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DATA TO THE VEGETATION BIOLOGY AND COENOLOGICAL RELATIONS OF *ALLIUM URSINUM* L. STANDS IN EASTERN TRANSYLVANIA

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Abstract

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The analysis of *Allium ursinum* s. l. stands in the natural forest vegetation of the Eastern Transylvanian area, concluded that this species realize high abundancy-dominancy values (A-D: 3-5) and strong coenological relations especially in the *Lathyro-Carpinion* alliance with peculiar 'Dacic' (Transylvanian) characteristics. The plant communities of the deciduous forests in the hilly area (oak-hornbeam and hornbeam-beech mixtures) like *Lathyro hallersteinii-Carpinetum* and *Carpino-Fagetum* contain the most widespred and representative stands of the wild garlic in the region, followed by the mountain plant communities of the beech woods and beech-spruce mixed forests like *Symphyto cordatae-Fagetum* and *Leucanthemo waldsteinii-Fagetum*. The riparian and the floodplain forest communities contain rare, local and mostly fragmentary stands of the wild garlic.

The stationary observations in three different sites (two in the Transylvanian Basin and one in the Carpathian area) indicate that the available water, soil moisture and humid microclimate, followed by soil rich in nitrogen and absence of aluminium, are the most important ecological factors for the forming of monospecific stands of *Allium ursinum*. The allelopathic activity of the wild garlic may also be important. Through its soil-mediated and volatile compounds it may influence other herbaceous plants, inhibing germination and growth. Due to its characteristic vegetation bio-logy and interspecific relations, leading to the formation of monospecific stands, the species may become locally invasive.

Key words: *Allium ursinum*, wild garlic, stands, plant community, coenological relations, Eastern Transylvania

Introduction

The increasing interest manifested in the biodiversity and the wild genetic resources of medicinal plants needs more and more scientific investigation, related not only to the chemical content, but also to the biology, ecology and coenology of the species and populations. The species *Allium ursinum* L. (commonly names: ramson, wild garlic, bear's garlic) were used by the traditional medicine since a long time especially its aerial parts and the bulbs (*Allii ursini herba, Allii ursini bulbus*) as an antifungal, antihypertensive and antiatherosclerotic agent (ALLEN & HATFIELD 2004, CARLSON 2007, SZABÓ 2005). The pharmacological studies evaluated its anti-infective, antimicrobial, antioxydant and anticancer properties and several clinical studies have focused on its potential effect in preventing cardiovascular diseases (SOBOLEWSKA et al. 2006, CARLSON 2007). Reports on chemical composition of the wild garlic evidenced the presence of many sulfur compounds (cysteine sulfoxides, divinyl sulfides, thiosulfinates), flavonoids and lectins and its allelopathic influences also (DJURDEVIŽ et al. 2003, SOBOLEWSKA et al. 2006).

Allium ursinum L. (sensu lato) is a perennial plant, widely distributed in Europe (but mostly absent in the North and in the evergreen Mediterranean region), which develops a characteristic garlic-like smell and flavour in the biotopes. It is present in various deciduous woodlands (ex. floodplain forests, oak-hornbeam, hornbeam-beech mixed woods) and mixed beech-fir and beech-spruce forests, preferring damp shadow places, meso- and eutrophic, neutral to moderately acid soils of the hilly and the mountainous vegetation belt, being part of the *Corydalis* ecological group. The species forms dense populations (synusia, facies) where which the other species are either sparsely present or absent. It is generally considered as a central-european floristic element, with subatlantic-submediterranean characters (SOÓ 1973, KEVEY 1978, OBERDORFER 1994).

Taxonomically the species *Allium ursinum* L. makes place in the Sect. *Ophioscorodon* (WEBB, 1980, STACE 1997) characterized by narrow naked bulbs, with only a few parallel fibres at the base, with 2-3 elliptical and basal leaves, with narow petioles up to as long as the blade, with stamens shorter than tepales. It differs from *A. victorialis* (Sect. *Anguinum*) which presents almost cylindrical bulbs, clustered on a short rhizome, leaves 2-3 narowly lanceolate to broadly elliptical, narrowed at the base into a short petiole, stamens longer than tepales. Many Floras recognize the variability of the species *Allium ursinum* by the presence of two infrataxa: subsp. *ursinum* whose pedicels are scabrid with numerous papillae, widespred in West and Central Europe, and the subsp. *ucrainicum* KLEOPOW & OXNER whose pedicels are represented by smooth (WEBB 1980) distributed mostly in East and South-East Europe, with a pontic-mediterranean character (ZAHARIADI 1966, CIOCÂRLAN 2000). The chromosome number for both subspecies is indicated as 2n: 14, when for the other *Allium* species frequently it is 2n: 16. Many transitional populations between these subspecies have been reported also (SOJAK 1968, ZAHARIADI 1966, DRĂGULESCU 1995). Recently, CZEREPANOV (1995), KRICSFALUSY & BUDNIKOV (2007) recognize only one taxon, the *Allium ursinum* L. (s. l.) whithout any infraspecific taxa.

Related to the biological diversity and the gene pool stability of *Allium ursinum* in Europe, the botanical literature indicates as less frequent in Eastern Europe (DRĂGULESCU 2003, OPREA 2005, ZAHARIADI 1966) that in Central and Western European regions (ADLER et al. 1994, OBERDORFER 1994). For this reason, its presence have been considered regionally/locally *aboundant* (KEVEY 1978) in Transdanubia, relatively *rare* (DRĂGULESCU 2003) in Central Transylvania, relatively frequent (PÁLFALVI 1999) in Eastern Transylvania, or even as a *nearly threatened* plant, like in the Ucrainian Carpathians (KRICSFALUSY & BUDNIKOV 2007). The necessity of the evaluation of natural populations and stands of the wild garlic, the conservation of its biotops and of the gene pool inside of deciduous mesic forests in Transylvania constitue a main task for vegetation biology and coenology. The present survey have been organized in order to contribute with new data and to elucidate some actuall aspects of its coenotic relations and to establish the conservation priorities concerning this species in the eastern part of Transylvania (Romania).

