Studia bot. hung. 40, pp. 11–35, 2009

VEGETATION OF THE BAGLYAS–ISZKA-HEGY DOLOMITE HORST RANGE (BAKONY MTS, HUNGARY)

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The Baglyas–Iszka-hegy dolomite horst range is an island-like block of the eastern Bakony. Based on the pedological features and the current secondary vegetation types (dry grasslands, scrubs) on parts of the bare dolomite plateau forming the central part of the region and on the gentle southern slopes the natural vegetation is presumed to be variably opened thermophilous oak forests dominated by Pubescent oak. Vegetation mapping showed that the zonal vegetation of the Baglyas-hegy region was xerophilous oak forest (cf. *Vicio sparsiflorae-Quercetum pubescentis*). The former extent of this association was probably greater than now. Its recent stands can mainly be found in tempered habitats of the valleys. The characteristic units of the vegetation in the mapped area are edaphic vegetation types determined by dolomite bedrock. The occurrences of rocky grassland–steppe slope–shrub forest complexes (*Seseli leucospermi-Festucetum pallentis*, *Fumano-Stipetum eriocaulis*, *Chrysopogono-Caricetum humilis*, *Cotino-Quercetum pubescentis*) of the Baglyas–Iszka-hegy range are especially remarkable. Although these are not undisturbed, in the last half of the century their development in several places was determined by natural processes. On other parts of the area (mainly on its northern third) moss-capped oak forests can be supposed as natural vegetation. Hornbeam oak forests occur just in extrazonal situations on more humid soils. Stands of *Fago-Ornetum* and *Primulo veris-Tilietum* occurring in valleys characterised by rocky and debris slopes are restricted, but are important vegetation patches. Species richness of these is lower than in the typical stands of the same associations occurring in the inner parts of the Bakony Mts, since in the region of Baglyas-hegy, beech groves, and in relation to these several humid forest elements, are absent or rare. Due to anthropogenic reasons, units of vegetation types with unclear plant coenological status are frequent in the study area.

Sub-Mediterranean elements, which are typical on the Balaton Uplands and on other parts of the eastern Bakony are also present, prominently in dry oak forest–dry grassland–rocky grassland series of the horst range (*e.g. Aethionema saxatile*, *Amelanchier ovalis*, *Artemisia alba*, *Bupleurum praealtum*, *Carex halleriana*, *Convolvulus cantabrica*, *Coronilla coronata*, *Crupina vulgaris*, *Ononis pusilla*, *Plantago argentea*, *Prospero elisae*, *Sternbergia colchiciflora*, *Valerianella coronata*). Species composition of the vegetation types is affected by Pannonian (*e.g. Astragalus vesicarius* subsp. *albidus*, *Seseli leucospermum*, *Iris humilis* subsp. *arenaria*) and continental elements (*Artemisia austriaca*, *Hypericum elegans*, *Phlomis tuberosa*, *Serratula lycopifolia*, *S. radiata*, *Silene bupleuroides*,

Stipa tirsa, *Taraxacum serotinum*, *Vinca herbacea*) of the plain-colline forest steppe vegetation occurring in high numbers caused by the mountain marginal status.

Considering the botanical merits of the area it is proposed that it should be declared a conservation area at a level that seems most appropriate in context of other protected areas in the wider region.

Key words: Bakony Mts, dolomite vegetation, phytogeography, vegetation map

INTRODUCTION

The study area belonging to the eastern Bakony is a dolomite block with low peaks and plateaus. The Baglyas-hegy–Iszka-hegy horst range (*ca* 41 km^2) is surrounded with the settlements of Inota (currently part of the town of Várpalota), Csór, Iszkaszentgyörgy, Kincsesbánya and Bakonykúti. Owing to the mountain marginal status the study area lies in a phytogeographically interesting position with several sub-Mediterranean, continental and Pannonian elements in its flora. As a result of the geomorphological features the typical dolomite vegetation of the Transdanubian Mts shows a good level of development. Typical species of the Pannonian plain flora and vegetation can be found in small refuges on plateaus and on piedmonts covered by loess and debris.

The area has been examined by the author since 1999, with the aim of completing a description and making a vegetation map. Compared to other areas of the Bakony Mts the vegetation of Baglyas-hegy and its surroundings is also less explored. Several parts of the mapped area were not studied consistently as well; Baglyas-hegy and Hideg-völgy of Inota were studied in a more detailed way than other places.

MATERIAL AND METHODS

Background information

The mapped area is a tectonically separated eastern block group of the eastern Bakony (Fig. 1), which is separated by the "Bakonykúti-süllyedék" (Bakonykút depression) from the Tés plateau. Its highest point is the peak of Baglyas-hegy (362 m). The central part of the region can be characterised by a dolomite plateau with small peaks, which are separated from each other by dry valleys ("aszó-völgyek") of tectonic origin ((Nagy)-Aszó-völgy, Bagoly-völgy, Sár-Horog, Túró-Horog, Száraz-Horog-völgy, Szenes-Horog-völgy

and a few other small nameless valleys). The range is bordered by the Inotai-dombok (Öreg-Kálvária-hegy, Belátó-hegy) from the west, Iszka-hegy and Gomba-hegy with gently lowering slopes from the east, and Vaskapu-hegy and Szeg-hegy from the north. Baglyas-hegy is bordered by Hideg-völgy from the west covered with young deposits, and slope debris on its piedmont. In the majority of the horst range Triassic dolomite appears on the surface, while the environs of Szilvágy and Vaskapu-hegy is mainly covered by Eocene limestone. On the margin of the mapped area and in some places on the dolomite plateau younger deposits are also typical: loess, sediment load, and travertine in smaller patches on the hill-sides (ÁDÁM *et al.* 1988, BENCE *et al.* 1990, GYALOG 2000).

This region is the driest and one of the warmest areas of the Bakony Mts (KAKAS 1960, ÁDÁM *et al.* 1988). The annual precipitation is around 600 mm, which is 200–250 mm less than the western microregions of the Bakony Mts ("Magas-Bakony") characterised by 850 mm and by Atlantic climate effects. Accordingly, this area (and the eastern margin of the Balaton Uplands) has the lowest proportion of the natural forest areas in the Bakony Region. The cover of the mesophilous forest associations here is the smallest in the region. On the block of Baglyas-hegy the beech forest is absent even extrazonally. The southeastern margin of the Bakony Region receives less precipitation primarily because of the foehn wind ("Bakonyi szél"). The poor water balance – owing to the marked bedrock karstification – also intensifies the drying effects of this type of wind. Rendzina soil with shallow soil layer is typical for the area, while brown forest soil developed on Eocene limestone and in areas covered with loess or young deposits.

Phytogeographically the mapped area belongs to the Veszprimense flora region of the Bakonyicum, however, its eastern marginal area is bordered by Colocense (SOÓ 1961). The area belongs to the zone of the forest-steppe climate based on the map of BORHIDI (1961). According to the vegetation map of ZÓLYOMI (1967, 1973) the potential natural vegetation of the region is Illyrian type Pubescent oak forests ("*Orno-Quercetum*"). The first reliable data about the forest cover of Baglyas-hegy and its environs lead back to the end of the 18th century. It is clearly shown on the topographic map of the first military land-survey that the forest cover of the region was almost the same as the current level: the plateau of Baglyas- and Iszka-hegy is bare, covered with grasslands, and the environs of Vaskapu-hegy is dominated by forests. In 1799 Kitaibel also described the region, and noted the deforested mountains above Csór and Inota ("Boglyas Teteje") as being of rocky character (GOMBOCZ 1945). Based on the landscape and forest historical researches carried out on other parts of the Bakony Mts, the bareness of the plateau is attributed to historical-scale grazing and wood-cutting (WALLNER 1941, 1942, 1943, BÖLÖNI 2004). In the case of Baglyas–Iszka-hegy range the extent of open dry oak forests containing natural openings was also a very important factor in the formation of the natural vegetation. Based on the geomorphological features and the actual extent of rocky grasslands it is presumed that fairly large naturally open areas were present here.

ZÓLYOMI (1958) described the most important vegetation types of the dolomite areas and their relationships in the Transdanubian Mts. FEKETE (1964) did not mention the block of Baglyas-hegy in his phytogeographical introduction about the Bakony Mts. The main reason, however, was not the fact that the area was uninteresting, but that the place was out of the focus of previous botanical researches. The overall situation and the pattern

of the vegetation types on the slopes of Baglyas-hegy display many similarities to the vegetation sketch used as an example by FEKETE (1964) about the southern side of "Móroc-tető".

