemis kitaibelii</i> Spreng. (Syn.: <i>A. cretica</i> subsp. <i>kitaibelii</i> (Spreng.) Ciocârlan)	SC (RO), AC (RO)	South-Apuseni-Carpathian endemic	Oprea 2005; Hurdu et al. 2012a, b
<i>Aquilegia nigricans</i> subsp. <i>subscaposa</i> (Borbás) Soó (Syn.: <i>A. subscaposa</i> Borbás; <i>A. vulgaris</i> subsp. <i>subscaposa</i> (Borbás) Borza)	EC (RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Morariu & Beldie 1976; Oprea 2005; Dihoru & Negrean 2009
<i>Aquilegia transilvanica</i> Schur <sup>32</sup>	SC (RO)/EC (RO)	East-South-Carpathian endemic	Oprea 2005; Kobiv 2012b
<i>Arabisopsis halleri</i> subsp. <i>tatrica</i> (Pawl.) Kolnik (Syn.: <i>Cardaminopsis halleri</i> subsp. <i>tatrica</i> (Pawl.) Dostál ex Mészéček)	WC (SK, PL)	West-Carpathian endemic	Kolník & Marhold 2006
<i>Arabisopsis neglecta</i> (Schult.) O'Kane et Al-Shehbaz <sup>33</sup> (Syn.: <i>Cardaminopsis neglecta</i> (Schult.) Hayek)	WC (SK, PL), EC (UA), RO, SC (RO)	West-East-South-Carpathian endemic	Jalas & Suominen 1994; Kliment 1999; Mészéček 2002; Oprea 2005
<i>Arenaria tenella</i> Kit. (Syn.: <i>A. ciliata</i> subsp. <i>tenella</i> (Kit.) Braun-Blanquet)	WC (SK, PL)	West-Carpathian endemic (Tatry Mts)	Perný & Michalková 2012
<i>Armeria maritima</i> subsp. <i>barcensis</i> (Simonk.) P. Silva (Syn.: <i>A. barcensis</i> Simonk.)	EC (RO)	East-Carpathian endemic	Beldie 1979; Dihoru & Pärnu 1987; Ciocârlan 2009
<i>Armeria pocutica</i> Pawl. <sup>34</sup>	EC (RO)	East-Carpathian endemic	Beldie 1979; Dihoru & Pärnu 1987; Ciocârlan 2009
<i>Asperula carpatica</i> Morariu <sup>35</sup>	EC (?UA, RO)	East-Carpathian endemic (Maramureş Mts)	Pawlowski 1962; Ciocârlan 1988, 2009; Kahalo & Syčák 2009; Negrean 2011
<i>Astragalus australis</i> subsp. <i>krájiniae</i> (Domin) Domin <sup>36</sup> (Syn.: <i>A. krájiniae</i> Domin)	EC (RO)/SC (RO) EC (UA)	East-South-Carpathian endemic East-Carpathian endemic	Negrean 2011 Domin 1931, 1935; Witkowski et al. 2003; Ziman 2009; Čornej 2011
<i>Astragalus excapus</i> subsp. <i>transsilvanicus</i> (Schur) Nyár. (Syn.: <i>A. excapus</i> var. <i>transsilvanicus</i> (Schur) Gams)	Tr (RO)	endemic to Transylvanian Basin	Roman et al. 1996; Dihoru & Negrean 2009
<i>Astragalus peterfii</i> Jáv. <sup>37</sup>	Tr (RO)	endemic to Transylvanian Basin	Roman et al. 1996; Şuteu et al. 2003; Dihoru & Negrean 2009; Bartha 2012

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Astragalus pseudopurpureus</i> Guşul.	EC (RO)	East-Carpathian endemic (Hâşmaş Mts)	Ciocărlan 2009; Dihoru & Negrean 2009
<i>Astragalus roemeri</i> Simonk. <sup>38</sup>	EC (RO)/AC (RO)	East-Apuseni-Carpathian endemic	Váczy & Beldie 1976; Dihoru & Negrean 2009; Bartha & Bartók 2013
<i>Alhambania turbith</i> subsp. <i>hungarica</i> (Borbás) Tutin <sup>39</sup> (Syn.: <i>A. hungarica</i> Borbás)	SC (RO, SRB)	South-Carpathian endemic	Stevanović et al. 1991; Popescu et al. 2003; Hurdu et al. 2012a, b; Sárbu et al. 2013
<i>Aubrieta columnae</i> subsp. <i>platycarpa</i> (Ciocărlan) Ciocărlan <sup>40</sup> (Syn.: <i>A. intermedia</i> subsp. <i>falcata</i> Ciocărlan)	SC (RO)	South-Carpathian endemic (Piatra Craiului Mts)	Beldie & Váczy 1976; Oprea 2005; Ciocărlan 2006, 2009; Negrean 2011
<i>Barbarea lepuznica</i> Nyár. <sup>41</sup> (Syn.: <i>B. vulgatis</i> subsp. <i>lepuznica</i> (Nyár.) Soó)	SC (RO)	South-Carpathian subendemic	Dihoru & Párvu 1987; Ciocărlan 2009; Dihoru & Negrean 2009; Strajeru & Stevanović 2013
<i>Bromus monocladus</i> Domin <sup>42</sup> (Syn.: <i>B. pannonicus</i> subsp. <i>monocladus</i> (Domin) P. M. Sm.; <i>Bromopsis pannonica</i> subsp. <i>monoclada</i> (Domin) Holub)	WC (SK)	West-Carpathian endemic	Kliment 1999; Dúbravková 2014 in litt.; Somlyay 2014 in litt.
<i>Campanula carpatica</i> Jacq.	WC (SK), EC (UA, RO), SC (RO)/AC	West-East-South-Apuseni-Carpathian (pan-Carpathian) endemic	Kliment 1999; Goliašová et al. 2008
<i>Campanula crassipes</i> Heuff.	SC (RO, SRB)	South-Carpathian endemic	Hurdu et al. 2012a, b
<i>Campanula glomerata</i> subsp. <i>subcapitata</i> (Popov) Fed. (Syn.: <i>C. subcapitata</i> Popov)	EC (SK, UA)	East-Carpathian endemic	Kliment 1999; Ziman et al. 2006; Goliašová et al. 2008
<i>Campanula kladniana</i> (Schur) Witasek <sup>43</sup> (Syn.: <i>C. rotundifolia</i> subsp. <i>kladniana</i> (Schur) Tackl)	EC (UA, RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Čopyk 1976; Tasenkevyc 2003; Oprea 2005; Ziman et al. 2006
<i>Campanula serrata</i> (Kit.) Hendrych (Syn.: <i>C. napuligera</i> Schur)	WC (SK, PL), EC (UA, RO), SC (RO), AC	West-East-South-Apuseni-Carpathian (pan-Carpathian) endemic	Kliment 1999; Goliašová et al. 2008
<i>Campanula tatarae</i> Borbás <sup>44</sup> (Syn.: <i>C. polymorpha</i> (Witasek) Prain et al.; <i>C. rotundifolia</i> subsp. <i>polymorpha</i> (Witasek) Tackl)	WC (SK, PL), EC (UA, RO), SC (RO), AC (RO)	West-East-South-Apuseni-Carpathian (pan-Carpathian) endemic	Kliment 1999; Goliašová et al. 2008
<i>Campanula xylocarpa</i> Kovanda	WC (SK, HU)	West-Carpathian endemic	Kliment 1999; Goliašová et al. 2008
<i>Cardamine glanduligera</i> O. Schwarz <sup>45</sup> (Syn.: <i>Dentaria glandulosa</i> Waldst. et Kit. ex Willd.)	WC (CZ, SK, PL, HU), EC (SK, PL, UA, RO), SC (RO), AC (RO), Tr (RO)	subendemic to Western, Eastern, Southern & Apuseni Carpathians and Transylvanian Basin (pan-Carpathian subendemic)	Jalas & Suominen 1994; Roman et al. 1996; Kliment 1999; Marhold & Kochjarová 2002

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Carduus kernerii</i> Simonk. subsp. <i>kernerii</i> <sup>46</sup> (Syn.: <i>C. transsilvanicus</i> A. Kern.)	EC (UA, RO), SC (RO)	East-South-Carpathian endemic	Franco 1976; Čopyk 1976; Oprea 2005; Čornej 2011; Hurdu et al. 2012a, b; Ziman & Derbak 2013
<i>Carduus kernerii</i> subsp. <i>lobulatifolius</i> (Cstüros et Nyár.) Soó <sup>47</sup> (Syn.: <i>C. lobulatifolius</i> Cstüros et Nyár.)	SC (RO)	South-Carpathian endemic	Dihoru & Pârvu 1987; Ciocârlan 2009; Dihoru & Negrean 2009; Hurdu et al. 2012a
<i>Carduus lobulatus</i> Borbás	WC (SK, PL)	West-Carpathian endemic	Kliment 1999; Šipošová et al. 2004a; Zarzycki 2008
<i>Centaurea reichenbachii</i> DC. <sup>48</sup> (Syn.: <i>C. reichenbachoides</i> Schur ex Hayek)	AC (RO)	Apuseni-Carpathians endemic	Dostál 1976; Ochsmann 2000; Hurdu et al. 2012a; Ciocârlan 2009; Sárbu et al. 2013
<i>Centaurea rodnensis</i> Simonk <sup>49, 50, 51</sup> (Syn.: <i>C. carpatica</i> (Porcius) Porcius, nom. illeg.; <i>C. rarauensis</i> Prodan)	EC (?UA, RO)	East-Carpathian endemic (Rodna Mts)	Beldie 1979; Tassenkevich 2011; Hurdu et al. 2012a, b; Koutecký 2013
<i>Centaurea simonkaiana</i> Hayek (Syn.: <i>C. trichocephala</i> subsp. <i>simonkaiana</i> (Hayek) Dostál)	AC (RO)	Apuseni-Carpathian endemic	Dihoru & Parvu 1987; Dihoru & Negrean 2009
<i>Centaurea triniifolia</i> Heuff. <sup>52</sup>	SC (RO, SRB)	South-Carpathian endemic	Dostál 1976; Ochsmann 2000; Hurdu et al. 2012a
<i>Cephalaria radiata</i> Griseb. et Schenk <sup>53</sup>	Tr (RO)/EC (RO), SC (RO), AC (RO)	subendemic to Transylvanian Basin	Prodan 1961; Dihoru & Pârvu 1987; Oprea 2005
<i>Cephalaria uralensis</i> subsp. <i>multifida</i> (Roman) Roman et Beldie <sup>54</sup>	SC (RO)	South-Carpathian endemic (Almajului Mts; Porțile de Fier Gorge)	Beldie & Váczy 1976; Dihoru & Pârvu 1987; Ciocârlan 2011; Sárbu et al. 2013
<i>Cerastium arvense</i> subsp. <i>lerchenfeldianum</i> (Schur) Asch. et Graebn. <sup>55, 56</sup> (Syn.: <i>C. lerchenfeldianum</i> Schur)	EC (RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Oprea 2005; Negrean & Oltean 1989; Hurdu et al. 2012b
<i>Cerastium tatrac</i> Borbás (Syn.: <i>C. glandulosum</i> (Kit.) Jáv. non Schur, nom. illeg.; <i>C. arvense</i> subsp. <i>glandulosum</i> (Kit.) Soó)	WC (SK, PL)	West-Carpathian endemic (Tatry Mts)	Kliment 1999; Letz & Michalková 2012
<i>Cerastium transsilvanicum</i> Schur	EC (RO), SC (RO)	East-South-Carpathian endemic	Čopyk 1976; Morariu & Beldie 1976; Jalas & Suominen 1983; Oprea 2005; Ciocârlan 2009
<i>Chrysosplenium alpinum</i> Schur	EC (UA, RO), SC (RO)	East-South-Carpathian endemic	Beldie 1977; Oprea 2005; Kobiv 2010; Čornej 2011; Sárbu et al. 2013
<i>Clinopodium pulegium</i> (Rochelet) Bräucher <sup>57</sup> (Syn.: <i>Micromeria pulegium</i> (Rochelet) Benth., nom. illeg.)	SC (RO, SRB)	South-Carpathian subendemic	Diklić & Nikolić 1986; Bogosavljević et al. 2007; Hurdu et al. 2012b; Đug et al. 2013; Slavkovska et al. 2013