Materials and methods

The investigation continues our studies related to the vegetation survey, coenological evaluation and distribution of various vegetation units in the Eastern part of

Transylvania (KOVÁCS 2004), with the characteristics of the studied area also: relief, soils, climate etc. Phytogeographically the study is focused to the nemoral and the boreal belt of vegetation, especially the hilly (subcarpathian) region of the Eastern part of the Transylvanian Basin, and the mountain area of the East Carpathians, actually being part of the counties territories Maros (Mureş), Hargita (Harghita) and Kovászna (Covasna). The hilly and the mountainous landscape, the climate and the soil conditions offer favourable biotope conditions to maintain the wild garlic (*Allium ursinum*) populations and stands.

Although its presence in this region have been mentioned by various floras and studies (SIMONKAI 1886, SOÓ1940, ZAHARIADI 1966, DRĂGULESCU 2003, OPREA 2005 etc), the ethnobotanical reviews (BUTURĂ 1979, PÁLFALVI 1999), data related to its vegetation biology and by coenological relations are discontinuous. Nowadays, natural scientist and tourists frequently met people collecting wild garlic herba in the field, but the scientific studies and theses (DANCIU 1974, KOVÁCS AL. 1981, KOVÁCS J. A. 1975, NECHITA 2003 etc.) present rare or sporadic data about its coenology and vegetation structures. It whoud be necessary to answer the question: are the wild garlic populations and stands in a decreasing or in an increasing phase of vegetation in the studied area? Therefore we organized vegetational studies using the itinerary and the stationary methods. The itinerary survey regards the forests in the hilly and in the mountainous area, the stationary observations have been organized in three different sites, two in the hilly area [Szenterzsébet (Eliseni), Szentábrahám (Avrămeşti)] and one in the mountainous area [Vargyas (Vârghiş)] where observations related to the local environmental factors and several biological characters (germination, growth etc.) referring to the wild garlic, were made.

In the coenological analysis we have used the concenpt of the coeno-ecological species groups (SOÓ 1973, ELLENBERG et al. 1992) and the standard procedures of the Braun-Blanquet method. The relevé size of plots ranged between 400-900 m^2 . The individual relevés were analysed in synoptic tables, using the constancy-class (K%) values. For the registration of the abundancy-dominancy (A-D) values registration in the field we used the more common notation in Europe, the modified Braun-Blanquet scale.

The modified Braun-Blanquet scale used:
r = rare individuals (1-2)
\+ = cover < 5%, individuals < 5
1 = cover < 5%, individuals < 50
2m = cover < 5%, individuals > 50
2a = cover 5-15%, various individuals
2b = cover 15-25%, various individuals
3 = cover 25-50%, various individuals
4 = cover 50-75%, various individuals
5 = cover 75-100, various individuals

The field investigation were carried out during the last decade, mostly in 2003-2007, when we applied itinerary and stationary succesive studies on the coenologically representative sites with wild garlic (*Allium ursinum*).

The nomenclature of species follows CIOCÂRLAN (2000), SIMON (2000) and OPREA (2005). The classification of the vegetation units and the community description was made in accordance with the code of phytosociological nomenclature (BORHIDI 2003), with special regards to the deciduous forests in a broad sense in Europe (DIERSCHKE 2004, KOVÁCS 2004).

Results and discussion

Syntaxonomical ordering

QUERCO-FAGETEA Br.-Bl. et Vlieger in Vlieger 1937
FAGETALIA SYLVATICAE Pawlowski in Pawl. et al. 1928
Symphyto cordatae-Fagion (Vida 1959) Täuber 1982
1. *Symphyto cordatae-Fagetum* Vida 1959
2. *Leucanthemo waldsteinii-Fagetum* (Soó 1964) Täuber 1987
QUERCO-CARPINETALIA Moor 1977
Lathyro-Carpinion Boşcaiu 1974
3. *Lathyro hallersteinii-Carpinetum* Coldea 1975
4. *Carpino-Fagetum* Paucă 1941
ALNO-FRAXINETALIA Moor 1975
Alnion incanae Pawlowski in Pawl. et Wallish 1928
Alnenion glutinosae-incanae Oberd. 1953
5. *Aegopodio-Alnetum* V. Kárpáti, I. Kárpáti et Jurkó 1961

Short characterization of the plant communities

1. *Symphyto cordatae-Fagetum* (Table 1.)

The mountainous eutrophic-mesotrophic beech forests, characteristics for the South-East Carpathians have a large distribution in the studied area, developed on various rocks, mostly on volcanic, chrystalline, conglomerate and calcareous substrate, especially on mesic sites. In the „subcarpathian" region this type of vegetation appears only fragmentary, being present only on the north exposition of the high hills. Stands with *Allium ursinum* belonging to this vegetation type have been identified in the following places: Valley of Sikaszó (Zetelaka, Zetea), Siklódi-kő (Siklód, Şiclod), Valley Visa (Ratosnya, Răstolniţa), Nagyhagymás-Naskalát Mts. (Mţii Hăghimaş-Năşcălat) area and, in the neigbourhood of the Valley of Vargyas (Cheile Vârghişului). This last site, the Hidegaszó-Vargyas valley (Homoródalmás, Mereşti) was considered as one representative site that express a special coenological relation of the *Allium ursinum* stands (Table 1.).