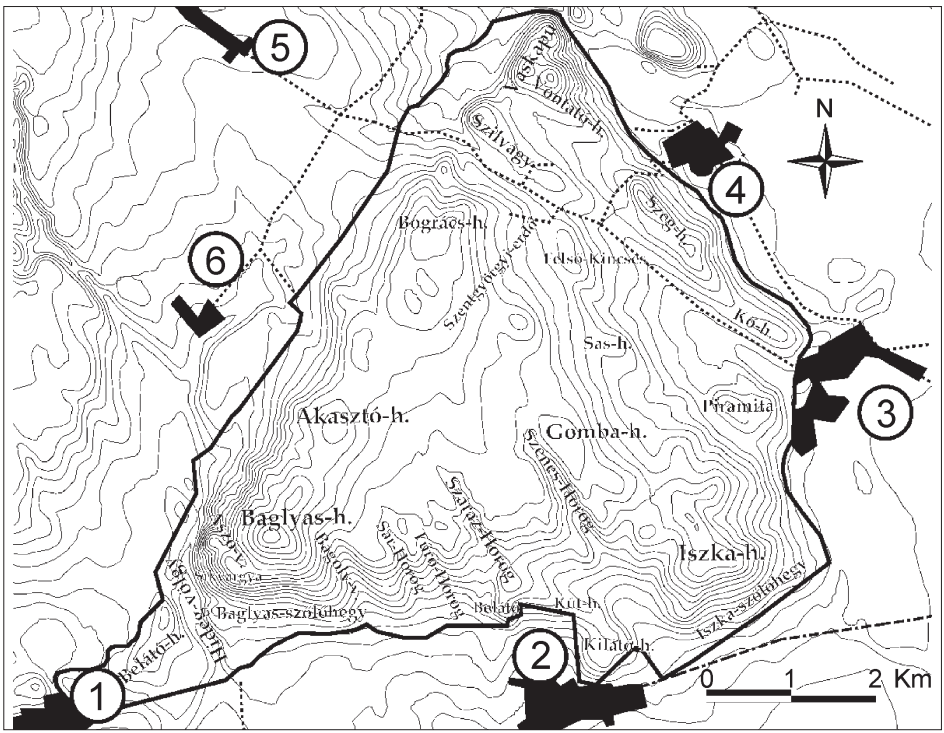

Fig. 1. The study area with the most important topographical names. [Hacked line: driveway system; Settlements: 1. Várpalota-Inota; 2. Csór; 3: Iszkaszentgyörgy; 4. Kincsesbánya; 5. Isztimér; 6: Bakonykúti]

Methods

The plant taxa and the syntaxa mentioned in this paper follow the nomenclature of SIMON (2000) and BORHIDI (2003) (with some exceptions, additions). For classification of the associations, presenting the results, statements and in some cases for the name usage, additional synthetic publications were also taken into consideration (ZÓLYOMI 1966, MUCINA *et al.* 1993, CHYTRÝ 2007, JANIŠOVÁ 2007).

The vegetation mapping of the eastern block group of Baglyas-hegy was completed between 2001 and 2006. The detailed habitat map produced at the scale of 1 : 10,000 (BAUER 2006) shows even the very small patches, and it contains many categories. The habitat (vegetation) map presented in this paper is a simplified version of the above-mentioned map; small patches were not depicted in the map published here. Categories of strongly

anthropogenic and degraded places were merged due to the scale used and for the ease of interpretability.

The map's categories cannot be identified in every case on the level of associations, therefore, codes of the Á-NÉR (Hungarian standardised habitat mapping system) (BÖLÖNI *et al.* 2007) are also provided. At the description of vegetation types the presence of taxa occurring only at 1–2 spots can be seen in square brackets ("[...]").

Connected to the vegetation mapping, data of certain plant species important from the aspect of phytogeography were also recorded. Maps show the occurrences of some rare species: *Allium moschatum*, *Artemisia austriaca*, *Astragalus vesicarius* subsp. *albidus*, *Centaurea stenolepis*, *Cephalaria transsylvanica*, *Crupina vulgaris*, *Glaucium corniculatum*, *Helleborus dumetorum*, *Hypericum elegans*, *Iris humilis* subsp. *arenaria*, *Muscari tenuiflorum*, *Ornithogalum comosum*, *Phlomis tuberosa*, *Prospero elisae*, *Serratula lycopifolia*, *S. radiata*, *Seseli leucospermum*, *Sternbergia colchiciflora*, *Stipa tirsa*, *Taraxacum serotinum* and *Valerianella coronata*.

RESULTS

The botanical research history of the region

The first data were collected by Pál Kitaibel, who visited this region during his journey into Baranya County (Iter Baranyense) (19.06.1799) (see GOMBOCZ 1945). Kitaibel recorded some really remarkable data from Hideg-völgy of Inota and Baglyas-hegy, *e.g. Astragalus vesicarius* subsp. *albidus*, *Serratula radiata*, *S. lycopifolia* (WALDSTEIN and KITAIBEL 1802), *Crepis pannonica* (KANITZ 1863) and noted additional floristic information (*e.g.* the presence of *Coronilla coronata*, *Aethionema saxatile*, *Plantago argentea*, *Vinca herbacea*, *Scabiosa canescens*, *Artemisia austriaca*) (see GOMBOCZ 1945). From the herbarium of Mihály Horhy some plants collected in the environs of Inota also appeared as early as the beginning of the 19th century, its most important record being *Aurinia saxatilis* (herb. spec. BP and HORHY 1815) collected from rocky spots of Inota ("in rupibus calcareis ad Inotam"). One of the most important taxa is *Ephedra distachya* recorded between Csór and Várpalota by József Sadler in his handwritten itinerary (SADLER 1817, "Iter Füredíense"). As shown by herbarium specimens at BP, the botanical exploration of the region was enriched by the variety of valuable observations between the 20s and the 50s of the 20th century. Moesz and Timkó already in 1923 added new data from the area of Iszka-hegy and Baglyas-hegy (*e.g. Amelanchier ovalis*, *Seseli leucospermum*,

Silene bupleuroides, *Allium moschatum*). In 1927 Filarszky and Kümmerle studied the area of Iszka-hegy, and made the first record of *Ajuga laxmannii* and *Ornithogalum pannonicum* (FILARSZKY and KÜMMERLE 1932, herb. spec. BP). Sándor Jávorka and Ádám Boros whose research was a major part of the stride of Hungarian floristic, visited the region of Baglyas-hegy at least five times. In the monograph written on the Bakony Mts by RÉDL (1942), there are some data, but mainly observations, from the region of Baglyas-hegy. In 1930 Jávorka found *Minuartia glomerata* in Hideg-völgy, and later recorded some really important, however previously unknown, species – occasionally in the company of Bálint Zólyomi, and Vera Csapody – on Baglyas-hegy (these include *Prospero elisae*, *Ornithogalum orthophyllum*, *Orchis mascula* subsp. *signifera*, *Carex alba*). Through the diaries (BOROS 1915–1972) and collections of Boros a number of important species are known from there: *Draba lasiocarpa*, *Coronilla vaginalis*, *Valerianella coronata*, *Erodium ciconium*, etc. RÉDL (1942) published Grúber's record of *Iris arenaria* with the note of "Inotai hegyek". BOROS (1937) briefly described the dolomite rocky steppe slope vegetation of Baglyas-hegy, and mentioned some typical species. KÁRPÁTI (1960) published in his monograph of reviewing *Sorbus* taxa the specimens collected by Jávorka and Boros. KÁRPÁTI (1960) identified one of the minor species of *Sorbus* collected by BOROS from Baglyas-hegy as *Sorbus redliana*, an endemism of the eastern Bakony (occurring in Burok-völgy and Baglyas-hegy). In the second half of the 20th century the majority of the region was used by the military and closed to the public, which significantly restricted any research work. The paper of LENCSÉS (1996) called the attention to the conservational importance of Baglyas-hegy, citing valuable new data (*e.g. Thalictrum aquilegiifolium*, *Trinia ramosissima*, *Silene viridiflora*). Some other data published by LENCSÉS (1996) (*e.g. Achillea crithmifolia*, *Cytisus procumbens*, *Sempervivum marmoreum*, *Dianthus serotinus*) are either erroneous or need verification. In the papers of PINKE *et al.* (2003, 2006) a few additional data can also be found relative to the extensive plough-lands around Baglyas-hegy.

The phytogeographical and conservational significance of Baglyas–Iszka-hegy range is strongly supported by previous research, but the many new data on the presence of several new and notable taxa revealed by our vegetation mapping, puts further emphasis on the merits of the area (*e.g. Helleborus dumetorum*, *Glaucium corniculatum*, *Phlomis tuberosa*, *Marrubium*

× *paniculatum*, *Bupleurum praealtum*, *Hypericum elegans*, *Cephalaria transylvanica*, *Aster amellus*, *Centaurea stenolepis*, *Centaurea scabiosa* var. *vertesensis*, *Limodorum abortivum*, *Sesleria uliginosa*, *Stipa tirsa*), and the majority of old data was justified as well (collections at BP, and BAUER 2001, 2004, 2007, BAUER and BÖLÖNI 2007).

The vegetation of the region

Both floristically and vegetation-wise, the area of Baglyas-hegy is an insufficiently explored part of the Bakony Region (Figs 2, 3). The local distribution of some rare species being important from a phytogeographical aspect is shown by Figures 4, 5, 6.

Results of the current vegetation mapping show that moss-capped oak forests dominate in the natural vegetation approximately on the northern third of the area. Hornbeam oak forests occur exclusively in extrazonal situations, on more humid places. Several subtypes of the thermophilous oak forests (*Vicio sparsiflorae-Quercetum pubescentis*, syn.: *Orno-Quercetum*) occur in the greatest extension in the area. Their former coverage was probably even greater than today. The natural (potential) vegetation was thermophilous variably opened oak forest dominated by Pubescent oak on areas of the currently bare dolomite plateau and on the southern slopes based on the pedological features and the current secondary vegetation types (dry grasslands, scrubs, patches with solitary seed-trees). Presently only a few zonal stands of *Vicio sparsiflorae-Quercetum pubescentis* are typical on the dolomite plateau, although in the valleys and the slopes its variants are the most typical forest associations. The particular elements of the region's vegetation are the edaphic vegetation types determined by dolomite bedrock and the given geomorphological features. Especially notable are the rocky grassland–steppe slope–shrub forest complexes (*Seseli leucospermi-Festucetum pallentis*, *Fumano-Stipetum eriocaulis*, *Chrysopogono-Caricetum humilis*, *Cotino-Quercetum pubescentis*) of Baglyas–Iszka-hegy range. These are not undisturbed but in the second half of the last century their development was determined by natural processes in several places. As a result of these processes several stands seem to be in a very good natural state. The *Fago-Ornetum* and *Primulo veris-Tilietum* stands of some valleys characterised by rocky, debris slopes are of small extension

but also valuable units of vegetation. This can be stated even if the species richness in these stands is lower than in the particular stands typical in the inner areas of the Bakony Mts, since in the environs of Baglyas-hegy the beech forest and its humid forest elements are absent, or quite rare. At present, units of vegetation types with unclear plant coenological status are frequent, caused by the different anthropogenic affects of studied area.