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Cochlearia borzaeana</i> (Coman et Nyár.) Pobed.	EC (RO)	East-Carpathian endemic	Kochiarová et al. 2006; Dihoru & Negrean 2009
<i>Cochlearia tatrae</i> Borbás	WC (SK, PL)	West-Carpathian endemic (Tatry Mts)	Kliment 1999; Kochiarová & Valachovič 2002
<i>Cota tinctoria</i> subsp. <i>fussii</i> (Griseb. et Schenk) Oberpr. et Greuter (Syn.: <i>Anthemis tinctoria</i> subsp. <i>fussii</i> (Griseb. et Schenk) Beldie)	EC (RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathians endemic	Dihoru & Pärvu 1987; Oprea 2005
<i>Crocus banaticus</i> J. Gay <sup>58</sup>	EC (UA, RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian subendemic	Mihály & Komendar 1993; Oprea 2005; Myhaľ 2009; Hurdu et al. 2012b
<i>Crocus discolor</i> G. Reuss (Syn.: <i>C. secpustensis</i> (Rehman et Wol.) Borbás)	WC (SK, PL)	West-Carpathian endemic	Májovský et al. 1991; Kliment 1999
<i>Cyanus dominii</i> (Dostál) Holub	WC (SK)	West-Carpathian endemic	Olišavská et al. 2011, 2012; Olišavská & Löser 2013
<i>Cyanus dominii</i> (Dostál) Holub subsp. <i>dominii</i> (Syn.: <i>Cyanus triumfetti</i> subsp. <i>dominii</i> (Dostál) Dostál; <i>Centaurea triumfetti</i> subsp. <i>dominii</i> Dostál)	WC (SK)	West-Carpathian endemic	Olišavská et al. 2011, 2012; Olišavská & Löser 2013
<i>Cyanus dominii</i> subsp. <i>slovenicus</i> (Dostál) Olišavská	WC (SK)	West-Carpathian endemic	Olišavská et al. 2011, 2012; Olišavská & Löser 2013
(Syn.: <i>Centaurea triumfetti</i> var. <i>slovenica</i> Dostál)			
<i>Cyanus dominii</i> subsp. <i>sokolensis</i> (Pawl.) Olišavská	WC (SK)	West-Carpathian endemic	Olišavská et al. 2011, 2012; Olišavská & Löser 2013
(Syn.: <i>Centaurea axillaris</i> var. <i>sokolensis</i> Pawl.)			
<i>Cyanus maramarosienis</i> (Jáv.) Dostál <sup>59</sup>	EC (?SK, UA, RO)	East-Carpathian endemic	Kliment 1999; Oprea 2005; Ciocărlan 2009; Sárbu et al. 2013
(Syn.: <i>Centaurea maramarosienis</i> (Jáv.) Czerep.; <i>C. mollis</i> subsp. <i>maramarosienis</i> (Jáv.) Soó)			
<i>Cyanus mollis</i> (Waldst. et Kit.) J. Presl et C. Presl <sup>60</sup>	WC (CZ, SK, PL, HU), EC (UA, RO), SC (RO), AC (RO), Tr (RO)	subendemic to Western, Eastern, Southern & Apuseni Carpathians and Transylvanian Basin (pan-Carpathian subendemic)	Kliment 1999; Oprea 2005; Olišavská & Löser 2013
(Syn.: <i>Centaurea mollis</i> Waldst. et Kit.; <i>Cyanus montanus</i> subsp. <i>mollis</i> (Waldst. et Kit.) Soják)			
<i>Cyanus pinnatifidus</i> (Schur) Holub (Syn.: <i>Centaurea pinnatifida</i> Schur; <i>C. triumfetti</i> subsp. <i>pinnatifida</i> (Schur) Dostál)	EC (RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Oprea 2005; Olišavská et al. 2012
<i>Cyanus pinnatifidus</i> (Schur) Holub subsp. <i>pinnatifidus</i> (Syn.: <i>Centaurea pinnatifida</i> Schur subsp. <i>pinnatifida</i> )	EC (RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Oprea 2005

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Cyanus pinnatifidus</i> subsp. <i>sooanus</i> (Borhidi) Greuter <sup>61</sup> (Syn.: <i>Centaurea pinnatifida</i> subsp. <i>sooana</i> (Borhidi) Soó)	EC (RO)	East-Carpathian endemic (Ceahlău Mts)	Borhidi 1957; Oprea 2005
<i>Cyclamen purpurascens</i> subsp. <i>immaculatum</i> (Hrabětová) Haldá et Soják <sup>62</sup> (Syn.: <i>C. fatrense</i> Haldá et Soják)	WC (SK)	West-Carpathian endemic (Veľká Fatra Mts, Nízke Tatry Mts)	Kliment 1999; Kanka et al. 2008; Turis 2009; Slovák et al. 2012; Kučera et al. 2013
<i>Dactylorhiza cordigera</i> subsp. <i>siculorum</i> (Soó) Soó <sup>63</sup> (Syn.: <i>Orechis cordigera</i> subsp. <i>siculorum</i> Soó)	EC (RO), AC (RO)	East-Apuseni-Carpathian endemic	Soó 1967, 1980b; Popescu & Sanda 1998; Oprea 2005; Ciocărlan 2009; Hurdu et al. 2012a
<i>Dactylorhiza maculata</i> subsp. <i>schurii</i> (Klinge) Soó <sup>64</sup> (Syn.: <i>Orechis maculata</i> var. <i>schurii</i> (Klinge) Paucă et Beldie)	EC (UA, RO), SC (RO), AC (RO), Tr (RO)	endemic to Eastern, Southern & Apuseni Carpathians and Transylvanian Basin	Soó 1967; Paucă & Beldie 1972; Čornej 2011; Hurdu 2014 in litt.
<i>Daphne arbuscula</i> Čelak.	WC (SK)	West-Carpathian endemic (Muránska planina Mts)	Erdelská & Turis 1996
<i>Delphinium elatum</i> subsp. <i>nacladense</i> (Zapat.) Holub <sup>65</sup> (Syn.: <i>D. nacladense</i> Zapat.)	EC (PL, UA, RO), SC (RO)	East-South-Carpathian endemic	Čopyk 1976; Starmühler 1996b; Oprea 2005; Kobiv et al. 2007a; Chorney et al. 2008; Mitka et al. 2008; Novikov 2013b
<i>Delphinium oxysepalum</i> Borbás et Pax <i>Delphinium simonkaiianum</i> Pawl.	WC (SK, PL) EC (RO), SC (RO), AC (RO)	West-Carpathian endemic East-South-Apuseni-Carpathian endemic	Kliment 1999 Morariu & Beldie 1976; Beldie 1977; Dihoru & Párvu 1987; Oprea 2005
<i>Dianthus callizonus</i> Schott et Kotschy	SC (RO)	South-Carpathian endemic (Piatra Craiului Mts)	Morariu & Beldie 1976; Coldea 1997; Ciocărlan 2009; Dihoru & Negrean 2009; Sárbu et al. 2013
<i>Dianthus carthusianorum</i> subsp. <i>tenuifolius</i> (Schur) Hegi <sup>66</sup> (Syn.: <i>D. tenuifolius</i> Schur)	EC (UA, RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Kuz'mina 2004; Fedorončuk & Čornej 2005; Oprea 2005; Čornej 2011
<i>Dianthus giganteus</i> subsp. <i>banaticus</i> (Heuff.) Tutin (Syn.: <i>D. banaticus</i> (Heuff.) Borbás)	SC (RO, SRB)	South-Carpathian endemic	Dihoru & Párvu 1987; Oprea 2005; Hurdu et al. 2012a, b
<i>Dianthus glacialis</i> subsp. <i>gelidus</i> (Schott, Nyman et Kotschy) Tutin (Syn.: <i>D. gelidus</i> Schott., Nyman et Kotschy)	EC (RO), SC (RO)	East-South-Carpathian endemic	Dihoru & Párvu 1987; Oprea 2005; Hurdu et al. 2012a
<i>Dianthus henteri</i> Heuff. ex Griseb. et Schenk	SC (RO)	South-Carpathian endemic	Dihoru & Párvu 1987; Popescu et al. 2003; Oprea 2005; Ciocărlan 2009; Sárbu et al. 2013



Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Dianthus nitidus</i> Waldst. et Kit. (Syn.: <i>D. nitidus</i> Waldst. et Kit. subsp. <i>nitidus</i> )	WC (SK, †PL)	West-Carpathian endemic	Kliment 1999; Kmeťová 2012
<i>Dianthus praecox</i> Willd. ex Spreng. subsp. <i>praecox</i> <sup>67, 68</sup> (Syn.: <i>D. plumarius</i> subsp. <i>praecox</i> (Willd. ex Spreng.) Domin)	WC (SK, PL)	West-Carpathian endemic	Kmeťová 1985, 2012
<i>Dianthus praecox</i> subsp. <i>lumnitzeri</i> (Wiesb.) Kmeťová <sup>69</sup> (Syn.: <i>D. lumnitzeri</i> Wiesb.; <i>D. plumarius</i> subsp. <i>lumnitzeri</i> (Wiesb.) Domin)	WC (A, CZ, SK)	West-Carpathian endemic	Baksay 1972; Kmeťová 1985, 2012; Somogyi et al. 2012
<i>Dianthus praecox</i> subsp. <i>pseudopraecox</i> (Novák) Kmeťová ex Dostál <sup>70, 71</sup> (Syn.: <i>D. hungaricus</i> subsp. <i>pseudopraecox</i> (Novák) Kmeťová ex Futák)	WC (SK, HU)	West-Carpathian endemic	Kmeťová 1985, 2012
<i>Dianthus spiculifolius</i> Schur <sup>72</sup> (Syn.: <i>D. kitaibelii</i> subsp. <i>spiculifolius</i> (Schur) Novák; <i>D. petraeus</i> subsp. <i>spiculifolius</i> (Schur) Ciocărlan)	EC (RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Morariu & Beldie 1976; Negrean & Oltean 1989; Fedoroničuk & Diduch 2002a; Oprea 2005; Holobiuc et al. 2009
<i>Doronicum carpaticum</i> (Griseb. et Schenk) Nymán <sup>73</sup>	EC (UA, RO), SC (RO)	East-South-Carpathian endemic	Álvarez Fernández 2003; Pachswöll 2013
<i>Draba dorneri</i> Heuff. <sup>74</sup>	SC (RO)	South-Carpathian endemic	Sârbru & Lupu 1989; Ion 2012; Cătană et al. 2013
<i>Draba haynaldii</i> Stur	EC (RO), SC (RO)	East-South-Carpathian endemic	Beldie 1979; Oprea 2005; Dihoru & Negrean 2009
<i>Draba koitschy</i> Stur <sup>75</sup>	EC (RO), SC (RO)	East-South-Carpathian endemic	Jalas et al. 1996; Oprea 2005; Ciocărlan 2009
<i>Draba lasiocarpa</i> subsp. <i>klasterskyi</i> (Chrtěk) Chrtěk	WC (SK)	West-Carpathian endemic (Slovenský kras Mts)	Peniašteková & Kliment 2002
<i>Draba simonkaiana</i> Jáv. <sup>76</sup> (Syn.: <i>D. stellata</i> subsp. <i>simonkaiana</i> (Jáv.) Ciocărlan)	SC (RO)	South-Carpathian endemic	Dihoru & Pârnu 1987; Oprea 2005; Ciocărlan 2009; Dihoru & Negrean 2009; Sârbru et al. 2013
<i>Erigeron hungaricus</i> (Vierh.) Pawł. <sup>77</sup> (Syn.: <i>E. nanus</i> Schur non Nutt., nom. illeg.)	WC (SK, PL), EC (RO), SC (RO)	West-East-South-Carpathian endemic	Kliment 1999; Oprea 2005; Mirek & Piętkos-Mirkowa 2008a; Ciocărlan 2009
<i>Eritrichium jankae</i> Simonk. <sup>78</sup> (Syn.: <i>E. nanum</i> subsp. <i>jankae</i> (Simonk.) Jáv.)	EC (RO), SC (RO)	East-South-Carpathian endemic	Oprea 2005; Ciocărlan 2009; Şuteu 2012; Sârbru et al. 2013
<i>Erysimum hungaricum</i> Zapal. <sup>79, 80</sup>	EC (RO)	East-Carpathian endemic (Maramureş Mts; Mt. Lostun Mic)	Kobiv et al. 2007a; Kobiv 2010; Sârbru et al. 2013