For the floristic composition of this plant community it is important that wild garlic (*Allium ursinum*) populations with a high abundancy-dominancy (A-D: 3-5; 55-85%) realize here a coenological 'facies' varied from the monodominant to the codominant stage. The coeno-ecological species group expressing with a high fidelity the mountaine biotope condonditions are composed by the following species: *Allium ursinum, Dentaria glandulosa, Hepatica transsilvanica, Symphytum cordatum, Pulmonaria rubra, Helleborus purpurascens, Aconitum moldavicum.* The habitat is edificated by the general *Fagetalia* elements also: *Dentaria bulbifera, Euphorbia amygdaloides, Anemone nemorosa, Salvia glutinosa, Galeobdolon luteum.*

The biotop is in the vicinety of a humid rocky valley and a mountain defile in which the *Allium ursinum* populations realize a smaller cover (A-D: 1-2b; 5-25%) and are accompanied by characteristic species for gorges like: *Mercurialis perennis, Phyllitis scolopendrium, Aruncus dioicus, Lunaria rediviva.*

Comparing the East Transylvanian community floristic composition dominated by *Allium ursinum* stands with the Central-European coenoses on mesic alluvial soils like *Querco-Ulmetum* resp. *Ficario-Ulmetum* (Oberdorfer 1994), the floristical-coenological differences are pregnant (significant differences regarding the tree layer and the herb layer composition). Nevertheless, succesive stationary observation (Vargyas, Vârghiş) demonstrated some particularities and similarities in the ecology of the sites. *Allium ursinum* is sensitive to the water content and to the drought and, as a characteristic plant of the forest herb layer, can form easily monospecific stands if the avaible water sources permits. Its populational structure is specific, as in spite of the very high domination of adult plants, the seedlings and the juvenile individuals are not supressed. These features/properties of the specific vegetation biology conditioned by the soil moisture contribute to realize a characteristic coenotic relations also in the East Transylvanian mountainous conditions.

2. *Leucanthemo waldsteinii-Fagetum*

The beech and spruce mixed woods (formely called *Chrysanthgemo rotundifolio-Piceo-Fagetum*) are localized in the mountainous region (about 800-1300 m s. l), at the contact of the Carpathian beech forests with spruce woods. There, in less mesotrophic habitats, some *Allium ursinum* stands have been observed also, like in valleys of the Nagyhagymás-Naskalát Mts. (Hăghimaş Mts., Naşcalat Mts.), alongside the mountain streams of the Csík Mts. (ex. Uz-valley, Csinód etc.) (PÁLFALVI 1999, KOVÁCS 2004). The tree layer of these coenoses are characterized and dominated by the species *Fagus sylvatica, Picea abies, Acer pseudoplatanus.* The herb layer presents characteristic species like: *Leucanthemum waldsteinii, Telekia speciosa, Adenostyles alliariae, Cicerbita alpina, Aegopodium podagraria* with a participation of the *Allium ursinum* stands, locally abundant (A-D: 2b-3), but generally less representative than in the former phytocoenoses.

The participation of the wild garlic in this mountain community is also conditioned by the soil water regim, the humid climate of the mountain valleys. It was observed that the mountainous people, the pastoral life contributes to the spreading of the ramson populations also (Gyimes Mts, Csík Mts.).

3. *Lathyro hallersteinii-Carpinetum* (Table 2.)

The mixed oak-hornbeam natural forests with Transylvanian resp. Dacic characteristics (called formely *Querco petraeae-Carpinetum* Borza 1941) occupy large territories in the Transylvanian Basin, and in the Eastern Subcarpathians also, especially on the Küküllő Plateau (Podişul Târnava) or on hilly area. In our survey, we identified extensive stands of *Allium ursinum* especially in the hilly region along the Nagyküküllő river valley (Valea Târnava Mare), in the forests situated in the neighbourhood of the localities Újszékely (Secuieni), Újlak (Uilac), Szenterzsébet (Eliseni), Alsóboldogfalva (Bodogaia) etc.

The tree layer of these coenoses is edified by the species *Quercus petraea, Quercus robur, Carpinus betulus, Acer campestre, Cerasus avium,* followed frequently by the shrub (bush) layer composed by *Ligustrum vulgare, Crataegus monogyna, Viburnum lantana, Carpinus betulus* etc. In the herb layer the wild garlic *Allium ursinum* realize sometimes monodominant stands of several hectares (A-D: 3-5) or interesting coenoses with *Stellaria holostea, Vinca minor, Arum maculatum, Corydalis solida, C. cava, Symphytum tuberosum, Isopyrum thalictroides, Silene dubia, Waldsteinia geoides* etc.

The floristic composition of the herb layer can be appropriate to the Central-European „Carpinion" forests, but several differential taxa (*Helleborus purpurascens, Erythronium dens-canis, Scilla bifolia* agg,, *Dactylis polygama, Lathyrus hallersteinii, Waldsteinia geoides*) indicate the Transylvanian (Dacic) coenological characteristics, expressed by the alliance of the *Lathyro hallersteinii-Carpinion.*

The valuable natural genetic sources of the woods with wild garlic in the Eastern part of the Transylvanian Basin presently is affected by strong human influences. It is important to establish territories as 'sites for special scientific interests' (SSSI), to maitain and to conserve the wild garlic forests for studies and for medicinal purposes. In this direction we initiated the first step at the Forest Administration and at the regional hunter associations.