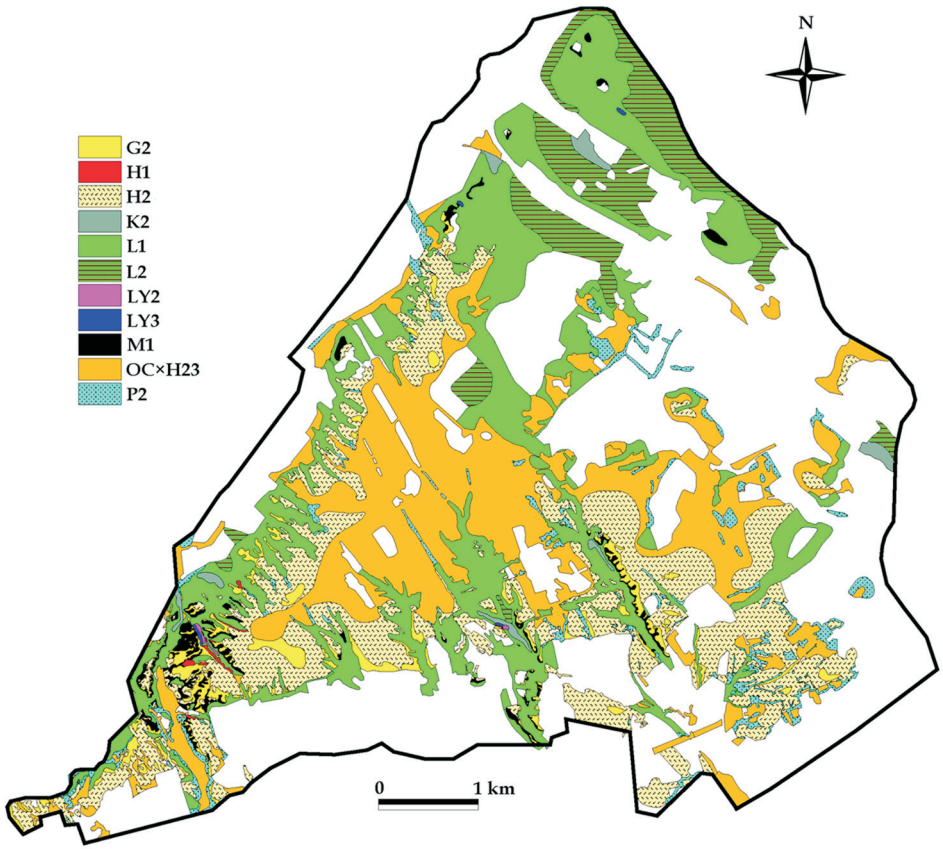

Fig. 2. Vegetation map of the Baglyas–Iszka-hegy dolomite horst range 1. Semi-natural vegetation types. [H1 = closed rock grasslands on dolomite (*Festuco pallenti-Brometum pannonici*); G2 = calcareous open rock grasslands on dolomite (*Seseli leucospermi- Festucetum pallentis*, *Fumano-Stipetum eriocaulis*); H2 = calcareous rock steppes (*Chrysopogono-Caricetum humilis*); OC × H2,3 = steppe grasslands and uncharacteristic dry grasslands; M1 = pubescent oak shrub woodlands (*Cotino-Quercetum pubescentis*); L1 = closed thermophilous oak woodlands (*Vicio sparsiflorae-Quercetum pubescentis*); L2 = Turkey oak-sessile oak woodlands; K2 = oak-hornbeam woodlands; LY2 = mixed forests of scree rocky slopes (*Primulo veris-Tilietum*); LY3 = *Fago-Ornetum*; P2 = dry scrub vegetation]

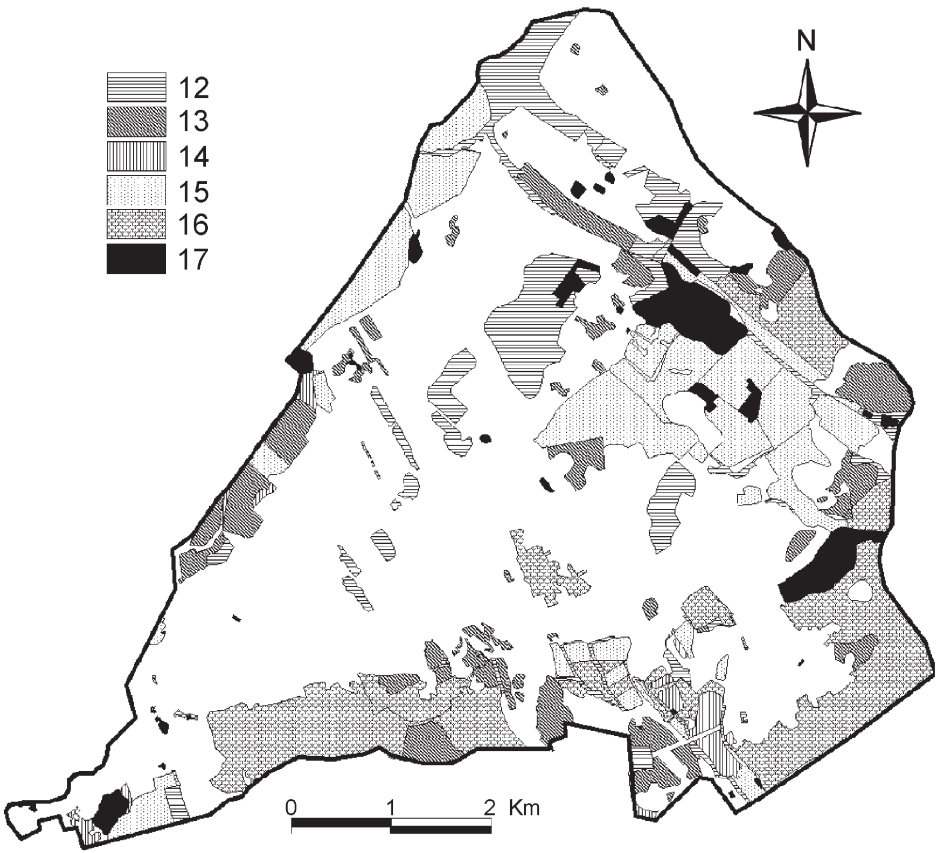

Fig. 3. Vegetation map of the Baglyas–Iszka-hegy dolomite horst range 2. Anthropogenic habitats, degraded forests and grasslands. [12 = uncharacteristic woodlands (RS); 13 = black and Scots pine plantations (S4); 14 = spontaneous stands of non-native tree species (P2 × S6); 15 = annual intensive arable fields; 16 = vineyards and orchards; 17 = other habitats]

The sub-Mediterranean elements typical of the Balaton Uplands and other parts of the eastern Bakony are also prominent in the dry oak forest–dry grassland–rocky grassland mosaic of the horst range (*e.g. Amelanchier ovalis*, *Coronilla coronata*, *Ononis pusilla*, *Aethionema saxatile*, *Convolvulus cantabrica*, *Plantago argentea*, *Bupleurum praealtum*, *Valerianella coronata*, *Artemisia alba*, *Prospero elisae*, *Sternbergia colchiciflora*, and *Carex halleriana*). Species composition of the vegetation types is affected by Pannonian

(*e.g. Astragalus vesicarius* subsp. *albidus*, *Seseli leucospermum*, *Iris humilis* subsp. *arenaria*) and continental elements (*Phlomis tuberosa*, *Artemisia austriaca*, *Hypericum elegans*, *Silene bupleuroides*, *Vinca herbacea*, *Serratula lycopifolia*, *S. radiata*, *Taraxacum serotinum*, *Stipa tirsa*) of the plain-colline forest-steppe vegetation occurring in high numbers caused by the mountain marginal status.

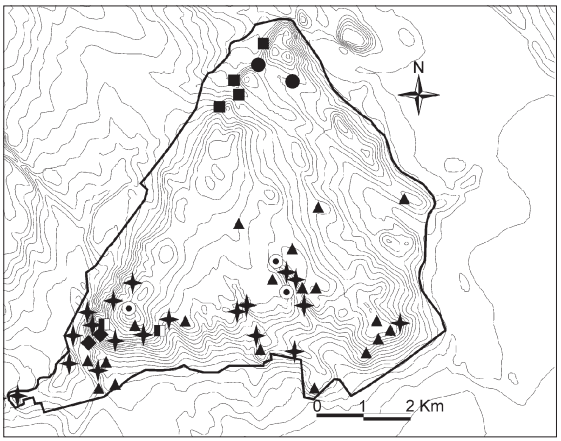

Fig. 4. Occurrences of some rare species in the mapped area of the eastern Bakony 1. [full square: *Helleborus dumetorum*; rhombus: *Astragalus vesicarius* subsp. *albidus*; star: *Seseli leucospermum*; full circle: *Centaurea stenolepis*; bisected square: *Iris humilis* subsp. *arenaria*; dot in circle: *Muscari tenuiflorum*; full triangle: *Ornithogalum comosum*]

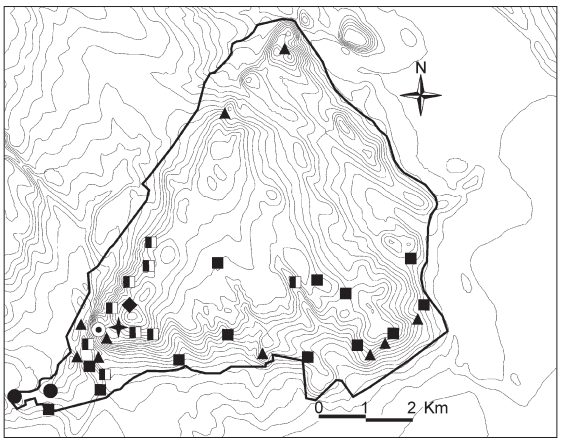

Fig. 5. Occurrences of some rare species in the mapped area of the eastern Bakony 2. [star: *Phlomis tuberosa*; bisected square: *Hypericum elegans*; full circle: *Artemisia austriaca*; dot in circle: *Serratula lycopifolia*; full triangle: *Serratula radiata*; full square: *Taraxacum serotinum*; rhombus: *Stipa tirsa*]