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<i>Erysimum pieninicum</i> (Zapal.) Pawl.	WC (PL)	West-Carpathian endemic (Pleniny Mts)	Maciejewska-Rutkowska et al. 2007; Korzeniak 2008
<i>Erysimum wahlenbergii</i> (Asch. et Engl.) Borbás	WC (SK, PL)	West-Carpathians endemic	Kliment 1999; Michalková 2002
<i>Erysimum witmannii</i> Zaw. <sup>81</sup>	WC (SK, PL, HU), EC (UA, RO), SC (RO)/?†AC	West-East-South-Carpathian endemic	Kliment 1999; Michalková 2002
<i>Erysimum witmannii</i> Zaw. subsp. <i>witmannii</i> <sup>82, 83, 84</sup> (Syn.: <i>E. baumgartenianum</i> Schur)	WC (SK, PL), EC (RO), SC (RO)/?†AC (RO)	West-East-South-Carpathian endemic	Nyárády 1955; Borza 1964; Tomšovic 1988; Kliment 1999; Ančev & Polatschek 2006
<i>Erysimum witmannii</i> subsp. <i>pallidiflorum</i> (Szépl. ex Jáv.) Sob (Syn.: <i>E. pallidiflorum</i> Szépl. ex Jáv.)	WC (SK, HU)	West-Carpathian endemic	Michalková 1999, 2002
<i>Erysimum witmannii</i> subsp. <i>transsilvanicum</i> (Schur) P. W. Ball <sup>85, 86</sup> (Syn.: <i>E. transsilvanicum</i> Schur; <i>E. czetzianum</i> Schur)	EC (UA, RO), SC (RO)	East-South-Carpathian endemic	Nyárády 1955; Popescu et al. 2003; Kobiv 2010; Oprea & Sîrbu 2012, 2013; Vojtkó et al. 2012
<i>Euphorbia carpatica</i> Wol. <sup>87, 88</sup> (Syn.: <i>Tithymalus carpaticus</i> (Wol.) Á. Löve et D. Löve; <i>T. jastewiczii</i> Chrtek et Křísa)	EC (UA, RO)	East-Carpathian endemic	Čopyk 1976; Mírek et al. 2002; Dîhoru & Negrean 2009; Čomej 2011
<i>Euphorbia sojakii</i> (Chrtek et Křísa) Dubovik (Syn.: <i>E. austriaca</i> subsp. <i>sojakii</i> Chrtek et Křísa; <i>Tithymalus sojakii</i> (Chrtek et Křísa) Holub)	EC (SK, PL, UA)	East-Carpathian endemic	Kliment 1999
<i>Euphrasia exaristata</i> Smejkal <sup>89</sup>	WC (SK, PL)	West-Carpathian endemic (Západné Tatry Mts: Červené vrchy massif)	Králík 1997; Staszkievicz 2009
<i>Euphrasia slovacica</i> (Yeo) Holub subsp. <i>slovaca</i> (Syn.: <i>E. arctica</i> subsp. <i>slovaca</i> Yeo)	WC (CZ, SK, PL), EC (UA, RO)	West-East-Carpathian endemic	Králík 1997; Kliment 1999; Oprea 2005; Čornej 2011; Sárbu et al. 2013
<i>Euphrasia stipitata</i> Smejkal	WC (SK)	West-Carpathian endemic (Krivánska Fatra Mts)	Králík 1997; Kliment 1999
<i>Euphrasia tatrae</i> Wettst. <sup>90</sup> (Syn.: <i>E. minima</i> subsp. <i>tatrae</i> (Wettst.) Hayek; <i>E. minima</i> var. <i>tatrae</i> (Wettst.) Pawl.)	WC (SK, PL), EC (UA, RO), ?SC (RO)	West-East-Carpathian endemic	Smejkal 1963; Mihoková & Mikoláš 1994; Smejkal & Četovský 1999
<i>Ferula sadlerana</i> Ledeb. <sup>91, 92</sup>	WC (SK, HU), AC (RO)	West-Apuseni-Carpathian subendemic	Lendvay & Kalapos 2014
<i>Festuca amethystina</i> subsp. <i>orientalis</i> Krajina <sup>93</sup> (Syn.: <i>F. inarmata</i> Schur)	EC (UA, RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Cvelev 1972, 1974, 1976; Prokudin et al. 1977; Oprea 2005; Sárbu et al. 2013

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<i>Festuca bucegiensis</i> Markgr.-Dann.	SC (RO)	South-Carpathian endemic	Oprea 2005; Ciocărlan 2009; Sârbu et al. 2013
<i>Festuca carpatica</i> F. Dietr. (Syn.: <i>F. pseudolaxa</i> Schur; <i>Leucopoa carpatica</i> (F. Dietr.) H. Scholz)	WC (SK, PL), EC (UA, RO), SC (RO)	West-East-South-Carpathian endemic	Kliment 1999
<i>Festuca gautieri</i> subsp. <i>lutea</i> (Hack.) Fogg et Signorini (Syn.: <i>F. gautieri</i> subsp. <i>lutea</i> (Hack.) Ciocărlan; <i>F. scoparia</i> subsp. <i>lutea</i> (Hack.) Beldie)	EC (RO)	East-Carpathian endemic (Hășmaș Mts)	Morariu & Beldie 1976; Oprea 2005; Sârbu et al. 2013
<i>Festuca nitida</i> subsp. <i>flaccida</i> (Schur) Markgr.-Dann.	EC (RO), SC (RO)	East-South-Carpathian endemic	Oprea 2005; Ciocărlan 2009; Sârbu et al. 2013
<i>Festuca pachyphylla</i> Degen ex Nyár. (Syn.: <i>F. rupicola</i> subsp. <i>pachyphylla</i> (Degen ex Nyár.) Beldie; <i>F. stricta</i> subsp. <i>rumelica</i> Foggi et Petrova)	SC (RO)	South-Carpathian endemic	Markgraf-Dannenberg 1980; Ciocărlan 2009; Hurdu et al. 2012a
<i>Festuca porcii</i> Hack.	EC (UA, RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Beldie 1972; Čopyk 1976; Oprea 2005; Kobiv et al. 2007a
<i>Festuca saxatilis</i> Schur <sup>94</sup> (Syn.: <i>F. rupicola</i> subsp. <i>saxatilis</i> (Schur) Rauschert; <i>F. rupicola</i> subsp. <i>saxatilis</i> (Schur) Beldie, nom. illeg.; <i>F. stricta</i> subsp. <i>saxatilis</i> (Host) Foggi et Signorini)	EC (SK, UA, RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Kliment 1999; Oprea 2005
<i>Festuca tatrae</i> (Czakó) Degen <sup>95</sup> (Syn.: <i>F. amethystina</i> subsp. <i>tatrae</i> (Czakó) Soó)	WC (SK, PL)	West-Carpathian endemic	Kliment 1999; Ciocărlan 2009; Čornej 2011
<i>Festuca versicolor</i> Tausch subsp. <i>versicolor</i> <sup>96</sup>	WC (SK, PL), EC (UA, RO), SC (RO)	West-East-South-Carpathian subendemic	Kliment 1999; Oprea 2005
<i>Festuca versicolor</i> subsp. <i>dominii</i> Krajina	EC (RO)	East-Carpathian endemic (Rodna Mts)	Dihoru & Pârvu 1987; Oprea 2005; Ciocărlan 2009
<i>Galium abaujense</i> Borbás	WC (SK, HU)	West-Carpathian endemic	Kliment 1999
<i>Galium album</i> subsp. <i>suberectum</i> (Klokov) Michalk. <sup>97, 98</sup> (Syn.: <i>G. suberectum</i> Klokov)	WC (SK), EC (UA)	West-East-Carpathian endemic	Klokov 1961; Michalková 1993; Gynda 2004
<i>Galium baillonii</i> D. Brândză	SC (RO)	South-Carpathian endemic	Dihoru & Pârvu 1987; Popescu et al. 2003; Oprea 2005; Ciocărlan 2009
<i>Galium kitaibelianum</i> Schult. et Schult. f. <sup>99</sup>	EC (RO), SC (RO), AC	East-South-Apuseni-Carpathian subendemic	Oprea 2005; Hurdu et al. 2012b

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<i>Galium transcarpathicum</i> Stojko et Tassenk.	EC (UA)	East-Carpathian endemic	Tasenkevič 2003; Gynda 2004; Kobiv 2010; Čornej 2011
<i>Genista tinctoria</i> subsp. <i>oligosperma</i> (Andrae) Jáv. <sup>100</sup> (Syn.: <i>G. oligosperma</i> (Andrae) Simonk.; <i>G. rupestris</i> Schur)	EC (UA, RO), SC (RO)	East-South-Carpathian endemic	Čopyk 1976; Morariu & Beldie 1976; Oprea 2005; Ciocărlan 2009; Čornej 2011
<i>Gentiana cruciata</i> subsp. <i>phlogifolia</i> (Schott et Kotschy) Tutin <sup>101</sup> (Syn.: <i>G. phlogifolia</i> Schott et Kotschy)	EC (RO), SC (RO)	East-South-Carpathian endemic	Morariu & Beldie 1976; Strid & Tan 1991; Oprea 2005; Ciocărlan 2009
<i>Gentiana laciniata</i> Kit. ex Kanitz <sup>102</sup>	EC (UA)	East-Carpathian endemic	Rybczyński et al. 2014
<i>Gentianella amarella</i> subsp. <i>reussii</i> (Toel) Holub (Syn.: <i>Gentiana reussii</i> Toel)	WC (SK)	West-Carpathian endemic	Kliment 1999; Šípošová et al. 2004b
<i>Gentianella farrae</i> (Borbás) Holub (Syn.: <i>G. austriaca</i> subsp. <i>farrae</i> (Borbás) Á. Löve et D. Löve)	WC (SK)	West-Carpathian endemic	Kliment 1999; Šípošová et al. 2004a
<i>Gentianella lutescens</i> subsp. <i>tatrae</i> (Ronniger) Holub	WC (SK)	West-Carpathian endemic	Kliment 1999; Mirek & Piękoś-Mirkowa 2010
<i>Gypsophila petraea</i> (Baumg.) Rchb. <sup>103</sup> (Syn.: <i>G. transsylvanica</i> Spreng.)	EC (RO), SC (RO)	East-South-Carpathian endemic	Morariu & Beldie 1976; Jalas & Suominen 1986; Oprea 2005; Hurdu et al. 2012b
<i>Helictotrichon decorum</i> (Janka) Henrard	EC (RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Morariu & Beldie 1976; Oprea 2005; CBIS 2008 ( <a href="http://www.carpat.es.org/cbisecc/bot.php?id=1222">http://www.carpat.es.org/cbisecc/bot.php?id=1222</a> )
<i>Hepatica transsylvanica</i> Fuss	EC (RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Morariu & Beldie 1976; Oprea 2005
<i>Heraclium carpathicum</i> Porcius	EC (UA, RO), SC (RO)	East-South-Carpathian endemic	Čopyk 1976; Oprea 2005; Kobiv et al. 2007a; Ciocărlan 2009; Dihoru & Negrean 2009
<i>Heraclium sphondylium</i> subsp. <i>transsylvanicum</i> (Schur) Brummitt (Syn.: <i>H. transsylvanicum</i> Schur; <i>H. palmatum</i> Baumg.)	EC (UA, RO), SC (RO), AC	East-South-Apuseni-Carpathian endemic	Čopyk 1976; Oprea 2005; Čornej 2011; Sárbu et al. 2013
<i>Hesperis matronalis</i> subsp. <i>schurii</i> Soó <sup>104</sup> (Syn.: <i>H. oblongifolia</i> Schur; <i>H. matronalis</i> subsp. <i>oblongifolia</i> (Schur) F. Dvořák)	SC (RO)	South-Carpathian endemic	Morariu & Beldie 1976; Beldie 1977; Ball 1993; Ciocărlan 2009
<i>Hesperis matronalis</i> subsp. <i>vrabelyiana</i> (Schur) Soó (Syn.: <i>H. vrabelyiana</i> (Schur) Borbás)	WC (HU)	West-Carpathian endemic (Bükk Mts)	Dvořák 1968; Soó 1968; Ball 1993; Šeffer et al. 2010