4. *Carpino-Fagetum* (Table 3).

The submontane and the hilly hornbeam-beech forest conserved and stocked the most important wild garlic stands in the area of Eastern Transylvania. The *Allium ursinum* stands have been recorded inside of the *Carpino-Fagetum* plant community, in mesic habitats of eutrophic-mesotrophic brown soils of the forests in the neighbourhood of the following localities: Kibéd (Chibed), Makfalva (Ghindari), Siklód (Şiclod), Szakadát (Săcădat), Lövéte (Lueta), Székelyudvarhely (Odorheiu-Secuiesc), Vargyas (Vârghiş), Erdőfüle (Filia), Kőrispatak (Crişeni), Kismedesér (Medişoru Mic), Rugonfalva (Rugăneşti), Gagy (Goagiu), Andrásfalva (Andreeni), Szentábrahám (Avrămeşti), Okländ (Ocland).

The tree layer of the plant community is structured by *Fagus sylvatica, Carpinus betulus, Acer platanoides, Cerasus avium, Tilia cordata*. The layer of shrubs is sporadic and composed by the species: *Lonicera xylosteum, Daphne mezereum, Ligustrum vulgare, Fagus sylvatica* etc. The herb layer composition is dominated by *Allium ursinum* stand as a facies (A-D: 3-5), followed by the vernal flora of the Transylvanian (Dacic) „Carpinion" species group: *Helleborus purpurascens, Erythronium dens-canis, Dentaria bulbifera, Scilla bifolia* agg., *Dactylis polygama, Vinca minor* etc.

The stationary analyses of the most representative stands of *Carpino-Fagetum* put in evidence that for the stable populations of *Allium ursinum* the most important environmental factors are: the mesic biotope, the spring water level, a good texture, an eutrophic-mesotrophic soil status and neutral to weakly acid soil reaction. In the studied sites with well balanced environmental conditions, the *Allium ursinum* stands present something like a polycormon structure, but reproducing by seeds, using a narrow ecological amplitude of the plant community. It was demostrated, that in the same population, without well developed vigurous and generative plants (shoots with inflorescence), can be observed seedlings, juvenile plants, senile plants and virginal individual plants can be

observed ensuring the stability of the population. The demographic pattern of the *Allium ursinum* contributes to conserve the homeostasis of the plant community. Like the former community, a part of the stands (ex. Kismedesér (Medişoru Mic), Szentábrahám (Avrămeşti) have been proposed to be protected, maintained and conserved for scientific and practical purposes.

5. *Aegopodio-Alnetum*

This plant community has fragmentary distribution in the reserch area. It can be observed alongside the rivers and brooks, walleys, wet places and small depressions mainly in the hilly region. The stands usually are situated near the hornbeam-beech mixture woods, beech forests, or in the transitional zone from these to the alderwoods. In the present survey only a few coenoses we recorded with *Allium ursunum* like: Maros (Mureş) river bank (Ratosnya, Răstoliţa), walley of Vargyas (Vargyas, Vârghiş), the stream Ing (Szentábrahám, Avrămeşti).

The tree layer of the analysed woods is edificated by *Alnus glutinosa, Carpinus betulus, Salix alba.* The shrub layer in some places can be also significant: *Sambucus nigra, Frangula alnus, Daphne mezereum, Padus racemosa.* In the herb layer, the *Allium ursinum* population presents lower domination than in other communities, but the average combined A-D (Abundancy-Dominancy) values (A-D: 1-3) confirme the coenotic structure of a 'facies'. The dominancy of *Allium ursinum* is followed by a series of herbaceus species: *Galium aparine, Aegopodium podagraria, Corydalis cava, Ranunculus ficaria, Caltha palustris, Paris quadrifolia, Festuca gigantea, Symphytum officinale, Carex brizoides, Filipendula ulmaria, Urtica dioica* etc. The herbaceous species composition shows that near the alliance characteristics hygrophilous and nitrophilous species can be found also, what reflects well the biotope features, like the humid climate of the valleys, mesic-fertile soils.

The field observations realized annually in some stationary sites [Vargyas (Vârghiş), Szentábrahám (Avrămeşti), Szenterzsébet (Eliseni)] demonstrated a series of common features in the vegetation biology of the wild garlic. The most important are the following: the seed germination depends on the temperature values of the late winter time and in the early spring period. For a good germination relatively low temterature is necessary, which generally occurs in the late winter time or in the early spring. The first shoots, leaves and inflorescences are developed in the population also under a relatively low temperature, in early spring (Aprile-May). The allelopathic activity influenced the establishment of the individual plants, because they influences other herbaceous plants from the herb layer by soil and the volatile compounds, which inhibit the other species seed germination and growth. The plant individuals can accumulate forming abundant populational structure, monospecific stands, so in the new stand structure several distinguished plant categories can be present: seedlings, juvenile plants, senile plants, generative plants (with inflorescences) and vegetative plants.

The plant individuals are sensitive to extreme ecological factors, like drought or very unbalanced microclimate conditions. In the formation of local pure stands, the most important ecological factors are related to the available water, the soil moisture, the humid microclimate, followed by the fertile soil, rich in nutrients, especially in N, the absence of the soil alluminium. Inside of forest community, the stands of *Allium ursinum*

arrive to be an adequat ecological indicator. In the whole vegetation biology of *Allium ursinum* the factors determining the intraspecific relations are relatively less important than the interspecific relations, leading to form the characteristic monospecific stands.