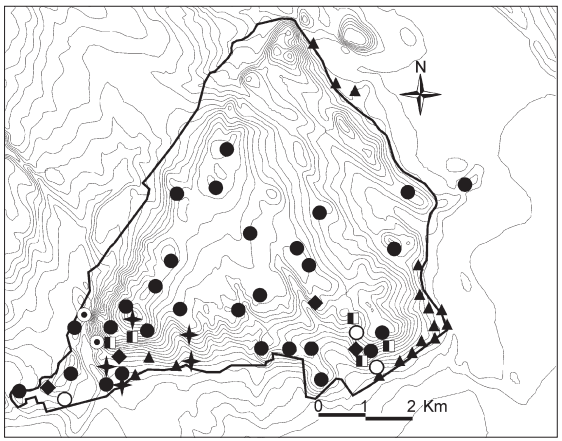

Fig. 6. Occurrences of some rare species in the mapped area of the eastern Bakony 3. [hollow circle: *Glaucium corniculatum*; dot in circle: *Valerianella coronata*; full triangle: *Cephalaria transsylvanica*; bisected square: *Crupina vulgaris*; rhombus: *Sternbergia colchiciflora*; full circle: *Allium moschatum*; star: *Prospero elisae*]

Vegetation units featured in the vegetation map

1. *Festuco pallenti-Brometum pannonici* Zólyomi 1958 [Closed rock grasslands on dolomite; H1]

Typical stands of this association can be found on steep northern slopes of Baglyas-hegy above Hideg-völgy. Small stands occur in Száraz-Horog and Szenes-Horog valleys, and in Vaskapu-hegy. Two types of the association are present in the study area: (1) dominated by *Bromus pannonicus* var. *reptans* (just on small patches), (2) dominated by *Carex humilis* (covering large surfaces).

The association can be identified apparently based on the dominant grass species and the characteristic colouring elements (*e.g. Coronilla vaginalis*, *Daphne cneorum*, *Phyteuma orbiculare*, *Thalictrum pseudominus*). Besides rocky grassland species, elements of oak-forests and mesophilous grassland species are also typical in the closed rocky grasslands. The most typical species of the mapped stands are: *Allium montanum*, *Anthericum ramosum*, *Anthyllis vulneraria* subsp. *polyphylla*, *Asperula tinctoria*, *Centaurea triumfettii*, *Festuca pallens*, *F. rupicola*, *Helianthemum ovatum*, *Hypericum elegans*, *Leucanthemum margaritae*, *Linaria genistifolia*, *Poa badensis*, *Polygala major*, *Potentilla arenaria*, *Sedum telephium* subsp. *maximum*, *Stachys recta*, *Teucrium chamaedrys*, *T. montanum*, *Vincetoxicum hirundinaria*, etc. *Amelanchier ovalis*, *Cotoneaster integerrimus* and *Fraxinus ornus* occur in scrubs and forest margins of the steep north facing slopes.

2. Calcareous open rock grasslands on dolomite [G2]

Stands of *Seseli leucospermi-Festucetum pallentis* and *Fumano-Stipetum eriocaulis* characterised by considerably large rock and soil surfaces belong to this category.

2a. *Seseli leucospermi-Festucetum pallentis* Zólyomi (1936) 1958 [G2]

In the study area this rocky grassland association occurs mainly on steep dolomite slopes and eroded ridges, which are sometimes broken with large rock formations. It can be found in various aspects (W, E, S and sometimes it also occupies north-facing slopes). Besides *Festuca pallens* and *Seseli leucospermum* occurring in several places of the study area characteristic species include *Acinos arvensis*, *Aethionema saxatile*, *Arenaria serpyllifolia*, *Campanula rotundifolia*, *Cerastium pumilum* subsp. *glutinosum*, *Dianthus plumarius* subsp. *regis-stephani*, *Erophila verna*, *Erysimum diffusum*, *Euphorbia segueriana*, *Fumana procumbens*, *Genista pilosa*, *Helianthemum canum*, *H. nummularium*, *H. ovatum*, *Hornungia petraea*, *Jovibarba hirta*, *Medicago prostrata*, *Melica ciliata*, *Minuartia rubra*, *M. setacea*, *M. verna* agg., *Onosma visianii*, *Paronychia cephalotes*, *Poa badensis*, *Potentilla arenaria*, *Saxifraga tridactylites*, *Scorzonera austriaca*, *Sedum album*, *S. sexangulare*, *Seseli hippomarathrum*, *S. osseum*, *Taraxacum erythrospermum*, *Teucrium montanum*, *Thalictrum pseudominus*, and *Thlaspi perfoliatum*. Locally rare elements in these dolomite rocky grasslands are *Astragalus vesicarius* subsp. *albidus*, *Biscutella laevigata*, *Coronilla vaginalis*, *Draba lasiocarpa* [Baglyas-hegy, Hideg-völgy, Száraz-Horog, Szenes-Horog], *Polygala amara*. Most of the populations of these locally rare species survived in the rocky grasslands of Hideg-völgy. *Aurinia saxatilis*, *Hieracium wiesbaurianum* and *Minuartia glomerata* also grow in Hideg-völgy, but they only occur in the "cliff variant" of the dolomite rocky grassland occurring on stonewalls.

2b. *Fumano-Stipetum eriocaulis* (Wagner 1941) corr. Zólyomi 1966* [G2]

Species composition of *Fumano-Stipetum eriocaulis* is rather similar to the previous association (2a), but it is a more closed type of grassland caused by the high density of *Stipa eriocaulis*. In the study area it is more frequent than *Seseli leucospermi-Festucetum pallentis*, and it covers larger surfaces. *Fumano-Stipetum eriocaulis* also occurs on friable dolomite

* The "*Stipo eriocauli-Festucetum pallentis* (Zólyomi 1958) Soó 1964" association of the Hungarian phytosociological literature is equal with the association published by WAGNER (1941) from the Lower-Austrian dolomite hills (*Fumano-Stipetum eriocaulis* (Wagner 1941) corr. Zólyomi 1966). Because of the chronology the *Stipo eriocauli-Festucetum pallentis* association name is a synonym. Equality of *Stipo eriocauli-Festucetum pallentis* occurring in the Transdanubian Mts and *Fumano-Stipetum eriocaulis* occurring on the Lower-Austrian dolomite hills was studied via coenological relevés; results of the comparative phytosociological examination will be published later by this author.

surfaces of the slopes, and it makes transition towards the *Chrysopogono-Caricetum humilis* (H2) stands, or occurs mosaically with them. Frequency of *Allium moschatum*, *A. flavum*, *Artemisia alba*, *Odontites lutea*, *Plantago argentea* in *Fumano-Stipetum eriocaulis* is similar to that of *Chrysopogono-Caricetum humilis*, but *Carex humilis* is not dominant. Species associated with chasms and rocky surfaces (*Sedum album*, *Jovibarba hirta*, *Seseli leucospermum*, *Helianthemum canum*) are rarer in *Fumano-Stipetum eriocaulis* than in the more opened rocky grasslands.

3. *Chrysopogono-Caricetum humilis* Zólyomi (1950) 1958 [Calcareous rock steppes; H2]

It is one of the most typical grassland associations on the plateau of the Baglyas–Iszka-hegy horst range. This association with the best natural state survived on the gently sloping plateau margins and on the tops or gentle slopes of the narrow combs. It is usually adjacent to open rocky grasslands.

Besides *Carex humilis*, dominant species in the given stands are *Artemisia alba*, *Bothriochloa ischaemum*, *Chrysopogon gryllus* or *Stipa capillata*. Species of rocky grasslands and steppe slopes are mixed in the mapped stands of the association, with characteristic species, including *Allium flavum*, *A. moschatum*, *A. sphaerocephalon*, *Arabis auriculata*, *Artemisia alba*, *Asperula cynanchica*, *Aster linosyris*, *Bromus squarrosus*, *Campanula sibirica*, *Centaurea micranthos*, *C. rhenana*, *C. scabiosa* var. *vertesensis*, *Cerastium pumilum* subsp. *glutinosum*, *Cruciata pedemontana*, *Dianthus pontederae*, *Dorycnium germanicum*, *Erophila verna*, *Erysimum diffusum*, *Globularia punctata*, *Hippocrepis comosa*, *Inula ensifolia*, *Iris pumila*, *Jurinea mollis*, *Linaria genistifolia*, *Linum tenuifolium*, *Muscari racemosum*, *Odontites lutea*, *Onosma visianii*, *Orchis tridentata*, *Petrorhagia saxifraga*, *Plantago argentea*, *Pseudolysimachion spicatum*, *Sanguisorba minor*, *Saxifraga tridactylites*, *Scabiosa canescens*, *Scorzonera austriaca*, *Silene otites*, *Teucrium montanum*, *Thesium linophyllon*, *Thlaspi perfoliatum* and *Trinia glauca*. In addition, characteristic sub-Mediterranean elements of the association, *e.g.* the *Convolvulus cantabrica*, *Crupina vulgaris* [Síkvárgya, Belátó (near Csór), Iszka-hegy], or *Anacamptis pyramidalis*, *Ononis pusilla*, *Prospero elisae* are present with robust populations. *Muscari tenuiflorum* and *Sternbergia colchiciflora* are rare elements of the mapped stands. Pannonian and continental forest-steppe species (sand- and loess-species) also occur in the *Chrysopogono-Caricetum humilis* stands of the Baglyas–Iszka-hegy horst range. *Iris humilis* subsp. *arenaria* [Baglyas-hegy, Síkvárgya, Bagolyvölgy], *Hieracium echioides*, *Ornithogalum comosum*, *Serratula radiata*, *Stipa tirsa* [Baglyas-hegy, on the plateau], *Taraxacum serotinum* are also important elements, they have survived mainly on less eroded surfaces.