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Hesperis slovaca</i> (F. Dvořák) F. Dvořák <sup>105</sup> (Syn.: <i>H. dinarica</i> subsp. <i>slovaca</i> F. Dvořák)	WC (SK)	West-Carpathian endemic (Nízke Tatry Mts)	Dvořák 1963, 1968; Zahradníková et al. 2002; Špišošová et al. 2004b
<i>Hieracium abietogenum</i> Nyár. ex Szelag <sup>106</sup>	SC (RO)	South-Carpathian endemic ( Retezat Mts)	Szelag 2003a, 2006b
<i>Hieracium austrotatricum</i> Szelag	WC (SK)	West-Carpathian endemic (Nízke Tatry Mts)	Ronikier & Szelag 2008; Ilnicki & Szelag 2011
<i>Hieracium bohatschianum</i> Zahn	SC (RO)	South-Carpathian endemic (Almajului Mts: Mt. Treskovat)	Ilnicki & Szelag 2011; Szelag 2011
<i>Hieracium borbasii</i> R. Uechtr. <sup>107</sup> (Syn.: <i>H. sparsum</i> subsp. <i>borbasii</i> (R. Uechtr.) Zahn)	SC (RO)	South-Carpathian endemic ( Retezat Mts)	Szelag 2006b; Ilnicki & Szelag 2011
<i>Hieracium borsanum</i> Mráz	EC (RO)	East-Carpathian endemic (Rodna Mts)	Mráz 2001b, 2003a
<i>Hieracium carpaticum</i> Besser subsp. <i>carpaticum</i>	WC (SK, PL)	West-Carpathian endemic	Zahn 1937; Chrtěk jr. 2014 in litt.; cf. Piękoś- Mirikowa & Mirek 2003; Šeffler et al. 2010
<i>Hieracium cernaeglavae</i> (Hruby et Zahn) Mráz (Syn.: <i>H. rohacsense</i> subsp. <i>cernaeglavae</i> (Hruby et Zahn) Zahn)	EC (UA, RO)	East-Carpathian endemic	Mráz 2002
<i>Hieracium coldei</i> Szelag (Syn.: <i>H. sparsum</i> subsp. <i>coldei</i> (Szelag) Greuter)	EC (RO), SC (RO)	East-South-Carpathian endemic	Szelag 2006a, b, 2012
<i>Hieracium crassipetalum</i> (Pawl. et Zahn) Chrtěk f.	WC (SK, PL)	West-Carpathian endemic	Chrtěk jr. & Marhold 1998; Štorchová et al. 2002; Chrtěk jr. et al. 2004a
<i>Hieracium czeremoszense</i> Wol. et Zahn	EC (UA)	East-Carpathian endemic	Zahn 1936; Šijakov 1989; Szelag 2007
<i>Hieracium dacicum</i> R. Uechtr.	SC (RO)	South-Carpathian endemic ( Retezat Mts)	Zahn 1938; Szelag 2014 in litt.
<i>Hieracium decipientiforme</i> (Wol. et Zahn) Schijakov	EC (UA)	East-Carpathian endemic	Chrtěk jr. 1997; Chrtěk jr. 2014 in litt.
<i>Hieracium devitii</i> Mráz (Syn.: <i>H. pietroszense</i> subsp. <i>devitii</i> (Mráz) Greuter)	EC (UA)	East-Carpathian endemic	Mráz 2003a
<i>Hieracium fagarasense</i> (Nyár. et Zahn) Nyár. <sup>108</sup> (Syn.: <i>H. sparsum</i> subsp. <i>fagarasense</i> Nyár. et Zahn)	SC (RO)	South-Carpathian endemic (Făgăraș Mts)	Szelag 2006b; Szelag 2014 in litt.; cf. Beldie 1979, Oprea 2005, Ciocărtian 2009, Sârbu et al. 2013
<i>Hieracium filarszkyi</i> Jáv. et Zahn	SC (RO)	South-Carpathian endemic ( Retezat Mts)	Zahn 1938; Szelag 2014 in litt.

<b>Taxon</b>	<b>Occurrence in the Carpathians</b>	<b>Category of endemism</b>	<b>References</b>
<i>Hieracium fritzeiforme</i> Zahn	SC (RO)	South-Carpathian endemic (Retezat Mts)	Zahn 1938; Szelag 2014 in litt.
<i>Hieracium hrynaiwiense</i> Wol. (Syn.: <i>H. raddeanum</i> subsp. <i>hrynaiwiense</i> (Wol.) Greuter)	EC (UA)	East-Carpathian endemic	Šljakov 1989; Mráz 2003b; Szelag 2007
<i>Hieracium jankae</i> R. Uechtr.	SC (RO)	South-Carpathian endemic (Almajului Mts)	Mráz & Szelag 2004; Szelag 2014 in litt.
<i>Hieracium jarzabczynum</i> (Pawl. et Zahn) Mráz et Chrték f.	WC (SK, PL)	West-Carpathian endemic	Chrték jr. & Mráz 2007; Chrték jr. et al. 2007
<i>Hieracium kotschyianum</i> Heuff. (Syn.: <i>H. kotschyianum</i> Heuff. subsp. <i>kotschyianum</i> ; <i>H. sparsum</i> subsp. <i>kotschyianum</i> (Heuff.) Zahn)	EC (RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Mráz & Szelag 2004; Szelag 2006b; Ilnicki & Szelag 2011
<i>Hieracium krivanense</i> (Wol. et Zahn) Schljakov	WC (SK, PL)	West-Carpathian endemic (Tatry Mts)	Chrték jr. & Marhold 1998; Štorchová et al. 2002; Chrték jr. et al. 2004a
<i>Hieracium lingelsheimii</i> Pax	WC (SK)	West-Carpathian endemic (Nízke Tatry Mts)	Schuhwerk & Ljippert 1999; Chrték jr. et al. 2004a
<i>Hieracium lommicense</i> Wol.	EC (UA)	East-Carpathian endemic	Šljakov 1989; Szelag 2007
<i>Hieracium lubriticaule</i> (Zahn) Borza (Syn.: <i>H. sparsum</i> subsp. <i>lubriticaule</i> Zahn)	SC (RO)	South-Carpathian endemic (Retezat Mts, Țarcu Mts)	Szelag 2003b, 2006b; Mráz & Szelag 2004
<i>Hieracium magocsyanum</i> Jáv. (Syn.: <i>H. sparsum</i> subsp. <i>magocsyanum</i> (Jáv.) Zahn)	SC (RO)	South-Carpathian endemic (Retezat Mts, Țarcu Mts)	Mráz & Szelag 2004; Szelag 2006b; Ilnicki & Szelag 2011
<i>Hieracium mirekii</i> Szelag	SC (RO)	South-Carpathian endemic (Retezat Mts)	Szelag 2006b; Ilnicki & Szelag 2011
<i>Hieracium mitkae</i> Szelag (Syn.: <i>H. kotschyianum</i> subsp. <i>longidentatum</i> Nyár. ex Szelag; <i>H. sparsum</i> subsp. <i>longidentatum</i> (Nyár. ex Szelag) Greuter)	SC (RO)	South-Carpathian endemic (Retezat Mts)	Szelag 2003a, 2006b
<i>Hieracium milinicae</i> (Hruby et Zahn) Chrték f. et Mráz (Syn.: <i>H. nigrescens</i> subsp. <i>milinicae</i> Hruby et Zahn)	WC (SK, PL)	West-Carpathian endemic (Tatry Mts)	Zahn 1927; Chrték jr. et al. 2004b; Chrték jr. & Mráz 2007
<i>Hieracium napaeum</i> Zahn	EC (RO), SC (RO), AC	East-South-Apuseni-Carpathian endemic	Zahn 1936; Szelag 2014 in litt.

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Hieracium negoitiense</i> (Răvărut et Nyár.) Soó <sup>109</sup> (Syn.: <i>Crepis negoitiensis</i> Răvărut et Nyár.)	SC (RO)	South-Carpathian endemic (Retezat Mts)	Morariu & Beldie 1976; Oprea 2005; Sárbu et al. 2013
<i>Hieracium nigrescens</i> subsp. <i>koprovanum</i> Rech. f. et Zahn	WC (SK, PL)	West-Carpathian endemic (Tatry Mts, Nízke Tatry Mts)	Zahn 1927; Mráz 2001b, 2002; Chrtrek jr. et al. 2004b, 2007
<i>Hieracium nigrilactucis</i> Nyár.	SC (RO)	South-Carpathian endemic (Retezat Mts)	Szelag 2006b
<i>Hieracium ossii-bucuracae</i> Nyár. ex Szelag <sup>110, 111</sup> (Syn.: <i>H. longifoliosum</i> Nyár. ex Szelag; <i>H. sparsum</i> subsp. <i>sparsiforme</i> (Degen et Zahn) Greuter)	SC (RO)	South-Carpathian endemic	Szelag 2003a, 2006b; Mráz & Szelag 2004
<i>Hieracium paleniceae</i> Rech. f. et Zahn	WC (SK)	West-Carpathian endemic (Západné Tatry Mts)	Zahn 1937; Procházka & Chrtrek jr. 1999; Chrtrek jr. 2014 in litt.
<i>Hieracium pallinae</i> Jáv. et Zahn	SC (RO)	South-Carpathian endemic (Retezat Mts)	Szelag 2014 in litt.; cf. Zahn 1938
<i>Hieracium pawlowskianum</i> Nyár. (Syn.: <i>H. riutarensis</i> Nyár. ex Szelag; <i>H. tomiásiforme</i> (Nyár.) Nyár.; <i>H. sparsum</i> subsp. <i>nigrovirenticeps</i> (Nyár. et Zahn) Greuter)	SC (RO)	South-Carpathian endemic (Retezat Mts, Ťarcu Mts)	Szelag 2003a, 2004a, 2006b
<i>Hieracium paxianum</i> Nyár. et Zahn	EC (UA, RO), SC (RO)	East-South-Carpathian endemic	Mráz et al. 2005
<i>Hieracium perfoliosum</i> Nyár. ex Szelag	SC (RO)	South-Carpathian endemic (Godeanu Mts)	Szelag 2003a, 2006b
<i>Hieracium pietroszense</i> Degen et Zahn <sup>112</sup>	EC (RO)	East-Carpathian endemic (Rodna Mts)	Mráz 2003a
<i>Hieracium pinetophilum</i> (Degen et Zahn) Chrtrek f.	WC (SK, PL)	West-Carpathian endemic	Chrtrek jr. & Marhold 1998; Štorchová et al. 2002; Chrtkek jr. et al. 2004a
<i>Hieracium pisaturensis</i> Nyár.	SC (RO)	South-Carpathian endemic (Retezat Mts)	Szelag 2003b, 2006b; Szelag 2014 in litt.; cf. Zahn 1938
<i>Hieracium pocuticum</i> Wol.	EC (UA, RO)	East-Carpathian endemic	Šijakov 1989; Szelag 2007; cf. Tassenkevych 2003
<i>Hieracium pojoritense</i> Wol.	EC (RO)	East-Carpathian endemic	Stefureac & Tăcină 1979; Mráz 2003b; Mráz & Szelag 2004; Mráz & Paule 2006; Szelag 2006b, 2007
<i>Hieracium polyphylllobasis</i> (Nyár. et Zahn) Szelag (Syn.: <i>H. sparsum</i> subsp. <i>polyphylllobasis</i> (Nyár. et Zahn) Greuter)	SC (RO)	South-Carpathian endemic (Retezat Mts)	Szelag 2006b; Ilnicki & Szelag 2011