Conclusion

The analysis of *Allium ursinum* s. l. stands in the natural forest vegetation of the Eastern Transylvanian region, respectively in the 'Subcarpathian' and in the 'East Carpathian' area, concluded that the species realize high abundancy-dominancy values (A-D: 3-5) and higher coenological relations especially in the *Lathyro-Carpinion* alliance with particular 'Dacic' (Transylvanian) characteristics. The plant communities of the deciduous forests in the hilly area (oak-hornbeam and hornbeam-beech mixtures) like *Lathyro hallersteini-Carpinetum* and *Carpino-Fagetum* contain the most widespred and representative stands of the wild garlic in the region, followed by the mountain plant communities of the beech woods and beech-spruce mixed forests of *Symphyto cordatae-Fagetum* and *Leucanthemo waldsteinii-Fagetum*. The riparian and the floodplain forest communities contain rare, fragmentary and locally stands of the wild garlic.

The stationary observations in three different sites [Vargyas (Vârghiş), Szentábrahám, (Avrămeşti), Szeterzsébet (Eliseni)] indicated that the development of balanced populational structure of *Allium ursinum,* respectively in the forming of the monospecific stands, the most important ecological factors are the available water, the soil moisture, the humid microclimate, followed by fertile N rich soils and absence of soil aluminium etc. In this process the allelopathic activity has also a main contribution, *Allium ursinum* individuals influence other herbaceous plants of coenose via soil and volatile compounds, which inhibit the other species seed germination and plant growth. The individual plants can densily accumulated forming abundant structure of distinguished categories: seedlings, juvenile plants, senile plants, vegetative and generative plants (shoots with inflorescences). Due to this characteristic vegetation biology, and the interspecific relations leading to monospecific stands, the species may become locally invasive.

Syntaxonomic tables

Table 1. *Symphyto cordatae-Fagetum*

Number of relevés	**1**	**2**	**3**	**4**	**5**	**K**
Slopes (degrees)	5	15	10	15	15	
Cover tree layer (%)	85	80	75	75	85	
Cover herb layer (%)	45	60	65	70	45	
Diagn. ass. - facies						
Fagus sylvatica	5	4	3	3	4	V
Allium ursinum	3	4	4	4	3	V
Symphyto cordatae-Fagion						
Dentaria glandulosa	1	2m	2a	-	1	IV
Hepatica transsilvanica	1	2m	-	2m	-	III
Symphytum cordatum	-	1	-	1	-	II
Pulmonaria rubra	+	-	+	-	-	II
Helleborus purpurascens	-	-	1	2m	-	II
Aconitum moldavicum	-	-	+	-	+	II

Fagetalia sylvaticae						
Daphne mezereum	-	-	-	+	+	II
Dentaria bulbifera	2b	2m	-	2a	1	IV
Euphorbia amygdaloides	1	1	2m	-	1	IV
Anemone nemorosa	2m	-	-	2a	1	III
Salvia glutinosa	-	1	1	+	-	III
Mercurialis perennis	2m	-	2m	-	2m	III
Actaea spicata	-	+	-	+	+	III
Circaea lutetiana	-	-	+	+	+	III
Galeobdolon luteum	2m	1	-	-	2m	III
Aconitum vulparia	-	-	2m	1	-	II
Isopyrum thalictroides	1	1	-	-	-	II
Astrantia major	-	2m	-	-	2m	II
Anemone ranunculoides	-	-	+	+	-	II
Corydalis cava	+	-	+	-	-	II
Paris quadrifolia	1	-	-	1	-	II
Querco-Fagetea						
Lonicera xylosteum	-	1	-	+	1	III
Dryopteris filix-mas	1	-	1	-	+	III
Galium odoratum	-	2m	-	1	1	III
Impatiens noli-tangere	-	-	+	+	-	II
Athyrium filix-femina	+	+	-	-	-	II
Glechoma hirsuta	-	-	1	+	-	II
Neottia nidus-avis	-	-	-	+	+	II
Galanthus nivalis	1	1	-	-	-	II
Lathraea squamaria	-	-	+	-	+	II
Pulmonaria officinalis	-	-	-	1	+	II
Arum maculatum	-	+	-	+	-	II
Aegopodium podagraria	-	-	+	1	1	III
Campanula persicifolia	+	-	+	-	-	II
Scrophularia nodosa	-	-	-	+	+	II
*Acerion s.*lat.						
Acer pseudoplatanus	1	-	1	-	1	III
Ulmus glabra	-	+	-	+	-	II
Aruncus dioicus	-	-	-	+	+	II
Polypodium vulgare	-	+	+	-	-	II
Variae						
Rubus idaeus	1	-	1	1	-	III
Asplenium trichomanes	-	+	+	-	+	III
Chrysosplenium alternifolium	2m	-	-	-	+	II
Geranium phaeum	-	+	-	+	-	II
Polystichum aculeatum	-	-	+	+	-	II

The place and data of relevés: 1-5: Vargyas (Vârghiş), Homoródalmás (Mereşti), 'Hidegaszó-Vargyas valley', surface 400 m^2, cover 100%, Exp. W, alt. 740-820 m (21. 04. 2006, 16. 04. 2007.)