4. Steppe grasslands and uncharacteristic dry grasslands [OC × H2,3]

This is a collective category. Part of these grasslands are strongly degraded (*e.g.* overgrazed) derivations of the rocky steppe slopes developed on the flat and gently sloping dolomite surfaces (H2 → OC); others appear to be originated from degraded loess grass-

lands of piedmont areas (H5a → OC); certain patches of the category are steppe meadow-like stands of deforested areas (H3, H3 → OC). Small rubbish patches also occur as regularly disturbing elements. This category also contains mosaic stands (OC × P2) with small shrub patches (which cannot be depicted at the given scale of our vegetation map).

The stabilised secondary dry grasslands (H3, H2,3 → OC) dominated by *Festuca valesiaca* agg. and *Stipa capillata* are often typical on plateaus. These cannot be identified as steppe slope associations as discussed in the Hungarian phytosociological literature. In our opinion, the *Festuco valesiacae-Stipetum capillatae* Sillinger 1930 (syn. *Ranunculo illyrici-Festucetum valesiacae* Klika 1931) association can be recognised in stands characterised by high species richness and occurrence on moderately deep soils. Typical species in these include *Adonis vernalis*, *Allium flavum*, *A. sphaerocephalon*, *Alyssum alyssoides*, *Artemisia campestris*, *Asperula cynanchica*, *Astragalus austriacus*, *A. onobrychis*, *Bothriochloa ischaemum*, *Bupleurum affine*, *Carduus nutans*, *Centaurea micranthos*, *Dorycnium herbaceum*, *Echium vulgare*, *Eryngium campestre*, *Falcaria vulgaris*, *Festuca valesiaca*, *Gagea pusilla*, *Hesperis tristis*, *Hypericum perforatum*, *Marrubium peregrinum*, *Medicago falcata*, *M. minima*, *Onosma arenaria* [Baglyas-hegy, Nagy-Tisztás (Iszkaszentgyörgy)], *Orlaya grandiflora*, *Ornithogalum comosum*, *Pimpinella saxifraga* agg., *Potentilla arenaria*, *Ranunculus illyricus*, *Sanguisorba minor*, *Scabiosa ochroleuca*, *Stipa capillata*, *Teucrium chamaedrys*, *Thlaspi perfoliatum* and *Verbascum speciosum*.

Several stands of the *Chrysopogono-Caricetum humilis* association have been homogenised, their species composition reflecting degradation (grazing, cart-tracks, digging fire-trenches, afforestation attempts, cross-motor cycling, off-road rally, etc.) typical on most areas of Baglyas-hegy plateau. *Bothriochloa ischaemum*, *Stipa capillata*, *Poa angustifolia* (H2 → OC) are often dominant in these stands.

Under this code, our vegetation map also displays the secondary dry grasslands (H5 → OC)typical on gentle slopes, and also forming plateau and piedmont patches on loess. These patches are characterised by the common occurrence of Pannonian loess grassland (*Salvio nemorosae-Festucetum rupicolae* Zólyomi ex Soó 1964) species (*e.g. Astragalus austriacus*, *Chamaecytisus austriacus*, *Euphorbia pannonica*, *Salvia austriaca*, *S. nemorosa*, *Taraxacum serotinum Vinca herbacea*, *Viola ambigua*). Typical elements also include *Aster linosyris*, *Bromus inermis*, *Dorycnium germanicum*, *Leontodon hispidus*, *Linaria genistifolia*, *Stipa pulcherrima*, *Thalictrum minus*, *Thymelaea passerina*, *Thymus pannonicus* and *Verbascum phoeniceum.* Rare species are: *Agropyron pectiniforme*, *Artemisia austriaca* [Inotai-dombok: Mandulás, Belátó-hegy (Inota)], *Allium atroviolaceum* [Hideg-völgy], *Brassica elongata* [Iszka-hegy, Belátó (near Csór), Kilátó-hegy, Kút-hegy, Belátó-szőlőhegy], *Serratula radiata* and *Silene bupleuroides.* These stands are considered transitional types between the loess steppe grasslands and mountainous dry grasslands. Such stands of H5 character can also be found in the abandoned orchards of hillside vineyards (the vegetation map does not show these small patches, they are depicted under the categories of vineyards and orchards).

Several parts of OC patches are composed of characterless weed, disturbance-tolerant and common dry grassland species including *Achillea collina*, *Artemisia absinthium*, *Bromus inermis*, *Carlina vulgaris* subsp. *intermedia*, *Centaurea micranthos*, *Cerinthe minor*, *Chondrilla juncea*, *Dactylis glomerata*, *Daucus carota*, *Echinops sphaerocephalus*, *Elymus*

repens, *E. hispidus*, *Euphorbia cyparissias*, *Galium verum*, *G. mollugo*, *Hypericum perforatum*, *Marrubium peregrinum*, *Medicago falcata*, *Pimpinella saxifraga*, *Sclerochloa dura*, *Scorzonera cana* and *Seseli annuum.* On the disturbed steppe meadows of the Bakony Region weed species, such as *Diplotaxis tenuifolia*, *Erucastrum nasturtiifolium*, *Tragus racemosus* thrive everywhere and also generally occur in the degrading stands of Baglyas–Iszka-hegy range. In these degraded dry grasslands, however, there is a certain number of weed species that are rare in the Bakony Mts and notable from a floristical point of view: *Centaurea solstitialis*, *Heliotropium europaeum*, *Marrubium vulgare* and *Xanthium spinosum*. Some rare pioneer weeds preferring plough-lands have been observed along cart-tracks: *Adonis flammea* [Iszka-hegy, Gomba-hegy, Baglyas-szőlőhegy], *A. aestivalis*, *Aegilops cylindrica*, *Bupleurum rotundifolium*, *Caucalis platycarpos*, *Cephalaria transsylvanica*, *Erodium ciconium* [Iszka-hegy, Belátó-szőlőhegy], *Erysimum repandum*, *Glaucium corniculatum* [Iszka-hegy, Belátó-hegy (Inota)], *Lactuca saligna*, *Nigella arvensis*, and *Valerianella dentata*. The occurrence of *Lavandula angustifolia* in some places marks earlier lavender cultivations.

5. *Cotino-Quercetum pubescentis* Soó (1931) 1932 [White oak shrub woodlands; M1]

The stands of the *Cotino-Quercetum pubescentis* shrub forests are typical on the southern and western slopes of Baglyas–Iszka-hegy horst range, on the plateau margins, steep valley slopes and around wooded peaks. On the warmest slopes its stands alternate with rocky grasslands and steppe meadows creating almost continuous transitions towards open calciphilous oak forests and rocky steppe slopes, and rocky grasslands. The mapped stands of this association are highly characteristic, even though pioneer stands dominated by *Fraxinus ornus* and *Cotinus coggygria* also occur on the steepest slopes covered with rock debris.

In the mapped *Cotino-Quercetum* stands the presence of *Quercus pubescens* and *Fraxinus ornus* is typical at variable rates. *Cotinus coggygria* is constant and forms low, dense stands in many places, but other typical scrub species of the calciphilous oak forests are also common. Rocky scrub [M7] patches (*Amelanchier ovalis*, *Cotoneaster* spp.) also occur in the shrub forests of the area. The herb layers in the mapped karst shrub forests are rather rich in species, and are made up of the elements of the adjoining plant associations (rocky grasslands and closed Pubescent oak forests). Species of the *Cotino-Quercetum* worth mentioning include *Anacamptis pyramidalis*, *Anchusa barrelieri* [Baglyas-hegy, Hideg-völgy], *Aster amellus* [Iszka-hegy, Vaskapu-hegy], *Buglossoides purpureo-coerulea*, *Bupleurum praealtum*, *Carex halleriana*, *Chamaecytisus ratisbonensis*, *Clematis recta*, *Colutea arborescens*, *Coronilla coronata*, *Dictamnus albus*, *Geranium sanguineum*, *Gymnadenia conopsea* [Szenes-Horog], *Hieracium cymosum*, *Limodorum abortivum* [Hideg- völgy], *Orchis tridentata*, *Peucedanum cervaria*, *Polygala major*, *Pulsatilla grandis*, *P. nigricans*, *Scorzonera hispanica*, *Serratula radiata*, *Thesium linophyllon*, *Valerianella coronata* [Baglyas-hegy, Hideg-völgy] and *Vinca herbacea.*

6. *Vicio sparsiflorae-Quercetum pubescentis* Zólyomi ex Borhidi et Kevey 1996 [Closed thermophilous oak woodlands; L1]

This variable association occupies the largest part of Baglyas-hegy–Iszka-hegy forest areas. Its mapped subtypes are the following: (1) Closed *Quercus pubescens* and *Fraxinus ornus* forests with smaller or larger natural openings (these are the natural stands of typical occurrence on plateaus and adjacent slopes); (2) Closed mature forests of *Fraxinus ornus* and *Quercus pubescens* (with *Quercus cerris*, forming transition to Turkey oak forest); (3) Patches characterised by the dominance of *Quercus cerris* and other derivation dominated by native tree species grown on L1 habitats; (4) Closed *Quercus pubescens* and *Fraxinus ornus* forests with poorly growing trees, of lower tree layer, sometimes with shrub-sized trees and often dense *Cotinus* stands in the lower shrub layer (shrub-forest like, but continuous closed stands of this association are typical on steeper (especially western) slopes of Baglyas-hegy; patches of *Cotino-Quercetum* adjoin almost as continuous transition to this type). (5) Derivation forest patches regenerated on Pubescent oak forest habitats often contain abundant *Cornus mas*, and *Acer campestre*. This type can sometimes be considered as shrubbery as well, yet it is important to separate it from the edge shrubbery (*e.g.* on the piedmont of Belátó-hegy); (6) *Quercus pubescens* forests with scattered specimens or small patches of Black pine; (7) Sparse stands, dispersedly with grazing-forest character mainly above valley heads, on the woodland edges (random grazing is still common today in many places).