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Hieracium porphyriticum</i> A. Kern. (Syn.: <i>H. sparsum</i> subsp. <i>porphyriticum</i> (A. Kern.) Zahn)	SC (RO), AC (RO)	South-Apusei-Carpathian endemic	Szelag 2006b; Ilnicki & Szelag 2011; Szelag 2014 in litt.
<i>Hieracium prassivae</i> Zahn	WC (SK)	West-Carpathian endemic (Vysoké Tatry Mts, Nízke Tatry Mts)	Šipošová et al. 2004b
<i>Hieracium pseudostygium</i> Wol. (Syn.: <i>H. nigratum</i> subsp. <i>pseudostygium</i> (Wol.) Zahn)	EC (UA)	East-Carpathian endemic	Šijakov 1989; Szelag 2007; cf. Čomej 2011
<i>Hieracium rapunculoidiforme</i> Wol. et Zahn <sup>113</sup>	EC (UA), ?(RO)	East-Carpathian endemic	Zahn 1911; Šijakov 1989
<i>Hieracium ratezaticum</i> (Nyár. et Zahn) Mráz	SC (RO)	South-Carpathian endemic (Retezat Mts)	Mráz 2001b; Mráz & Szelag 2004
<i>Hieracium rohacsense</i> Kit.	WC (SK, PL)	West-Carpathian endemic	Mráz 2001a, 2002, 2005a; Šipošová et al. 2004a
<i>Hieracium scitulum</i> Wol. <sup>114</sup>	EC (UA)	East-Carpathian endemic	Šijakov 1989; Chrtek jr. 2004; Szelag 2007
<i>Hieracium silesiaticum</i> E. Krause <sup>115</sup>	WC (SK, PL)	West-Carpathian subendemic	Chrtek jr. 1996; Chrtek jr. et al. 2002; Szelag 2004b, 2006b; Mráz 2005b
<i>Hieracium slovacum</i> Chrtek f.	WC (SK)	West-Carpathian endemic (Belianske Tatry Mts)	Chrtek jr. & Marhold 1998; Štorchová et al. 2002; Chrtek jr. et al. 2004a
<i>Hieracium subsinuatum</i> Borbás (Syn.: <i>H. subserratosinuatum</i> Zahn, nom. illeg.)	WC (SK)	West-Carpathian endemic (Tatry Mts)	Zahn 1937; Kliment 1999; Procházka & Chrtek jr. 1999; Chrtek jr. 2014 in litt.
<i>Hieracium telekianum</i> Boros et Lengyel (Syn.: <i>H. sparsum</i> subsp. <i>telekianum</i> (Boros et Lengyel) Greuter)	EC (RO)	East-Carpathian endemic (Harghita Mts)	Mráz & Szelag 2004; Szelag 2006b; cf. Beldie 1977, Ciocărlan 2009, Sárbu et al. 2013
<i>Hieracium tomiásae</i> (Nyár. et Zahn) Nyár. (Syn.: <i>H. sparsum</i> subsp. <i>tomiásae</i> Nyár. et Zahn; <i>H. sparsum</i> var. <i>tomiásae</i> (Nyár. et Zahn) Ciocărlan)	SC (RO)	South-Carpathian endemic (Țarcu Mts: Mt. Tomeasa)	Mráz & Szelag 2004; Szelag 2006b; Ilnicki & Szelag 2011; cf. Dihoru & Părvu 1987
<i>Hieracium tomosense</i> Simonk. <i>Hieracium tubulare</i> Nyár. <sup>116</sup> (Syn.: <i>H. sparsum</i> var. <i>tubulare</i> (Nyár.) Ciocărlan; <i>H. sparsum</i> subsp. <i>tubulatum</i> (Zahn) Greuter)	EC (RO), SC (RO) SC (RO)	East-South-Carpathian endemic South-Carpathian endemic (Retezat Mts)	Ilnicki & Szelag 2011; Szelag 2013 Mráz & Szelag 2004; Szelag 2006a, b; Ilnicki & Szelag 2011
<i>Hieracium ukertiinae</i> Wol. et Zahn	EC (UA)	East-Carpathian endemic	Šijakov 1989; Szelag 2014 in litt.
<i>Hieracium vapanicanum</i> (Lengyel et Zahn) Chrtek f. et Mráz	WC (SK, PL)	West-Carpathian endemic	Zahn 1927; Chrtek jr. et al. 2004b, 2007; Chrtek jr. & Mráz 2007
<i>Hieracium virgicautle</i> Năgeli et Peter <sup>117</sup>	WC (SK, PL, HU)	West-Carpathian endemic	Zahn 1930; Chrtek jr. et al. 2004a
<i>Hieracium worochtae</i> Wol.	EC (UA)	East-Carpathian endemic	Zahn 1938; Šijakov 1989; Szelag 2007



Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Hieracium zajacii</i> Szlag	WC (SK)	West-Carpathian endemic (Veľká Fatra Mts)	Szlag 2010
<i>Hieracium zanogae</i> Pax	SC (RO)	South-Carpathian endemic ( Retezat Mts)	Szlag 2006b
<i>Hylotelephium argutum</i> (Haw.) Holub (Syn.: <i>Sedum carpathicum</i> G. Reuss; <i>S. telephium</i> subsp. <i>fabaria</i> (W. D. J. Koeh) Kirschl.)	WC (†CZ, SK, PL), EC (SK, UA, RO), SC (RO), AC (RO)	West-East-South-Apuseni-Carpathian (pan-Carpathian) endemic	Grulich 1984; Kliment 1999
<i>Jovibarba globifera</i> subsp. <i>preissiana</i> (Domin) Holub <sup>18</sup>	WC (SK, PL), EC (UA, RO)	West-East-Carpathian subendemic	Letz 1998; Kliment 1999
(Syn.: <i>J. preissiana</i> (Domin) Omelezuk et Czopik)			
<i>Jurinea transylvanica</i> (Spreng.) Simonk. <sup>19</sup>	Tr (RO)/EC (RO), SC (RO), AC (RO)	subendemic to Transylvanian Basin	Dihoru & Párvu 1987; Oprea 2005
(Syn.: <i>J. mollis</i> subsp. <i>transylvanica</i> (Spreng.) Hayek)			
<i>Knautia kitaibelii</i> (Schult.) Borbás subsp. <i>kitaibelii</i> WC (A, CZ, SK, PL) <sup>120, 121</sup>		West-Carpathian subendemic	Soják 1983; Štěpánek 1985, 1997; Kliment 1999; Böhm & Facsar 2000; Kolař et al. 2009
<i>Knautia slovacica</i> Štěpánek	WC (SK)	West-Carpathian endemic	Štěpánek 1983, 1985
<i>Koeleria macrantha</i> subsp. <i>transsilvanica</i> (Schur) A. Nyár. <sup>122</sup>	EC (†UA, RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Deyl 1934; Ghișa 1972; Soják 1983; Popescu et al. 2003; Oprea 2005; Kricsfalussy & Budnikov 2007
(Syn.: <i>K. transsilvanica</i> Schur; <i>K. macrantha</i> subsp. <i>transsilvanica</i> (Schur) Beldie, nom. illeg.)			
<i>Koeleria tristis</i> Domin	WC (SK)	West-Carpathian endemic	Kliment 1999; Pečinka et al. 2006
<i>Lathyrus transsilvanicus</i> (Spreng.) Fritsch <sup>123, 124, 125</sup>	WC (SK, HU), EC (UA, RO), Tr (RO)/AC (RO)	subendemic to Western & Eastern Carpathians and Transylvanian Basin	Kliment 1999; Oprea 2005; Petrova & Vladimirov 2009; Proc' & Kiš 2009; Kobiv 2010; Tosheva et al. 2011; Marinov et al. 2014
<i>Leontodon kulezyskii</i> Popov (Syn.: <i>L. repens</i> Schur, nom. illeg.)	EC (UA, RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Čopyk 1976; Hel'tman 1989; Oprea 2005; Čornej 2011
<i>Leucanthemopsis alpina</i> subsp. <i>tatrae</i> (Vierh.) Holub <sup>126</sup>	WC (SK, PL)	West-Carpathian endemic (Tatry Mts, Nizke Tatry Mts)	Holub 1977; Kliment 1999; Mirek & Piękoś-Mirkowa 2009, 2010
(Syn.: <i>L. tatrae</i> (Vierh.) Holub; <i>Chrysanthemum alpinum</i> f. <i>tatrae</i> Vierh.)			
<i>Leucanthemum rotundifolium</i> (Waldst. et Kit. ex Willd.) DC. <sup>127</sup>	WC (SK, PL), EC (SK, PL, UA), SC (RO), AC (RO)	West-East-South-Apuseni-Carpathian (pan-Carpathian) subendemic	Zelený 1970; Čopyk 1976; Kliment 1999; Oprea 2005
(Syn.: <i>L. waldsteinii</i> (Sch. Bip.) Pouzar; <i>Chrysanthemum rotundifolium</i> Waldst. et Kit. ex Willd.)			

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Linum extraaxillare</i> Kit. <sup>128</sup> (Syn.: <i>L. perenne</i> subsp. <i>extraaxillare</i> (Kit.) Nyman)	WC (SK, PL), EC (UA, RO), SC (RO)	West-East-South-Carpathian subendemic	Kliment 1999; Oprea 2005; Petrova & Vladimirov 2009; Vladimirov et al. 2011
<i>Linum uninerve</i> (Rochel) Jáv. <sup>129, 130</sup>	SC (RO)/EC (RO)	East-South-Carpathian subendemic	Dihoru & Párvu 1987; Oprea 2005; Petrova 2011
<i>Luzula alpinopilosa</i> subsp. <i>obscura</i> S. Fröhner	WC (SK, PL), EC (UA, RO), SC (RO)	West-East-South-Carpathian endemic	Kliment 1999; Oprea 2005; Mírek & Přešková-Mirková 2010; Čornej 2011
<i>Melampyrum saxosum</i> Baumg. <sup>131, 132</sup> (Syn.: <i>M. sylvaticum</i> subsp. <i>saxosum</i> (Baumg.) P. Beauv.; <i>M. herbichii</i> Wol.)	EC (SK, PL, UA, RO), SC (RO)	East-South-Carpathian endemic	Štech & Drábková 2005; Těšitel & Štech 2007; Michalík & Mitka 2008; Těšitel et al. 2009
<i>Minuartia oxypetala</i> (Wol.) Kulcz. (Syn.: <i>M. verna</i> subsp. <i>oxypetala</i> (Wol.) G. Halliday)	EC (UA, RO)	East-Carpathian endemic	Pawłowski 1939; Beldie 1977; Fedorončuk & Diduch 2002b; Oprea 2005; Kobiv et al. 2007a; Kobiv 2010; Čornej 2011
<i>Minuartia pauciflora</i> (Kit. ex Kanitz) Dvořáková <sup>133</sup> (Syn.: <i>M. zarenchnyi</i> (Zapat.) Klokov)	WC (SK, PL), EC (UA)	West-East-Carpathian endemic	Dvořáková 2003
<i>Nigritella carpatica</i> (Zapat.) Teppner, E. Klein et M. Zagulskij (Syn.: <i>Gymmadenia carpatica</i> (Zapat.) Teppner et E. Klein)	EC (UA, RO)	East-Carpathian endemic	Teppner et al. 1994; Teppner & Klein 1998; Teppner 2004; Čornej 2009
<i>Nocca banatica</i> (R. Uechtr.) F. K. Mey. <sup>134</sup> (Syn.: <i>Thlaspi dacicum</i> subsp. <i>banaticum</i> (R. Uechtr.) Nyár.; <i>T. dacicum</i> subsp. <i>banaticum</i> (R. Uechtr.) Dvořáková, nom. illeg.)	SC (RO)	South-Carpathian endemic	Beldie 1977; Dihoru & Párvu 1987; Popescu et al. 2003; Oprea 2005; Ciocărlan 2009; Dihoru & Negrean 2009; Sárbu et al. 2013
<i>Nocca caerulea</i> subsp. <i>tatrensis</i> (Zapat.) Holub (Syn.: <i>Thlaspi caerulea</i> subsp. <i>tatrense</i> (Zapat.) Dvořáková)	WC (SK, PL)	West-Carpathian endemic	Kliment 1999; Hodálková & Mártonfi 2002
<i>Nocca dacica</i> (Heuff.) F. K. Mey. subsp. <i>dacica</i> (Syn.: <i>Thlaspi dacicum</i> Heuff. subsp. <i>dacicum</i> )	EC (UA, RO), SC (RO)	East-South-Carpathian endemic	Morariu & Beldie 1976; Jalas et al. 1996; Tasenkevič 2003; Oprea 2005; Ciocărlan 2009
<i>Nocca jankae</i> (A. Kern.) F. K. Mey. <sup>135</sup> (Syn.: <i>Thlaspi jankae</i> A. Kern.)	WC (SK, HU)	West-Carpathian endemic	Clapham & Akeyrod 1993; Kliment 1999; Hodálková & Mártonfi 2002
<i>Onosma pseudarenaria</i> Schur subsp. <i>pseudarenaria</i> <sup>136</sup>	Tr (RO)/EC (RO), AC (RO)	subendemic to Transylvanian Basin	Oprea 2005; Dihoru & Negrean 2009; Şuteu 2012
<i>Onosma viridis</i> (Borbás) Jáv. <sup>137, 138</sup> (Syn.: <i>Onosma tornensis</i> Jáv.)	WC (SK, HU), SC (RO), AC (RO), Tr (RO)	endemic to Western, Southern & Apuseni Carpathians and Transylvanian Basin	Griņtescu & Nyárády 1960a; Kolarčík et al. 2010; Mártonfi et al. 2014