Table 2. *Lathyro hallersteinii-Carpinetum*

Number of relevés	**1**	**2**	**3**	**4**	**5**	6	K
Slopes (degrees)	5	10	10	5	10	12	
Cover tree layer (%)	55	75	70	80	75	75	
Cover herb layer (%)	85	55	75	50	70	80	
Diagn. ass. - facies							
Quercus petraea	2b	2b	2a	2b	3	3	V
Carpinus betulus	2b	3	3	3	2b	2b	V
Allium ursinum	5	3	4	3	4	5	V
Lathyro-Carpinion							
Cerasus avium	1	-	1	-	1	-	III
Tilia cordata	-	1	-	1	-	-	II
Erythronium dens-canis	2m	2m	-	-	2m	1	IV
Stellaria holostea	-	2m	+	2m	+	-	IV
Scilla bifolia agg.	1	-	-	1	1	-	III
Dactylis polygama	-	1	1	-	-	1	III
Carex pilosa	2m	-	-	2m	-	-	II
Geum urbanum	-	1	-	1	-	-	II
Vinca minor	1	2a	-	-	-	-	II
Querco-Carpinetalia/Fagetalia							
Anemone nemorosa	1	-	+	1	-	+	IV
Corydalis solida	-	2m	-	1	1	1	IV
Isopyrum thalictroides	+		1	+	1	-	IV
Symphytum tuberosum	-	2m	1	2m	-	1	IV
Helleborus purpurascens	+	-	+	-	+		III
Lilium martagon	-	+	-	+	-	+	III
Aconitum vulparia	+	1	-	-	1	-	III
Euphorbia amygdaloides	-	-	+	+	-	+	III
Mercurialis perennis	-	1	-	-	+	+	III
Galium odoratum	+	1	-	+	-	-	III
Asarum europaeum	-	-	+	-	-	+	II
Hepatica nobilis	+	-	-	-	+	-	II
Dentaria bulbifera	-	1	-	+	-	-	II
Lathyrus vernus	+	-	+	-	-	-	II
Astrantia major	-	+	-	-	+	-	II
Querco-Fagetea							
Acer campestre	-	1	1	2m	-	+	IV
Corylus avellana	+	-	-	-	+	1	III
Ligustrum vulgare	-	1	1	1	-	-	III
Viburnum lantana	+	-	-	-	1	-	II
Crataegus monogyna	-	+	-	+	-	-	II
Ranunculus ficaria	1	2a	+	-	2m	-	IV
Pulmonaria officinalis	-	+	-	1	-	+	III
Arum maculatum	-	+	-	-	-	+	II
Primula veris	1	-	1	-	-	-	II
Galanthus nivalis	+	2m	-	-	-	-	II
Festuca gigantea	-	-	-	+	-	+	II
Brachypodium sylvaticum	1	1	-	-	-	-	II

Variae							
Cornus mas	-	+	+	-	-	-	II
Prunus spinosa	1	-	-	-	+	-	II
Euphorbia epithymoides	-	+	+	-	-	-	II

The place and data of relevés: 1-3. Szenterzsébet-Újlak (Eliseni-Uilac) 'Kérő' alt. 480 m, (27. 04. 2006.; 20. 04. 2007.);20. 04. 2007; 4-6. Alsóboldogfalva -Szenterzsébet (Bodogaia-Eliseni) 'Egereskút', alt. 510 m, (05. 05. 2006.; 18. 04. 2007.)

Table 3. *Carpino-Fagetum*

Number of relevés	**1**	**2**	**3**	**4**	**5**	**6**	**K**
Slopes (degrees)	12	15	10	15	12	15	
Cover tree layer (%)	85	90	80	85	80	80	
Cover herb layer (%)	40	55	43	65	45	60	
Diagn. ass. - facies							
Fagus sylvatica	4	5	4	5	5	4	V
Carpinus betulus	2a	2m	2a	1	1	2b	V
Allium ursinum	3	4	3	4	3	4	V
Lathyro-Carpinion							
Tilia cordata	r	+	-	+	-	+	IV
Cerasus avium	-	+	+	-	-	+	III
Carex pilosa	1	-	1	-	1	1	IV
Erythronium dens-canis	-	2m	2m	1	-	1	IV
Scilla bifolia agg.	2m	-	2m	1	-	+	III
Stellaria holostea	-	2m	1	-	1	2	III
Dactylis polygama	2m	2m	-	-	2m	1	IV
Helleborus purpurascens	-	+	1	-	-	+	III
Vinca minor	-	-	2m	2m	-	2m	III
Querco-Carpinetalia/Fagetalia							
Quercus petraea	-	1	-	1	-	2m	III
Acer pseudoplatanus	-	-	+	-	+	+	III
Dentaria bulbifera	1	-	1	-	1	1	IV
Symphytum tuberosum	-	1	2m	1	-	1	IV
Galeobdolon luteum	1	-	-	1	1	1	IV
Euphorbia amygdaloides	+	1	-	-	+	+	IV
Galium odoratum	-	1	1	-	2m	2m	IV
Salvia glutinosa	+	-	-	+	+	-	III
Anemone nemorosa	1	1	-	-	1	-	III
Isopyrum thalictroides	-	-	+	+	-	+	III
Corydalis cava	1	-	1	-	-	1	III
Lathyrus vernus	-	+	-	+	-	+	III
Impatiens noli-tangere	-	-	+	-	+	+	III
Hepatica nobilis	+	-	-	+	-	+	III
Ranunculus auricomus agg.	-	-	+	-	+	1	III
Ajuga reptans	+	-	-	+	-	-	II
Querco-Fagetea							
Acer platanoides	+	-	+	+	-	+	IV
Lonicera xylosteum	-	+	-	-	++	III	

Daphne mezereum	-	-	+	-	+	+	III
Galanthus nivalis	-	-	1	1	-	+	III
Pulmonaria officinalis	1	+	-	+	-	+	III
Aegopodium podagraria	-	1	1	-	-	+	III
Neottia nidus-avis	+	-	-	+	+	-	III
Arum maculatum	-	-	+	-	+	-	II
Lilium martagon	-	+	-	+	-	-	II
Scrophularia nodosa	+	-	-	-	-	+	II
Lapsanna communis	-	+	-	+	-	-	II
Campanula persicifolia	-	-	+	-	-	-	II
Alliaria petiolata	-	+	-	+	-	-	II
Variae							
Galeopsis speciosa	+	+	-	-	-	-	II
Galium aparinae	-	+	+	-	-	-	II