The above sub-types are classified in a complex way by their extension, pedological features, the neighbouring vegetation types and the character of the former landscape use. There are examples for both the characterless stands with poor herb layer, and others with particularly important, species-rich patches. In typical stands the character species of the herb layer corresponds well to the formal description of the association. The Pubescent oak forests have been enriched with humid forest elements on locations near mesophytic forests, and have also been enriched with thermophilous elements typical in xerotherm grasslands occurring near the shrub forests. Notable plant taxa recorded in the calciphilous oak forests of the mapped area are: *Acer campestre*, *Ajuga genevensis*, *Anthemis tinctoria*, *Arabis turrita*, *Berberis vulgaris*, *Brachypodium pinnatum*, *B. sylvaticum*, *Bromus erectus*, *Bupleurum falcatum*, *Campanula persicifolia*, *C. rapunculoides*, *Carex halleriana*, *C. humilis*, *C. michelii*, *Centaurea triumfettii*, *Cornus mas*, *C. sanguinea*, *Coronilla varia*, *Corydalis pumila*, *Cotinus coggygria*, *Cotoneaster tomentosus*, *Crataegus monogyna*, *Dianthus pontederae*, *Dictamnus albus*, *Euonymus verrucosus*, *Euphorbia epithymoides*, *Festuca rupicola*, *Fraxinus ornus*, *Galium mollugo*, *Hieracium sabaudum*, *Hypochoeris maculata*, *Inula conyza*, *I. hirta*, *Iris variegata*, *Lactuca quercina*, *Laserpitium latifolium*, *Lithospermum officinale*, *Melica uniflora*, *Melittis carpatica*, *Orchis purpurea*, *Oryzopsis virescens*, *Polygonatum odoratum*, *Potentilla heptaphylla*, *Prunus spinosa*, *Pulmonaria mollis*, *Pyrus pyraster*, *Quercus pubescens*, *Rhamnus catharticus*, *Sedum telephium* subsp. *maximum*, *Serratula tinctoria*, *Silene nutans*, *Smyrnium perfoliatum*, *Tanacetum corymbosum*, *Teucrium chamaedrys*, *Trifolium alpestre*, *T. rubens*, *Ulmus minor*, *Valeriana collina*, *Veratrum nigrum*, *Verbascum austriacum*, *Veronica chamaedrys*, *Viburnum lantana*, *Vicia tenuifolia*, *Vincetoxicum*

hirundinaria, *Viola hirta* and *V. suavis*. Locally rare elements are *Phlomis tuberosa* [Baglyas-hegy, Nagy-Aszó-völgy], *Serratula lycopifolia* [Baglyas-hegy, Hideg-völgy], *Scutellaria columnae* [Szentgyörgyi-erdő], *Coronilla coronata* [Inota: Baglyas-hegy], *Cephalanthera rubra* [Hideg-völgy], *Orchis mascula* subsp. *signifera* [Baglyas-hegy, Nagy-Aszó-völgy], *O. militaris* [Baglyas-hegy].

7. *Quercetum petraeae-cerris* Soó 1963 [Turkey oak-sessile oak woodlands; L2]

These are mature forests characterised by a higher proportion of *Quercus cerris*, typical in Szentgyörgyi-erdő and those to the north on some parts of Szeg-hegy–Vaskapu-hegy range at Kincsesbánya with milder slopes, having better soil conditions. From the aspect of local silviculture it is one of the most valuable forests of the mapped area; shown also by the fact that its stands are considerably altered (partly → RS), where intensive forestry operations are conducted. Only some parts of the middle-aged or mature stands exhibit the characteristic features of these oak forest associations. Besides the dominant *Quercus cerris*, accompanying species occur with variable frequency (frequent: *Quercus petraea*, *Q. pubescens*, *Acer campestre*, *A. platanoides*, *Fraxinus ornus*; sporadical: *Acer pseudoplatanus*, *Fraxinus excelsior*, *Carpinus betulus*). The shrub layer is dense; besides the offsprings of the tree layer *Ligustrum vulgare*, *Cornus sanguinea*, *Rubus fruticosus*, *Prunus spinosa*, *Crataegus monogyna* and *Lonicera xylosteum* are frequent. Common elements of the herb layer include *Dactylis polygama*, *Poa nemoralis*, *Calamagrostis epigeios* and *Melica uniflora*. *Clinopodium vulgare*, *Digitalis grandiflora*, *Tanacetum corymbosum*, *Hypericum hirsutum*, *Pulmonaria mollis*, *Hieracium sabaudum*, *Campanula persicifolia*, *C. rapunculoides*, *Clematis vitalba*, etc. are also typical components here. Rare accompanying species are *Calamintha sylvatica* [Vaskapu-hegy, Vontató-hegy, Szeg-hegy], *Centaurea stenolepis* [Vontató- hegy], *Cephalanthera damasonium* [Vaskapu-hegy, Szilvágy]. *Ailanthus altissima*, *Robinia pseudo-acacia* and other weed species (*Conyza canadensis*, *Rubus fruticosus* agg., *Solidago canadensis*, *S. gigantea*, etc.) are extending (and *Robinia* is locally also planted) in disturbed areas, in young forests and at forest edges. In terms of structure and tree species composition the Turkey-oak afforestations and other old stands are characterless, regenerated forests of little botanical merit.

8. Oak-hornbeam woodlands [K2]

Typical hornbeam oak forest patches are rather rare in the study area. Our vegetation map illustrates only those hornbeam-oak forest stands whose composition of the herb layer clearly identifies the association. These can mainly be found in meso/microclimatic shelters, at locations with deeper soils (Száraz-Horog, Szenes-Horog, Hideg-völgy), and on northern slopes. Every stand of this category is extrazonal. The most characteristic species in the herb layer are *Adoxa moschatellina*, *Aethusa cynapium*, *Ajuga reptans*, *Anemone ranunculoides*, *Brachypodium sylvaticum*, *Convallaria majalis*, *Corydalis cava*, *Dentaria bulbifera*, *Ficaria verna*, *Galanthus nivalis*, *Galium odoratum*, *Isopyrum thalictroides*,

Lathraea squamaria, *Lilium martagon*, *Melica uniflora*, *Mercurialis perennis*, *Polygonatum latifolium*, *Pulmonaria officinalis*, *Smyrnium perfoliatum*, *Symphytum tuberosum* and *Viola mirabilis. Helleborus dumetorum* [Bogrács-hegy, Vaskapu-hegy] is a locally rare element.

9. *Primulo veris-Tilietum platyphyllae* (Isépy 1968) Borhidi 1996 [Mixed forests of scree rocky slopes, rich in *Tilia* spp. LY2]

The steep, stony-rocky northern slopes are rather frequent in the region, but debris slope forests with typical appearance have only developed in a few places. The debris slope forests of dolomite areas are drier than those developed on limestone-debris slopes, and at association level they can be identified as *Primulo veris-Tilietum cordatae* formerly recorded in the Vértes Mts (Isépy 1968). The most typical stand can be found in the Száraz-Horog valley.

The tree layer is dominated by two species of linden (*Tilia cordata*, *T. platyphyllos*), typically accompanied by *Acer campestre*, *Fraxinus excelsior*, *F. ornus*, *Sorbus torminalis*, and in the shrub layer *Cornus mas*, *Corylus avellana*, and *Staphylea pinnata* occur in all stands. In the herb layer *Alliaria petiolata*, *Corydalis cava*, *Geranium robertianum*, *Glechoma hirsuta*, *Lilium martagon*, *Mercurialis perennis*, *Oryzopsis virescens*, *Polygonatum latifolium* and *Primula veris* are frequent.

10. *Fago-Ornetum* Zólyomi (1950) 1958 [LY3]

In comparison with the stands typical in the inner areas of the eastern Bakony Mts, our study area contains only some really small, poorly developed stands of this association. In these forest patches *Carex alba* and *C. humilis* are dominant in the herb layer. *Asperula tinctoria*, *Leucanthemum margaritae* and *Phyteuma orbiculare* – common in the closed dolomite rocky grasslands – are also typical in the stands. The herb layer is mainly composed by species of the dry oak forests (*Bupleurum falcatum*, *Campanula rapunculoides*, *C. persicifolia*, *Digitalis grandiflora*, *Laserpitium latifolium*, *Peucedanum cervaria*, *Polygonatum latifolium*, *P. odoratum*, *Primula veris*, *Tanacetum corymbosum*, *Veratrum nigrum*, *Vincetoxicum hirundinaria*, etc.) with the addition of a few mesophilous forest elements (*Asarum europaeum*, *Carex digitata*, *Knautia drymeia*, *Lilium martagon*).

11. Dry scrub vegetation [P2]

Generally, homogeneous patches of the *Pruno spinosae-Crataegetum* Soó (1927) 1931 stands were marked with the category of P2, but shrubberies of various size, dominated by *Cotinus*, and steppe shrubs (M6) are also typical here (*e.g.* on xerotherm forest edges, abandoned grail pits on Iszka-hegy). The most frequent elements of the scrub patches are *Crataegus monogyna*, *Prunus spinosa* and *Rosa canina* agg. In forest edges *Acer campestre*, *Cornus mas*, *Fraxinus ornus*, *Ligustrum vulgare*, etc. are also mingled with the shrubbery.