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Ophrys holubiana</i> Andras. <sup>139</sup>	WC (CZ, SK)	West-Carpathian endemic	Kliment 1999; Dítě 2014 in litt.
<i>Ornithogalum orthophyllum</i> subsp. <i>acuminatum</i> (Schur) Zahar.	SC (RO)	South-Carpathian endemic (Bárcsei Mts; Postăvarul massif)	Dihoru & Pârvu 1987; Oprea 2005
<i>Oxytropis campestris</i> subsp. <i>tatrae</i> (Borbás) Dostál	WC (SK, PL), EC (RO), SC (RO)	West-East-South-Carpathian endemic	Kliment 1999; Tassenkevich 2011
<i>Oxytropis carpatica</i> Uechtr. (Syn.: <i>O. jacquinii</i> subsp. <i>carpatica</i> (R. Uechtr.) Hausskn.)	WC (SK, PL), EC (UA, RO), SC (RO)	West-East-South-Carpathian endemic	Kliment 1999; Oprea 2005
<i>Papaver corona-sancti-stephani</i> Zapal. (Syn.: <i>P. alpinum</i> subsp. <i>corona-sancti-stephani</i> (Zapal.) Borza; <i>P. pyrenaicum</i> subsp. <i>corona-sancti-stephani</i> (Zapal.) Borza)	EC (RO), SC (RO)	East-South-Carpathian endemic	Beldie 1977; Dihoru & Pârvu 1987; Oprea 2005; Ciocărlan 2009; Sárbu et al. 2013
<i>Papaver tatricum</i> (A. Nýár.) Ehrend. (Syn.: <i>P. alpinum</i> subsp. <i>tatricum</i> A. Nýár.)	WC (SK, PL)	West-Carpathian endemic	Kliment 1999
<i>Papaver tatricum</i> (A. Nýár.) Ehrend. subsp. <i>tatricum</i>	WC (SK, PL)	West-Carpathian endemic (Tatry Mts)	Bernátová 2002; Mirek & Piękoś-Mirkowa 2010
<i>Papaver tatricum</i> subsp. <i>fatraemagnae</i> Bernátová	WC (SK)	West-Carpathian endemic (Veľká Fatra Mts)	Bernátová 2002; Šipošová et al. 2004a; Kliment et al. 2008
<i>Pedicularis baumgartenii</i> Simonk. <sup>140</sup>	SC (RO)/EC (RO)	East-South-Carpathian endemic	Beldie 1977; Dihoru & Pârvu 1987; Oprea 2005; Ciocărlan 2009; Sárbu et al. 2013
<i>Peucedanum rochelianum</i> Heuff. <sup>141, 142</sup>	Tr (RO)	subendemic to Transylvanian Basin	Beldie 1977; Dihoru & Pârvu 1987; Oprea 2005; Ciocărlan 2009; Sárbu et al. 2013
<i>Phyteuma tetramerum</i> Schur	EC (UA, RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Čopyk 1976; Morariu & Beldie 1976; Negrean & Oltean 1989; Oprea 2005; Čornej 2011
<i>Phyteuma vagneri</i> A. Kern. (Syn.: <i>P. spiciforme</i> Rochel)	EC (UA, RO), SC (RO)	East-South-Carpathian endemic	Dihoru & Pârvu 1987; Negrean & Oltean 1989; Oprea 2005
<i>Pilosella platicensis</i> (Wol.) Soják (Syn.: <i>Hieracium platicense</i> Wol.)	EC (UA)	East-Carpathian endemic	Szelag 2007
<i>Pilosella ulleipschii</i> (Blocki) Szelag <sup>143</sup> (Syn.: <i>P. alpicola</i> subsp. <i>ulleipschii</i> (Blocki) Soják; <i>Hieracium alpicola</i> subsp. <i>ulleipschii</i> (Blocki) Zahn)	WC (SK, PL)/EC (RO), SC (RO)	West-East-South-Carpathian endemic	Szelag 2008; Singliarová et al. 2008, 2011a, b, 2013; Singliarová & Mráz 2009; Ilnicki & Szelag 2011
<i>Plantago atrata</i> subsp. <i>carpatica</i> (Soó) Soó	WC (SK, PL), EC (UA, RO), SC (RO)	West-East-South-Carpathian endemic	Kliment 1999; Oprea 2005; Sárbu et al. 2013

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Poa babiogorensis</i> Bernátová, Májovský et Obuch	WC (PL)	West-Carpathian endemic (Beskid Żywiecki Mts: Mt. Babia Góra)	Bernátová et al. 1999, 2003a
<i>Poa carpatica</i> (V. Jirásek) Chopik <sup>144</sup>	WC (SK, PL), EC (UA)	West-East-Carpathian endemic	Čopyk 1976; Bernátová et al. 2006
(Syn.: <i>P. nemoralis</i> subsp. <i>carpatica</i> V. Jirásek)			
<i>Poa granitica</i> Braun-Blanq.	WC (SK, PL), EC (UA, RO), SC (RO)	West-East-South-Carpathian endemic	Kliment 1999
<i>Poa granitica</i> Braun-Blanq. subsp. <i>granitica</i>	WC (SK, PL)	West-Carpathian endemic (Tatry Mts)	Kliment 1999; Mirek & Piękoś-Mirkowa 2008b
<i>Poa granitica</i> subsp. <i>disparilis</i> (Nyár.) Nyár. <sup>145</sup>	EC (UA, RO), SC (RO)	East-South-Carpathian endemic	Ghişa & Beldie 1972; Beldie 1972; Oprea 2005; Cioacărian 2009; Kobiv 2010; Sárbu et al. 2013
(Syn.: <i>P. delyti</i> Chrték et V. Jirásek)			
<i>Poa margilicola</i> Bernátová et Májovský	WC (SK)	West-Carpathian endemic (Veľká Fatra Mts: Mt. Borišov)	Bernátová & Májovský 1997; Bernátová et al. 2003b; Sipošová et al. 2004a
<i>Poa nobilis</i> Skalińska <sup>146</sup>	WC (SK, PL)	West-Carpathian endemic (Tatry Wysokie Mts)	Piękoś-Mirkowa et al. 1996; Kliment 1999; Piękoś-Mirkowa 2008
<i>Poa pannonica</i> subsp. <i>scabra</i> (Asch. et Graebn.) Soó <sup>147</sup>	WC (SK, HU), †EC (UA)/SC (RO)	West-South-Carpathian endemic	Kliment 1999; Oprea 2005; Dúbravková et al. 2010; Borhidi et al. 2012
<i>Poa rehmannii</i> (K. Richt.) Wol. <sup>148</sup>	EC (UA, RO)	East-Carpathian endemic	Čopyk 1976; Beldie 1979; Oprea 2005; Dihoru & Negrean 2009; Čornej 2011; Sárbu et al. 2013
(Syn.: <i>P. rehmannii</i> (K. Richt.) Szafer, nom. illeg.; <i>P. nemoralis</i> subsp. <i>rehmannii</i> (K. Richt.) Asch. et Graebn.)			
<i>Poa sejuncta</i> Bernátová, Májovský et Obuch	WC (SK)	West-Carpathian endemic (Západné Tatry Mts: Mt. Osobitá)	Bernátová et al. 1999, 2003a
<i>Prangos carinata</i> Griseb. ex Degen <sup>149, 150</sup>	SC (RO)	South-Carpathian endemic (Almajului Mts: Porțile de Fier Gorge)	Morariu & Beldie 1976; Beldie 1977; Dihoru & Párvu 1987; Oprea 2005; Dihoru & Negrean 2009
(Syn.: <i>P. carinata</i> Griseb. ex Grecescu, nom. illeg.; <i>P. ferulacea</i> subsp. <i>carinata</i> (Griseb. ex Degen) Dihoru)			
<i>Primula auricula</i> subsp. <i>hungarica</i> (Borbás) Soó <sup>151</sup>	WC (SK, PL)	West-Carpathian subendemic	Soó 1964, 1980a; Simon 1992; Kliment 1999
<i>Primula auricula</i> subsp. <i>serratifolia</i> (Roche) Jáv.	SC (RO, SRB)	South-Carpathian endemic	Beldie 1979; Popescu et al. 2003; Oprea 2005; Cioacărian 2009; Dihoru & Negrean 2009
<i>Primula leucophylla</i> Pax <sup>152</sup>	EC (RO)	East-Carpathian endemic	Șuteu 2012; Șuteu et al. 2011, 2013; Hurdú et al. 2014 in litt.
(Syn.: <i>P. elatior</i> subsp. <i>leucophylla</i> (Pax) Hestl-Harr.f. ex W. W. Sm. et H. R. Flechter)			
<i>Primula wulfeniana</i> subsp. <i>baumgartneriana</i> (Degen et Moesz) Lüdi	SC (RO)	South-Carpathian endemic	Dihoru & Párvu 1987; Oprea 2005; Dihoru & Negrean 2009; Negrean 2011; Hurdú et al. 2012a; Sárbu et al. 2013
(Syn.: <i>P. baumgartneriana</i> Degen et Moesz)			