The place and data of relevés: 1-2: Kismedesér (Medişoru Mic) 'Magos' (alt. 700 m), 'Herczegláz', 07. 05. 2006.; 18. 04. 2007.);18. 04. 2007; 3.-4: Szentábrahám (Avrămeşti) 'Solymosi-láz' ('Demeter'), alt. 670 m, (12. 04. 2007.); 5: Siklód (Şiclod) 'Mt. Siklód', alt. 890 m, (16. 04. 2007.); 6. Rugonfalva (Rugăneşti) 'Koparcz', alt. 680 m, (26. 04. 2006.; 11. 04. 2007.)

REFERENCES

ADLER, W., OSWALD, K., FISCHER, R. (Ed.) (1994): Excursionsflora von Österreich. – Verlag Eugen Ulmer, Stuttgart und Wien.

AGUIAR, C., AEDO, C. (2006): De Novarum Flora Lusitana Commentarii - VII. 24. *Allium ursinum* L. subsp. *ursinum*: confirmacao da presenca em Portugal. – Silva Lusitana 14 (2).

ALLEN, E. D., HATFIELD, G. (2004): Medicinal plants in folk tradition: an ethnobotany of Britain and Ireland. – Timber Press, Cambridge.

ANDERSSON, E. M. (1993): Aluminium toxicity as a factor limiting the distribution of *Allium ursinum* L. – Annals of Botany 72: 607-611.

BORHIDI, A. (2003): Magyarország növénytársulásai. – Akadémiai Kiadó, Budapest.

BUTURĂ, V. (1979): Enciclopedie de etnobotanică românească. – Editura Ştiinţifică si Enciclopedică, Bucureşti.

CARLSON, M. (2007): Garlic: What we know and what we don't know. – Arch. Intern. Med. 167: 325-326.

CIOCÂRLAN, V. (2000): Flora ilustrată a României. – Edit. Ceres, Bucureşti, pp. 919.

CZEREPANOV, K. S. (1995): Vascular plants of Russia and adjacent states (the former USSR). – Cambridge University Press, pp. 6.

DANCIU, M. (1974): Studii geobotanice în sudul Munţilor Baraolt. – Rezumatul tezei de doctorat, Bucureşti.

DIERSCHKE, H. (2004): Sommergrüne Laubwälder (*Querco-Fagetea* s.lat.) in Europa - Einführung und Übersicht. – Tuexenia 24: 13-17.

DJURDJEVIŽ , L., DINI , A., PAVLOVIŽ, P., MITROVIŽ, M., TESEVIŽ, V. (2003). Allelopathic potential of *Allium ursinum* L. – Biochemical Systematics and Ecology 32 (6): 533-544.

DRĂGULESCU, C. (2003): Cormoflora judeþului Sibiu. – Editura Pelicanus, Braşov.

ELLENBERG, H. (1982): Vegetation Mitteleuropas mit den Alpen in ökologischer Sicht. – Verlag Eugen Ulmer, Stuttgart.

ELLENBERG, H. WEBER, E. H., DÜLL, R., WIRTH, V., WERNER, W., PAULISSEN, D. (1992): Zeigerwerte von Pflanzen in Mitteleuropa. – 2. Aufl. Erich Goltze Göttingen.

ENO, S. (2006): National Vegetation Classification survey for Newhall Glen Site of Special Scientific Interest (SSSI) – Scottish Natural Heritage Commissioned Report No. 143.

ERNST, O. H. (1979): Population biology of *Allium ursinum* in Northerm Germany. – The Journal of Ecology 67 (1): 347-362.

HÖHN, M. (1998): Vascular flora of the Kelemen (Călimani) mountains on side of the Maros (Mureş) river drainage area. – Mentor Kiadó, Marosvásárhely.

JANDL, R., KOPESZKI, H., GLATZEL, G. (2004): Effect of a dense *Allium ursinum* L. ground cover on nutrient dynamics and mesofauna of a *Fagus sylvatica* (L.) woodland. – Plant and Oil 189 (2): 245-294.

KARPAVIÈIENÉ, B. (2003): Intensity of generative and vegetative reproduction of *Allium ursinum*. – Botanica Lithuanica 9 (1): 3-12.

KEVEY, B. (1978): Az *Allium ursinum* L. magyarországi elterjedése. - Bot. Közlem. 65 (3): 165-175.

KEVEY, B., CZIMBER Gy. (1982): Az *Allium ursinum* növényföldrajzi szerepe a Szigetközben. – Keszthelyi Agr. Egyet. Mosonmagyaróvár Mezőgazd. Kar. XXIV (8): 1-21.

KOVÁCS, AL. (1981): Flora şi vegetaţia Munţilor Bodoc (jud. Covasna). – Aluta. Studii şi Com. Muz. Sf. Gheorghe, XII-XIII, 363-405.

KOVÁCS, J. A. (1974): Contribuţii fitocenologice din Masivul Rez (jud. Harghita) I. Asociaţii forestiere. – Studii şi Cercet. Biol. Veget., Bucureşti, 25 (1): 34-42.

KOVÁCS, J. A. (1975): Contribution to the study of vascular plants from Rez Massif. – Travaux de la Station „Stejarul", Ecologie Terrestre et Génétique, (1974-1975): 283-292.