12. Other uncharacteristic woodlands and plantations mixed with non-native tree species [RS]

This is a collective category mainly containing degraded and uncharacteristic woody vegetation dominated by various deciduous species, *e.g.* regenerated or planted stands of native species (*e.g. Acer platanoides*, *Quercus cerris*, *Fraxinus excelsior*), partly young forests on Pubescent oak forest habitats, with uncharacteristic, or extremely weedy herb layer. Intensively cultivated forest areas like that of Szentgyörgyi-erdő, Vontató-hegy; *Robinia pseudo-acacia* plantations, and various stands mixed with the latter (the pure stands of *Robinia* are small and altogether not worth mentioning, therefore they are mentioned in this category) belong to this type. As usual, the shrub layer is also uncharacteristic in these stands (with *Clematis vitalba*, *Rosa canina*, *Rubus fruticosus* agg.), the herb layer is also composed of all-tolerant forest species, nitrofrequent elements, and weeds. Tree stands planted in narrow bands (S7) and cutting areas; newly planted forests (→RS); areas of unsuccessful afforestation attempts (almost square polygons) in the vegetation of Baglyas-hegy plateau dominated by grasslands also belong to this category.

13. Black and Scots pine plantations [S4]

Plantations of pine forest established primarily with *Pinus nigra* are common in the mapped area, just like in other Hungarian dolomite areas. Similarly, on the northern piedmont surface of Baglyas-hegy *Pinus sylvestris* is also commonly seen in plantations. Our habitat map only marks the homogeneous stands with the category S4. In the case of those stands in which *Pinus* species occur individually or in small patches the recognisable natural associations were named.

14. Spontaneous stands of non-native tree species [P2 × S6]

Ailanthus altissima, *Elaeagnus angustifolia* and the mainly planted, but spontaneously also spreading *Robinia pseudo-acacia* are invasive woody species in the mapped area. All natural habitats from rocky grasslands to cleared dry oak forests are threatened by these. Nevertheless, the rapid spreading of these invasive species is typically related to anthropogenic activities, including forest economic, or agricultural landscape usage (areas of harvesting and improper forest afforestations, abandoned orchards with spontaneously spreading non-native scrub species, wreckage areas, etc.). The invasive arboreal species are common in categories RS and U; code P2 × S6 marks those patches where the spread of non-native woody species is a determining element in the current vegetation (independently from the actual landscape use). Its largest patch used to be a large-scale orchard, which is currently mainly covered by the dense stand of *Elaeagnus angustifolia*.

15. Annual intensive arable fields [T1]

On the map the young (sometimes grazed) lea-lands (temporarily abandoned, fallowed areas), and foggage lands were included in this category.

16. Vineyards and orchards [T8, T6, T7, O12]

This is also a collective category set up for small and large-scale orchards and vineyards, and their currently abandoned stands. Some abandoned huge almond plantations and vineyards belong to this category, nowadays covered by weedy dry grasslands. Previously abandoned small-scale vineyards and orchards can be found on the border of the mapped region on the southern side of Iszka-hegy and Baglyas-hegy. On these sites, originally dry grasslands and scrubs dominated by native species, a regeneration process is underway shown by developing semi-natural vegetation.

17. Other habitats [U]

A collective category containing (Villages [U3], Yards, premises, wreckage, dumping grounds [U4], Mine dumps, dumping grounds covered by ground [U5], Open mines [U6]). All these are classified into one unit under the code of "U". Farms, abandoned military objects, pit-heaps, abandoned and cultivated stone-pits, roads also fall in this category. Attention should be paid to such places as these are channels of the invasive species' spreading.

Vegetation units occurring on small patches not featured in the vegetation map

18. Xeromesophilous grasslands [H4]

Small patches of such grasslands can generally be found mainly on the edges of Pubescent oak forests, in cleaned stands, or in harvested areas used as grazing-forest. In forest clearing-like semi-dry grasslands mostly *Bromus erectus* s.l., more rarely *Brachypodium pinnatum* and other grass species (*Avenula pubescens*, *Dactylis glomerata*, *Festuca rupicola*, etc.) are predominant in the study area. Xerotherm forest and xeromesophilous grassland elements are typical, but species common in rocky grasslands or humid forests also occur. The most abundant stands of xeromesophilous grasslands occur around Szentgyörgyi-erdő, some of their common species including *Adonis vernalis*, *Anthericum ramosum*, *Arabis hirsuta*, *Buglossoides purpureo-coerulea*, *Bupleurum falcatum*, *Campanula bononiensis*, *C. glomerata*, *Carex humilis*, *Chamaecytisus austriacus*, *C. supinus* subsp. *aggregatus*, *Dianthus pontederae*, *Dictamnus albus*, *Dorycnium germanicum*, *Filipendula vulgaris*, *Fragaria viridis*, *Galium glaucum*, *Genista tinctoria* subsp. *elatior*, *Glechoma hirsuta*, *Inula ensifolia*, *Lactuca quercina*, *Linaria genistifolia*, *Lithospermum officinale*, *Melampyrum cristatum*, *Peucedanum cervaria*, *Pimpinella saxifraga* agg., *Polygonatum odoratum*, *Potentilla recta*, *Primula veris*, *Pulmonaria mollis*, *Ranunculus polyanthemos*, *Scorzonera purpurea*, *Sedum telephium* subsp. *maximum*, *Tanacetum corymbosum*, *Teucrium chamaedrys*, *Thalictrum minus*, *Trifolium montanum*, *Veronica austriaca*, *Veronica chamaedrys*, *Vinca herbacea* and *Vincetoxicum hirundinaria.* Sporadical elements in these grasslands include *Anacamptis*

pyramidalis, *Inula oculus-christi*, *Laserpitium latifolium*, *Libanotis pyrenaica*, *Peucedanum alsaticum*, *Pulsatilla grandis*, *P. pratensis* subsp. *nigricans* and *Ranunculus illyricus*.

This vegetation type can often be found on the edges of calciphilous oak forests occurring in dry valleys. Therefore almost every stand is mixed with scrubs and thinning forest edges. Because most of the H4 patches are rather small, in our treatment they were merged with the adjoining P2, L1, and OC × H2,3 categories (→P2 / →L1).

19. Pioneer grasslands on rocks and walls [I3]

Stonewall vegetation grows typically on dolomite rocks of Hideg-völgy, Nagy-Aszó-völgy, Száraz-Horog and Szenes-Horog valleys. Species related to chasm grasslands, open dolomite rocky grasslands and rocky forests are commonly seen on these stonewalls. Typical elements of the studied stands are *Asplenium ruta-muraria*, *A. trichomanes*, *Campanula rotundifolia*, *Cardaminopsis arenosa*, *Draba lasiocarpa*, *Geranium lucidum*, *G. rotundifolium*, *Hornungia petraea*, *Medicago prostrata*, *Sedum album*, *S. telephium* subsp. *maximum*, *Seseli osseum*, etc. *Aurina saxatilis*, a rather rare species in the eastern Bakony Mts also occurs on these rock walls. These habitats are small, thus could not be featured as individual patches at the scale of the map (→G2).

20. *Prunetum tenellae* Soó 1947 [Continental deciduous steppe thickets; M6]

Only a few small stands can be found in the study area. The basic structure of the steppe-scrubs in these thickets is easily recognised. Alongside *Prunus tenella*, *P. fruticosa*, *Rosa gallica* (Iszka-hegy, Kis-Bácsó), *R. spinosissima* valuable steppe species (*e.g. Chamaecytisus austriacus*, *Euphorbia pannonica*, *Salvia nemorosa*, *Silene bupleuroides*) and in the herb layer other common dry grassland elements occur in these small shrubberies. Stands belonging to this association usually can be found on abandoned vineyards of Baglyas-szőlőhegy, Belátó-szőlőhegy and Iszka-szőlőhegy. These habitats are small, thus could not be featured as individual patches at the scale of the map (→P2, / →T8).

21. *Cotoneastro-Amelanchieretum* Jakucs 1961 [Continental deciduous rock thickets; M7]

A few, but robust population of *Amelanchier ovalis* occur in the dolomite block of the study area. Specimens of *Cotoneaster* occurring individually or in small groups mainly grow on rock-edges and ridge-edges, but as these places are small, they are impossible to feature on the map at its scale. Patches including *Amelanchier* scrubs are mapped as mainly open dolomite rocky grasslands (G2) and karst shrub-forests (→G2, M1).

22. Thermophilous woodland fringes [M8]

These are small, band-like occurrences, which cannot be represented on the map at its published scale. These stands are adjacent to the H4 and L1 categories, so they were figured under these codes (→L1).

23. Wooded pastures [P45, L1 × P45]

Previously, forest grazing was a typical form of land-use in the mapped region. Today, characteristic grazing-forests can only be found in a few places of the plateau. Originally, mainly the calciphilous forests were used for grazing; today the most beautiful such stand got thinned and became a grazing-forest [P45]. It is found on the southern margin of Szentgyörgyi-erdő (where some grazing is still taking place), but as a small unit it is not depicted on the vegetation map as an individual patch (→L1).

24. H2 × S4

Rocky steppe slopes with planted trees and small patches of *Pinus nigra*. This category is small, thus it could not be featured at the scale of the map (→H2).

25. L1 × S6

Originally these are L1 stands, whose characteristics can still be recognised, but because of the spreading and plantation of non-indigenous elements they became uncharacteristic. This is especially true for the narrow band-like stands where *Robinia* and *Ailanthus* dominate. This category an individual patch could not be displayed at the scale of the map (→RS).

Part of the studied area is a valuable section of the Eastern Bakony Natura 2000 site. The desired level of protection could not have been reached due to former military usage. However, based on the botanical and landscape natural merits certain parts of the Baglyas–Iszka-hegy horst range should be preserved in a strictly protected area.

* * *

Acknowledgements – The author would like to thank G. Fekete, for the invaluable professional consultations, as well as Z. Kenyeres and L. Somlyay. I would also like to acknowledge the help of J. Cservenka and A. Márkus during the mapping work, and J. Bölöni for providing access to the forest maps. Finally, many thanks are due to the Balaton Uplands National Park Directorate for the assistance with all phases of the work.

REFERENCES

ÁDÁM, L., MAROSI, S. and SZILÁRD, J. (1988): *A Dunántúli-középhegység, B) Regionális tájföldrajz*. [The Transdanubian Mountains, B) Regional geography]. – Akadémiai Kiadó, Budapest, 494 pp.