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Pulmonaria rubra</i> subsp. <i>filarszkyana</i> (Jáv.) Domin <sup>153</sup>	EC (UA, RO)	East-Carpathian endemic	Čopyk 1976; Beldie 1979; Oprea 2005; Čornej 2011; Ciocârlan 2009; Sárbu et al. 2013
<i>Pulsatilla slavica</i> G. Reuss <sup>154</sup> (Syn.: <i>P. filarszkyana</i> Jáv.)	WC (SK, PL)	West-Carpathian endemic	Goliašová 1985; Kliment 1999; Šipošová et al. 2004b; Ciocârlan 2009
<i>Pulsatilla subslavica</i> Futák ex Goliašová (Syn.: <i>P. halleri</i> subsp. <i>slavica</i> (G. Reuss) Zamels)	WC (SK)	West-Carpathian endemic	Goliašová 1985; Kliment 1999
<i>Pyrola carpatica</i> Holub et Křisa (Syn.: <i>P. rotundifolia</i> subsp. <i>carpatica</i> (Holub et Křisa) Beldie et Váczy)	WC (SK, PL), EC (UA, RO), SC (RO)	West-East-South-Carpathian endemic	Kliment 1999; Oprea 2005; Ciocârlan 2009
<i>Ranunculus altitatrensis</i> Paclová et Murín	WC (SK)	West-Carpathian endemic (Vysoké Tatry Mts)	Paclová 1999
<i>Ranunculus carpaticus</i> Herbich	EC (SK, UA, RO), SC (RO)	East-South-Carpathian endemic	Kliment 1999; Oprea 2005
<i>Ranunculus flabellifolius</i> Heuff. ex Rchb. <sup>155</sup>	SC (RO, SRB)	South-Carpathian endemic	Jalas & Suominen 1989; Stevanović et al. 1991; Dunkel 2011
<i>Ranunculus malinovskii</i> Elenevsky et Deryv.-Sok. (Syn.: <i>R. kladnii</i> auct. non Schur)	EC (UA)	East-Carpathian endemic	Cvelev 2001; Diduch et al. 2004; Čornej 2011; Turlaj 2011
<i>Ranunculus pseudomontanus</i> Schur <sup>156, 157</sup> (Syn.: <i>R. montanus</i> subsp. <i>pseudomontanus</i> (Schur) Ciocârlan)	WC (SK, PL), EC (UA, RO), SC (RO), AC	West-East-South-Apusei-Carpathian (pan-Carpathian) subendemic	Kožuharov & Petrova 1988; Kliment 1999; Oprea 2005
<i>Rosa coziae</i> Nyár. <sup>158, 159</sup> (Syn.: <i>R. villosa</i> subsp. <i>coziae</i> (Nyár.) Ciocârlan)	SC (RO)	South-Carpathian endemic	Oprea 2005; Ciocârlan 2009; Kerényi-Nagy 2011; Hurdú et al. 2012a
<i>Salix kitaibeliana</i> Willd. (Syn.: <i>S. retusa</i> subsp. <i>kitaibeliana</i> (Willd.) Jáv.)	WC (SK, PL), EC (UA, RO), SC (RO)	West-East-South-Carpathian endemic	Kliment 1999
<i>Salvia transsylvanica</i> (Schur ex Griseb. et Schenk) Schur <sup>160</sup>	Tr, EC (RO)/SC (RO)	endemic to Transylvanian Basin, Eastern and Southern Carpathians	Dihoru & Párvu 1987; Oprea 2005
<i>Saussurea porcii</i> Degen <sup>161</sup>	EC (UA, RO)	East-Carpathian endemic	Kobiv et al. 2007b; Dihoru & Negrean 2009; Bahlej 2010; Kobiv 2010; Počynok & Prokopiv 2010; Derevenko 2011; Mátiš et al. 2014
<i>Saxifraga moschata</i> subsp. <i>dominii</i> Soó	WC (SK, PL)	West-Carpathian endemic	Kliment 1999
<i>Saxifraga moschata</i> subsp. <i>kotulae</i> S. Pawł.	WC (SK, PL)	West-Carpathian endemic (Tatry Mts, Nízke Tatry Mts)	Kliment 1999; Mirek & Piękoś-Mirkowa 2010

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Saxifraga mutata</i> subsp. <i>demissa</i> (Schott et Kotschy) D. A. Webb (Syn.: <i>S. demissa</i> Schott et Kotschy; <i>S. transsilvanica</i> Fuss)	SC (RO)	South-Carpathian endemic	Beldie 1977; Dihoru & Pârvu 1987; Webb 1993; Oprea 2005; Ciocârlan 2009; Sârbu et al. 2013
<i>Saxifraga wahlenbergii</i> Ball	WC (SK, PL)	West-Carpathian endemic	Kliment 1999; Cieślak et al. 2013
<i>Scabiosa columbaria</i> subsp. <i>banatica</i> (Waldst. et Kit.) Diklić <sup>16</sup>	SC (RO, SRB), AC (RO)/EC (RO)	East-South-Apuseni-Carpathian endemic	Prodan 1961; Diklić 1973; Mardari 2009; Hurdu et al. 2012b
(Syn.: <i>S. banatica</i> Waldst. et Kit.; <i>S. columbaria</i> subsp. <i>banatica</i> (Waldst. et Kit.) Soó, nom. illeg.)			
<i>Scabiosa lucida</i> subsp. <i>barbata</i> Nyár. (Syn.: <i>S. pseudobanatica</i> subsp. <i>barbata</i> (Nyár.) Cirtsek; <i>S. opaca</i> Klokov)	EC (UA, RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Kobiv et al. 2007a; Oprea 2005
<i>Scilla kladnii</i> Schur <sup>163</sup>	WC (CZ, SK, HU, PL), EC (SK, PL, UA), SC (RO), AC (RO), Tr (RO)	subendemic to Western, Eastern, Southern & Apuseni Carpathians and Transylvanian Basin (pan-Carpathian subendemic)	Kereszty 1993; Kricsfalussy & Vajnagi 1994; Kliment 1999; Kochjarová et al. 2004, 2005; Trávníček et al. 2010
(Syn.: <i>S. bifolia</i> subsp. <i>subtriphylla</i> (Schur) Domin; <i>S. alpina</i> Schur)			
<i>Scorzoneroideis pseudotaraxaci</i> (Schur) Holub (Syn.: <i>Leontodon pseudotaraxaci</i> Schur; <i>L. montanus</i> subsp. <i>pseudotaraxaci</i> (Schur) Finch et P. D. Sell)	WC (SK, PL), EC (UA, RO), SC (RO)	West-East-South-Carpathian endemic	Kliment 1999; Oprea 2005; Čornej 2011
<i>Sempervivum carpathicum</i> Wettst. ex Prodan <sup>164</sup>	WC (SK, PL), EC (PL, UA, RO), SC (RO)	West-East-South-Carpathian endemic	Letz 1998; Kliment 1999
<i>Sempervivum carpathicum</i> Wettst. ex Prodan subsp. <i>carpathicum</i> <sup>165</sup> (Syn.: <i>S. montanum</i> subsp. <i>carpathicum</i> (Wettst. ex Prodan) A. Berger)	WC (SK, PL), EC (PL, UA, RO), SC (RO)	West-East-South-Carpathian endemic	Letz 1998, 2002; Letz & Marhold 1998; Kliment 1999
<i>Sempervivum carpathicum</i> subsp. <i>heterophyllum</i> (Hazsl.) Letz <sup>166</sup> (Syn.: <i>S. montanum</i> subsp. <i>heterophyllum</i> (Hazsl.) Jáv. ex Soó)	WC (SK)	West-Carpathian endemic	Letz 1998, 2002; Letz & Marhold 1998; Kliment 1999
<i>Sempervivum matricum</i> Letz <sup>167</sup>	WC (SK, HU)	West-Carpathian subendemic	Blanár & Letz 2005; Letz 2009
<i>Senecio dacicus</i> Hodállová et Marhold (Syn.: <i>S. herecynicus</i> subsp. <i>dacicus</i> (Hodállová et Marhold) Greuter)	SC (RO), AC (RO)	South-Apuseni-Carpathian endemic	Hodállová & Marhold 1998; Hodállová 1999a, b; Negrain 2011

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Senecio ucranicus</i> Hodállová <sup>168</sup> (Syn.: <i>S. hercynicus</i> subsp. <i>ucranicus</i> (Hodállová) Greuter)	EC (SK, PL, UA, RO), SC (RO)	East-South-Carpathian subendemic	Hodállová 1999b; Rola 2014
<i>Sesleria heufflerana</i> Schur	WC (SK, HU), EC (UA, RO), SC (RO), AC (RO), Tr (RO)	subendemic to Western, Eastern, Southern & Apuseni Carpathians and Transylvanian Basin (pan-Carpathian subendemic)	Kliment 1999
<i>Sesleria heufflerana</i> Schur subsp. <i>heufflerana</i> <sup>169</sup>	WC (SK, HU), EC (UA, RO), SC (RO), AC (RO), Tr (RO)	subendemic to Western, Eastern, Southern & Apuseni Carpathians and Transylvanian Basin (pan-Carpathian subendemic)	Čopyk 1976; Gejdeman 1986; Kliment 1999; Oprea 2005
<i>Sesleria heufflerana</i> subsp. <i>hungarica</i> (Ujhelyi) Deyl <sup>170</sup> (Syn.: <i>S. hungarica</i> Ujhelyi)	WC (HU)	West-Carpathian endemic (Bükk Mts)	Lysák 1996; Kliment 1999; Borhidi et al. 2012
<i>Sesleria rigida</i> Heuff. ex Rchb. <sup>171</sup> (Syn.: <i>S. haymaldiana</i> Schur; <i>S. rigida</i> subsp. <i>haymaldiana</i> (Schur) Beldie)	EC (RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Morariu & Beldie 1976; Beldie 1979; Oprea 2005; Kuzmanović et al. 2013
<i>Sesleria tatrae</i> (Degen) Deyl <sup>172</sup> (Syn.: <i>S. sadlerana</i> subsp. <i>tatrae</i> (Degen) Deyl)	WC (SK, PL)	West-Carpathian subendemic	Fabiszewski 1970; Hendrych 1987; Kliment 1999; Budzáková et al. 2014
<i>Silene dinarica</i> Spreng. <i>Silene nivalis</i> (Kit.) Rohrb. (Syn.: <i>Lychnis nivalis</i> Kit.; <i>Polyschemone nivalis</i> (Kit.) Schott, Nyman et Kotschy)	SC (RO) EC (RO)	South-Carpathian endemic East-Carpathian endemic (Rodna Mts)	Beldie 1977; Chater et al. 1993; Ciocărlan 2009 Coldea 1997; Oprea 2005; Ciocărlan 2009; Dihoru & Negrean 2009; Sárbu et al. 2013
<i>Silene nutans</i> subsp. <i>dubia</i> (Herbich) Zapal. (Syn.: <i>S. dubia</i> Herbich) <sup>173,174</sup>	EC (SK, PL, UA, RO), SC (RO), AC (RO) EC (UA, RO)	East-South-Apuseni-Carpathian endemic East-Carpathian endemic	Kliment 1999; Oprea 2005; Meredá et al. 2012
<i>Silene zawadzkkii</i> Herbich (Syn.: <i>Elisanthe zawadzkkii</i> (Herbich) Klokov; <i>Melandrium zawadzkkii</i> (Herbich) A. Braun; <i>Sileneanthe zawadzkkii</i> (Herbich) Griseb. et Schenk) <i>Soldanella carpatica</i> Vierh.	WC (SK, PL)	West-Carpathian endemic	Kliment 1999; Zhang & Kadereit 2002; Kochjarová & Hroudá 2006
<i>Sorbus amici-petri</i> Mikoláš <sup>175</sup>	WC (SK)	West-Carpathian endemic (Čierna hora Mts)	Mikoláš 2003
<i>Sorbus atrimontis</i> Bernátová et Májovský	WC (SK)	West-Carpathian endemic (Veľká Fatra Mts)	Bernátová & Májovský 2003; Uhlířová & Bernátová 2004; Kliment et al. 2008