KOVÁCS, J. A. (2004): Syntaxonomical checklist of the plant communities of Szeklerland (Eastern Transylvania). – Kanitzia J. Bot. Szombathely 12: 75-149.

KOVÁCS, J. A., LUPAŞCU, GH., TÓTH, E. (1978): Caracterizarea ceno-ecologică a speciei *Vinca minor* L. – Probleme de ecologie terestră. Ed. Acad. Bucureşti, 72-78.

KRICSFALUSY, V., BUDNIKOV, G. (2007): Threatened vascular plants in the Ucrainian Carpathians: current status, distribution and conservation. – Thaiszia. J. Bot. Košice 17: 11-32.

NYÁRÁDY, E. Gy. (1944): Kolozsvár és környékének flórája. DR. BEREI SOÓ REZSŐ közreműködésével. – Erdélyi Múzeum Egyesület Növénytára, Kolozsvár, pp. 688.

NECHITA, N. (2003): Flora şi vegetaţia cormofitelor din masivul Hăşmaş, Cheile Bicazului şi Lacul Roşu. – Bibliotheca Historiae naturalis II, Piatra Neamţ, 383 p.

OBERDORFER, E. (1994): Pflanzensoziologische Excursionflora. 7. Auuflage. – Verlag Eugen Ulmer, Stuttgart, 1050 pp.

OPREA, A. (2005): Lista critică a plantelor vasculare din România. – Editura Univ. "A. I. Cuza" Iaşi.

OROIAN, S. (1998). Flora şi vegetaţia Defileului Mureşului între Topliţa şi Deda. – Casa de Editura Mureş, Tg. Mureş, 426 pp.

PÁLFALVI, P. (1999): A medvehagyma (*Allium ursinum* L.). – Erdélyi Nimród, 1 (2), pp. 26.

PUXBAUM, H., KÖNIG, G. (1996): Observation of dipropenyldisulfide and other organic sulfur compounds in the atmosphere of a beech forest with *Allium ursinum* ground cover. – Atmospheric Environment 31 (2): 291-294.

RYCHNOVSKÁ, M., BEDNÁ , V. (1998): Floodplain forest: herb layer as indicator of its ecological status. – Acta Univ. Palackianae Olomucensis, Biologica 36: 7-15.

SANDA, V., POPESCU, A., DOLTU, M. I. (1974): Contribuţii la cunoaşterea vegetaţiei din bazinul mijlociu al Târnavei Mari. – St. Com. Muz. Brukenthal Sibiu, Şt. nat. 20: 65-94.

SĂMĂRGHIŢAN, M. (2003): Caracterizarea fitocenologică a făgetelor din Valea Gurghiului. – Marisia, Studia Sci. Nat. Tg. Mureş 27: 53-68.

SCHNITZLER, A., CARBINIER, R., JOSÉ-MIGUEL S.-P. (1991): Variation in vernal species composition in alluvial forests of the Rhine valley, eastern France. – J. Veget. Sci. 2: 485-490.

SHMANOVA, I. V., KRICSFALUSY, V. (1995): Biomorphological and ecological-cenotic characteristic of *Allium ursinum* L. in the Carpathians. – Rastitelnye resursy (St.Petersburg) vol. 31. (3): 1-18.

SIMONKAI, L. (1886): Enumeratio Florae Transsilvanicae vasculosae critica. Budapest.

SOBOLEWSKA, D., JANECZKO, Z., KISIEL, W., PODOLAK, I., GALANTY, A., TROJANOWSKA, D. (2006): Steroidal glycosides from the underground parts of *Allium ursinum* L. and their cytostatic and antimicrobial activity. – Acta Poloniae Pharmaceutica - Drog Research, Vol. 63 (3): 219-223.

SOÓ, R. (1940): A Székelyföld flórájának előmunkálatai (Prodromus florae Terrae Siculorum) (Transilvaniae Orientalis). – Magyar Flóraművek III. Inst. Syst-Geobot. Kolozsvár, pp. 146.

SOÓ, R. (1943): A Székelyföld flórája (Flora Terrae Siculorum Trans. Orientalis) – Magyar Flóraművek VI. Inst. Geobot, Kolozsvár, pp. 62.

SOÓ, R. (1973): Synopsis systematico-geobotanica florae vegetationisque Hungariae. V. – Akadémiai Kiadó, Budapest, pp. 65-77.

STACE, C. (1992): New Flora of the British Isles. – Cambridge University Press.

SOJAK, J. (1968): Rozší eni plemen *Allium ursinum* v. Ceskoslovensku. – Preslia 40: 294-300.

SZABÓ, L. Gy. (2005): Gyógynövény-ismereti tájékoztató. – Schmidt und Co. Melius Alapítvány, Baksa-Pécs, p. 78.

TÄUBER, F. (1992): Contribuţii la sintaxonomia cărpinetelor carpato-dacice (*Lathyro-Carpinetalia*). – Contrib. Bot. Cluj-Napoca 1991-1992: 15-29.

TUTIN, G. T. (1957): Biological Flora of the British Isles: *Allium ursinum*. – J. of Ecology 45 (3): 1003-1010.

WEBB, A. D. (1980): *Allium*. In: Flora Europaea volume 5. (Ed. TUTIN, G. T., HEYWOOD, H. V., BURGES, A. N., MOORE, M. D., VALENTINE, H. D., WALTERS, O. A., WEBB, A. D.) – Cambridge University Press, Cambridge, pp. 49-69.

ZAHARIADI, C. (1966): *Liliaceae*. In.:Flora R. S. Romania. Edit. Academiei R. S. R. Bucureşti, pp. 193-197.