BAUER, N. (2001): Florisztikai adatok a Bakonyból és a Bakonyaljáról. (Floristical data from the Bakony and the Bakonyalja). – *Folia Mus. Hist.-Nat. Bakonyiensis* **17**: 21–35.

BAUER, N. (2004): Florisztikai adatok a Bakonyból és a Bakonyaljáról II. (Floristical data from the Bakony and the Bakonyalja (Hungary) II). – *Kitaibelia* **9**(1): 187–206.

BAUER, N. (2006): *Baglyas–Iszka-hegy sasbércvonulat vegetációja*. [Vegetation of the Baglyas–Iszka-hegy horst range]. – Csopak, BfNPI Adattár, 64 pp. (mscr.).

BAUER, N. (2007): Florisztikai adatok a Bakonyból és a Bakonyaljáról III. (Floristic data from the Bakony Mountains and the Bakonyalja III). – *Kitaibelia* **12**(1): 41–51.

BAUER, N. and BÖLÖNI, J. (2007): A Pisum elatius Stev. és más új növényfajok a Bakony hegységből. (The Pisum elatius Stev. and other new species in the flora of the Bakony Mountains). – *Kitaibelia* **12**(1): 26–29.

BENCE, G., BERNHARDT, B., BIHARI, D., BÁLINT, CS., CSÁSZÁR, G., GYALOG, L., HAAS, J., HORVÁTH, I., JÁMBOR, Á., KAISER, M., KÉRI, J., KÓKAY, J., KONDA, J., LELKESNÉ FELVÁRI, GY., MAJOROS, GY., PEREGI, ZS., RAINCSÁK, GY., SOLTI, G., TÓTH, Á. and TÓTH, GY. (1990): *A Bakony hegység földtani képződményei*. [Geology of Bakony Mountains (Hungary)]. – Magyar Állami Földtani Intézet, Budapest, 119 pp.

BORHIDI, A. (1961): Klimadiagramme und Klimazonale Karte Ungarns. – *Acta Univ. Sci. Budapest. Rolando Eötvös*, Sect. Biol. **4**: 21–50.

BORHIDI, A. (2003): *Magyarország növénytársulásai*. [Plant communities of Hungary]. – Akadémiai Kiadó, Budapest, 610 pp.

BOROS, Á. (1937): *Fejér-vármegye növénytakarója*. [Flora of Fejér County]. – Magyar Városok és Vármegyék Monográfiája Vol. 22, Budapest, pp. 3–14.

BOROS, Á. (1915–1972): *Florisztikai jegyzetek.* 1–58. [Floristical notes. 1–58]. – MTM, Tudománytörténeti Gyűjtemény, Budapest, (mscr.).

BÖLÖNI, J. (2004): *Többszempontú erdőtipológiai vizsgálatok a Tési-fennsík déli részén*. [Multiphasic forest typological studies on the southern part of the Tés plateau]. – PhD ért. tézisei, NyME, EMK, Sopron, 17 pp.

BÖLÖNI, J., MOLNÁR, ZS., ILLYÉS, E. and KUN, A. (2007): A new habitat classification and manual for standardized habitat mapping. – *Annali di Botanica*, n. ser. **7**: 55–76.

CHYTRÝ, M. (ed.) (2007): *Vegetace České Republiky 1. Travinná a keřičková vegetace*. (Vegetation of the Czech Republic 1. Grassland and heathland vegetation). – Academia, Praha, 497 pp.

FEKETE, G. (1964): *A Bakony növénytakarója*. (Die Pflanzendecke des Bakony-Gebirges). – A Bakony természettudományi kutatásának eredményei I. Veszprém Megyei Múzeumi Igazgatóság, Veszprém, 53 pp.

FILARSZKY, S. and KÜMMERLE, J. (1932): *Ajuga laxmanni (L.) Benth*. – Magyar Nemzeti Múzeum Növénytani Osztálya, Budapest, Schedae ad Floram Hungaricam Exsiccatam Centuria (Jegyzék Magyarország növényeinek gyűjteményéhez) IX, p. 26.

GOMBOCZ, E. (1945): *Diaria itinerum Pauli Kitaibelii*. I–II. – Természettudományi Múzeum, Budapest, 1082 pp.

GYALOG, L. (2000): *Magyarország földtani térképe*. L-34-25 Székesfehérvár. [Geological map of Hungary, L-34-25 Székesfehérvár]. – Magyar Állami Földtani Intézet, Budapest.

HORHY, M. (1815): *Flora Bakonyensis*. Centuria I. – Palota, 5 pp. (mscr).

ISÉPY, I. (1968): Szurdokerdők és törmeléklejtő-erdők a Vértes-hegységben. (Schlucht- und Schuttabhangwälder im Vértes-Gebirge). – *Bot. Közlem.* **55**: 199–204.

JANIŠOVÁ, M. (ed.) (2007): *Travinnobylinná vegetácia Slovenska – elektronický expertný systém na identifikáciu syntaxónov*. (Grassland vegetation of Slovakia – electronic expert system for syntaxa identification). – Botanický ústav SAV, Bratislava, 260 pp.

JÁVORKA, S. (1925): *Magyar Flóra*. 1–2. (Flora Hungarica). – Studium, Budapest, 1307 pp.

KAKAS, J. (1960): *Magyarország éghajlati atlasza*. [Climatic atlas of Hungary]. – Akadémiai Kiadó, Budapest, 78 pp.

KANITZ, A. (1863): Reliquiae Kitaibelianae e manuscriptis musei Nationalis Hungarici. – Guil. Braumüller, Vindobonae, 130 pp.

KÁRPÁTI, Z. (1960): Die Sorbus-Arten Ungarns und der angrenzenden Gebiete. – *Feddes Repert.* **62**(2–3): 71–334.

LENCSÉS, G. (1996): *A várpalotai Baglyas-hegy természeti értékei és növényvilága*. [Natural values and flora of Baglyas-hegy (Várpalota)]. – Bio-Gero Ökocsoport, Várpalota, Nagykanizsa, 64 pp.

MUCINA, L., GRABHERR, G. and ELLMAUER, T. (1993): *Die Pflanzengesellschaften Österreichs I. Anthropogene Vegetation*. – Gustav Fischer Verlag, Jena, Stuttgart, New York, 578 pp.

PINKE, GY., SCHMIDT, D., SCHMIDMAJER, Á., KIRÁLY, G. and UGHY, P. (2003): Adatok a Dunántúli-középhegység és a Nyugat-Magyarországi peremvidék gyomflórájának ismeretéhez I. (Data to the weed flora in northwestern Hungary I). – *Kitaibelia* **8**(1): 161–184.

PINKE, GY., PÁL, R., MESTERHÁZY, A., KIRÁLY, G., SZENDRŐDI, V., SCHMIDT, D., UGHY, P. and SCHMIDMAJER, Á. (2006): Adatok a Dunántúli-középhegység és a Nyugat-Magyarországi peremvidék gyomflórájának ismeretéhez II. (Data to the weed flora in northwestern Hungary II). – *Kitaibelia* **10**(1): 154–185.

RÉDL, R. (1942): *A Bakony-hegység és környékének flórája*. (Flora regionis montium Bakony). – Magyar Flóraművek V. Egyházmegyei Könyvnyomda, Veszprém, 157 pp.

SADLER, J. (1817): *Iter Füreddiense*. – MTM, Tudománytörténeti Gyűjtemény, Budapest (mscr.).

SIMON, T. (2000): *A magyarországi edényes flóra határozója*. [The identification book of the vascular plants of Hungary]. 4th ed. – Nemzeti Tankönyvkiadó Rt., Budapest, 976 pp.

SOÓ, R. (1961): Neue floristisch-geobotanische Einteilung Ungarns. – *Ann. Univ. Budapest*. **4**: 155–166.

WAGNER, H. (1941): Die Trockenrasengesellschaften am Alpenostrand. Eine Pflanzensoziologische Studie. – *Denkschr. Akad. Wiss. Wien, Math.-Naturwiss. Kl.* **104**: 1–81.

WALDSTEIN, F. and KITAIBEL, P. (1802): *Descriptiones et Icones plantarum rariorum Hungariae*. 1. – Vindobonae, 104 pp.

WALLNER, E. (1941): A Bakony erdőtakarójának átalakulása a XVIII. század végéig. [History of the forests in Bakony Mts until the end of the 18th century]. – *Földr. Közlem*. **69**: 1–29.

WALLNER, E. (1942): A Bakony erdőtakarójának pusztulása a XIX. században. [Consumption of the forests in the Bakony Mts in the 19th century]. – *Földr. Közlem*. **70**: 34–42.

WALLNER, E. (1943): A Bakony erdőtakarójának jelen képe. [Present landscape of the forests in the Bakony Mts]. – *Földr. Közlem.* **71**: 260–277.

ZÓLYOMI, B. (1958): *Budapest és környéke természetes növénytakarója*. [Flora and vegetation of Budapest and its environs]. – In: PÉCSI, M. (ed.): Budapest természeti képe. Akadémiai Kiadó, Budapest, pp. 509–642.

ZÓLYOMI, B. (1966): A Pannóniai Flóratartomány és a környező területek sziklagyepjeinek új osztályozása. [New classification of the rocky grasslands of the Hungarian Flora Region and the neighbouring areas]. – *Bot. Közlem*. **53**(1): 49–54.

ZÓLYOMI, B. (1967): *Rekonstruált növénytakaró, 1:1500000*. [Reconstructed vegetation cover]. – In: RADÓ, S. (ed.): Magyarország nemzeti atlasza. [National atlas of Hungary]. Kartográfiai Vállalat, Budapest, p. 31.

ZÓLYOMI, B. (1973): *Magyarország természetes vegetációja*. [Natural vegetation of Hungary]. – In: HORTOBÁGYI, T. (ed.): Növénytan 2, Tankönyvkiadó, Budapest.

(Received 13 January, 2009)