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Sorbus borbasii</i> Jáv.	SC (RO)	South-Carpathian endemic	Kárpáti 1960; Oprea 2005; Ciocărlan 2009; Dihoru & Negrean 2009; Hurdu et al. 2012a
<i>Sorbus caeruleomontana</i> Bernátová et Májovský	WC (SK)	West-Carpathian endemic (Nízke Tatry Mts; Mt. Siná)	Bernátová & Májovský 2003; Šípošová et al. 2004b
<i>Sorbus dacica</i> Borbás	AC (RO)	Apuseni-Carpathian endemic (Trascău Mts)	Kárpáti 1960; Dihoru & Negrean 2009; Hurdu et al. 2012a
<i>Sorbus diversicolor</i> Bernátová et Májovský	WC (SK)	West-Carpathian endemic (Veľká Fatra Mts)	Bernátová & Májovský 2003; Šípošová et al. 2004a; Uhlířová & Bernátová 2004
<i>Sorbus dolomiticola</i> Mikoláš <sup>176</sup>	WC (SK)	West-Carpathian endemic (Čierna hora Mts)	Mikoláš 1996
<i>Sorbus haljamovae</i> Bernátová et Májovský <sup>177</sup>	WC (SK)	West-Carpathian endemic	Bernátová & Májovský 2003; Uhlířová & Bernátová 2004
<i>Sorbus hazslinszkyana</i> (Soó) Májovský (Syn.: <i>S. austriaca</i> subsp. <i>hazslinszkyana</i> (Soó) Kárpáti)	WC (SK, HU)	West-Carpathian endemic	Kárpáti 1960; Kliment 1999
<i>Sorbus margittaiana</i> (Jáv.) Kárpáti (Syn.: <i>S. hostii</i> subsp. <i>margittaiana</i> Jáv.)	WC (SK)	West-Carpathian endemic (Krivánska Fatra Mts)	Bernátová et al. 1998; Májovský et al. 1998
<i>Sorbus montisalpae</i> Bernátová et Májovský	WC (SK)	West-Carpathian endemic (Veľká Fatra Mts)	Bernátová & Májovský 2003; Šípošová et al. 2004a; Uhlířová & Bernátová 2004
<i>Sorbus pekarovae</i> Májovský et Bernátová	WC (SK)	West-Carpathian endemic (Veľká Fatra Mts; Mt. Pekárová)	Májovský & Bernátová 1996; Bernátová & Májovský 1999; Šípošová et al. 2004a
<i>Sorbus salatinii</i> Bernátová et Májovský	WC (SK)	West-Carpathian endemic (Nízke Tatry Mts; Mt. Salatin)	Bernátová & Májovský 2003; Šípošová et al. 2004b
<i>Sorbus scepusiensis</i> Kovanda	WC (SK)	West-Carpathian endemic (Volvoské vrchy Mts)	Kovanda 1985, 1986; Kliment 1999
<i>Sorbus umbellata</i> subsp. <i>banatica</i> (Jáv.) Kárpáti	SC (RO)	South-Carpathian endemic	Kárpáti 1960; Ciocărlan 2009
<i>Sorbus zuzanae</i> Májovský et Bernátová <sup>178</sup>	WC (SK)	West-Carpathian endemic	Bernátová & Májovský 2003; Šípošová et al. 2004a; Uhlířová & Bernátová 2004
<i>Stipa crassiculmis</i> subsp. <i>heterotricha</i> Dihoru et Roman <sup>179</sup>	SC (RO)	South-Carpathian endemic (Cozia Mts)	Dihoru & Párvu 1987; Negrean & Oltean 1989; Dihoru & Negrean 2009; Negrean 2011; Vázguez & Gutiérrez 2011
<i>Stipa danubialis</i> Dihoru et Roman	SC (RO)	South-Carpathian endemic (Almajului Mts; Porțile de Fier Gorge)	Beldie 1979; Dihoru & Párvu 1987; Oprea 2005; Ciocărlan 2009; Dihoru & Negrean 2009



Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Swertia punctata</i> Baumg. <sup>180</sup> (Syn.: <i>S. peremisi</i> subsp. <i>punctata</i> (Baumg.) Cioacălan)	EC (UA, RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian subendemic	Beldie 1979; Tan & Vladimirov 2001; Oprea 2005; Kriessfalussy & Budnikov 2007; Kobiv 2010, 2012a
<i>Symphytium cordatum</i> Waldst. et Kit. ex Willd. <sup>181</sup> (Syn.: <i>S. cordatum</i> Waldst. et Kit., nom. illeg.; <i>S. cordifolium</i> Baumg.)	WC (SK, PL), EC (SK, PL, UA, RO), SC (RO), AC (RO), Tr (RO)	subendemic to Western, Eastern, Southern & Apuseni Carpathians and Transylvanian Basin (pan-Carpathian subendemic)	Čopyk 1976; Roman et al. 1996; Kliment 1999; Oprea 2005; Čornej 2011
<i>Syringa josikaea</i> J. Jacq. ex Rehb. f.	EC (UA), AC (RO)	East-Apuseni-Carpathian endemic	Dihoru & Negrean 2009; Bîlz 2013; Lendvay et al. 2013
<i>Taraxacum carpathicum</i> Štěpánek et Kirschner <sup>182</sup>	SC (RO)	South-Carpathian endemic	Štěpánek et al. 2011
<i>Taraxacum erythrocarpum</i> Kirschner et Štěpánek	WC (SK)	West-Carpathian endemic	Kirschner & Štěpánek 1985; Kliment 1999
<i>Taraxacum nigricans</i> (Kit.) Rehb. <sup>183</sup>	WC (SK)	West-Carpathian endemic (Nizke Tatry Mts)	Štěpánek et al. 2011
<i>Taraxacum pawlowskii</i> Soest <sup>184</sup>	WC (PL, ?SK)	West-Carpathian endemic (Tatry Wysokie Mts)	Tacik 1980; Mirek & Piękoś-Mirkowa 2009, 2010
<i>Taraxacum pienniticum</i> Pawł. <sup>185</sup> (Syn.: <i>T. hoppeanum</i> subsp. <i>pienniticum</i> (Pawł.) Pawł.)	WC (PL)	West-Carpathian endemic (Preniny Mts; Mt. Trzy Korony)	Zarzycki 1986; Mirek et al. 1995; Wróbel & Zarzycki 2008
<i>Tephrosieris longifolia</i> subsp. <i>moravica</i> Holub	WC (CZ, SK)	West-Carpathian endemic	Kochjarová 1998; Kochjarová & Hrouda 2004; Janišová et al. 2012; Hegedišová et al. 2013; Olšavská et al. 2015
<i>Thalictrum minus</i> subsp. <i>carpathicum</i> (B. Kotula) Osvač.	WC (SK, PL)	West-Carpathian endemic (Tatry Mts)	Kliment 1999; Mirek & Piękoś-Mirkowa 2010
<i>Thesium kernerianum</i> Simonk.	EC (RO), SC (RO)	East-South-Carpathian endemic	Negrean & Oltean 1989; Oprea 2005; Dihoru & Negrean 2009
<i>Thymus alternans</i> Klokov <sup>186</sup>	EC (SK, UA, RO)/SC (RO), AC (RO)	East-South-Apuseni-Carpathian subendemic	Klokov 1960; Mártonfi 1996; Kliment 1999; Oprea 2005; Mártonfi 2014 in litt.
<i>Thymus bihoriensis</i> Jalas (Syn.: <i>T. marginatus</i> A. Kern. non Sm. ex Dickson, nom. illeg.)	EC (RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Beldie 1979; Dihoru & Pârnu 1987; Oprea 2005
<i>Thymus comosus</i> Heuff. ex Griseb. et Schenk (Syn.: <i>T. comosus</i> Schur, nom. illeg.)	EC (RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Morariu & Beldie 1976; Dihoru & Pârnu 1987; Oprea 2005
<i>Thymus dactylicus</i> Borbás <sup>187</sup> (Syn.: <i>T. porcii</i> Borbás)	EC (RO), SC (RO), SRB), AC (RO)	East-South-Apuseni-Carpathian subendemic	Guşuleac 1961; Diklić & Vasić 2000

Taxon	Occurrence in the Carpathians	Category of endemism	References
<i>Thymus pulcherrimus</i> Schur	WC (SK, PL), EC (UA, RO), SC (RO)	West-East-South-Carpathian subendemic	Kliment 1999; Oprea 2005
<i>Thymus pulcherrimus</i> Schur subsp. <i>pulcherrimus</i> (Syn.: <i>T. circumcinctus</i> Klokov)	WC (SK, PL), EC (UA, RO), SC (RO)	West-East-South-Carpathian endemic	Mártonfi 1997; Kliment 1999; Čornej 2011
<i>Thymus pulcherrimus</i> subsp. <i>sudeticus</i> (Lyka) P. A. Schmidt <sup>188, 189</sup>	WC (SK, PL)	West-Carpathian subendemic	Kliment 1999
(Syn.: <i>T. carpathicus</i> Čelak.)			
<i>Trifolium orbelicum</i> subsp. <i>monticolum</i> (Domin) Májovský	WC (SK, PL)	West-Carpathian endemic	Kliment 1999; Mirek & Piękoś-Mirkowa 2010
<i>Trifolium pratense</i> subsp. <i>kotulae</i> (Pawl.) Soják <sup>190</sup> (Syn.: <i>T. pratense</i> var. <i>kotulae</i> Pawl.; <i>T. frigidum</i> Schur)	WC (SK, PL), EC (UA, RO), SC (RO)	West-East-South-Carpathian endemic	Kliment 1999; Oprea 2005; Kriesfalussy & Budnikov 2007
<i>Trifolium sarosienae</i> Hazsl. <sup>191</sup> (Syn.: <i>T. medium</i> subsp. <i>sarosienae</i> (Hazsl.) Simonk.; <i>T. sarosienae</i> subsp. <i>banaticum</i> (Heuff.) Holub)	WC (SK, HU), EC (?UA, RO), SC (RO), AC (RO), Tr (RO)	subendemic to Western, Eastern, Southern & Apuseni Carpathians and Transylvanian Basin (pan-Carpathian subendemic)	Hendrych 1993, 1995; Kliment 1999
<i>Trisetum flavescens</i> subsp. <i>tatriticum</i> Chrték <sup>192</sup>	WC (SK), EC (SK, PL, †UA)	West-East-Carpathian endemic	Kliment 1999; Čornej 2011
<i>Trisetum fuscum</i> (Kit. ex Schult.) Schult. (Syn.: <i>T. ciliare</i> (Kit.) Domin)	WC (SK, PL), EC (UA, RO), SC (RO), AC (RO)	West-East-South-Apuseni-Carpathian (pan-Carpathian) endemic	Kliment 1999; Oprea 2005
<i>Trisetum macrotrichum</i> Hack.	EC (RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Buia & Morariu 1972; Morariu & Beldie 1976; Oprea 2005
<i>Tulipa hungarica</i> Borbás <sup>193, 194</sup> (Syn.: <i>T. hungarica</i> subsp. <i>undulatifolia</i> (Roman) Roman et Beldie)	SC (RO, †SRB)	South-Carpathian endemic	Ciocărlan 2009; Dihoru & Negrean 2009; Negrean 2011; Čalić et al. 2012; Stevanović 2013
<i>Valeriana tripteris</i> subsp. <i>heterophylla</i> (Baumg.) Rostański <sup>195, 196, 197</sup> (Syn.: <i>V. tripteris</i> var. <i>heterophylla</i> Baumg.; <i>V. transsilvanica</i> Schur; <i>V. sisymbriifolia</i> Schur non Vahl, nom. illeg.)	EC (SK, PL, UA, RO), SC (RO), AC (RO)/WC (PL)	East-South-Apuseni-Carpathian endemic	Schur 1866; Simonkai 1887; Katina 1961; Morariu 1961; Rostański 1967, 1970; Prokudin 1987; Dmytrach 2010; Tassenkevyc 2014
<i>Viola declinata</i> Waldst. et Kit. <sup>198</sup>	EC (UA, RO), SC (RO), AC (RO)	East-South-Apuseni-Carpathian endemic	Oprea 2005; Velev & Apostolova 2009
<i>Viola jooi</i> Janka <sup>199</sup>	EC (UA, RO), SC (RO), AC (RO), Tr (RO)	subendemic to Eastern, Southern & Apuseni Carpathians and Transylvanian Basin	Grinşescu et al. 1955; Oprea 2005; Čornej 2011; Cristea 2014