

BOTANICAL VALUES OF THE ÖREG-HEGY AND JUHÁSZ-HALOM NEAR CSOMÁD

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This paper presents the results of studies on the flora and vegetation of the dry grassland remnants of the Öreg-hegy and Juhász-halom near Csomád. Detailed floristical survey showed that there are 1–1 strictly protected and 25–13 protected plant species at these two locations, respectively. In addition to the presence of several protected plant species, these sites are of great conservation value, because they represent important elements in a network of more or less degraded, but still semi-natural grassland patches of the original steppe woodland vegetation embedded in the intensively used landscape around Budapest.

Key words: Csomád, flora, Juhász-halom, Öreg-hegy, vegetation

INTRODUCTION

Large urban agglomerations usually lack natural values. This is true for the large area surrounding Budapest, where – except for the mountains – very little is left from the semi-natural vegetation. What is left usually occurs in the form of isolated patches in the sea of arable fields, or – in slightly better cases – of plantations of non-native trees. One of the largest and most significant such area lies west of Csomád and extends westwards, towards Göd. Botanical values of this area are hardly known compared with the well studied Somlyó-hegy near Fót (FEKETE and KOVÁCS 1982, SEREGÉLYES 1990) located only a few kilometres to the south. However, its greatest zoological attraction has been known for long. The largest population of the strictly protected butterfly (*Plebejus sephirus*) – feeding on *Astragalus excapus* – occurs in the sandy grasslands of the Csomád–Göd region (BÁLINT 2001).

Study area

The study area – the Öreg-hegy and the Juhász-halom – lies at the western periphery of the Gödöllői-dombság (Gödöllő Hills) surrounded by the deposits of the Pesti-hordaléksík (Pest Plain) (PÉCSI *et al.* 1958, KARÁTSON 1997). Öreg-hegy (Öreg Hill, 250 m) is the northwestward extension of the Oldal-hegy (Oldal Hill,

260 m) that lies west of Csomád. These hills are built up of Miocene (Karpatian = Late Burdigalian stage, Egyházasgerge formation), *i.e.* calcareous sandstone with *Chlamys* (RAINCSÁK 2001). PÉCSI (1958) and RAINCSÁK (2001) reported the presence of calcareous sandstone with *Bryozoa* from the Magas-, Disznó-, and Hátulsó-hegy (Magas, Disznó, and Hátulsó Hills) near Csomád (Fót formation), which is a major rock type on the Somlyó-hegy near Fót. PÉCSI (1958) also described the fossil-rich loosely cemented gravel and breccia of the Burdigalian (= Karpatian) stage from the western slopes of the Somlyó-hegy near Fót. Since both formations of this period are present in our study area, it is not surprising that the rock we collected on the northern slopes of the Öreg-hegy turned out to be gravelly sandstone with *Pecten* belonging to the Fót formation (NAGYMAROSY, A. and SZENTPÉTERY, I., *ex verb.*). This formation is characterised by higher carbonate content and more solid cementation than the Egyházasgerge formation. The hill is surrounded by Quaternary gravelly-sandy deposits that extend to the foothills.

Further to the northwest, Juhász-halom – in addition to Lower Miocene sandstone and Quaternary slope deposits – is built up of mixed deposits of gravel, sand and loess (RAINCSÁK 2001). (Juhász-halom in fact is a small hill of 190.4 m in height northwest of the Öreg-hegy. However, not having any official name, in this paper Juhász-halom refers to the whole valley between the Juhász-halom and the Öreg-hegy).

This area – being located in the border zone between the Nagyalföld (Great Hungarian Plain) and the Északi-középhegység (North Hungarian Mountains) – is characterised by a transitional climate. Summers are less warm than in the plains due to higher elevation, neighbouring higher mountains and to the relative proximity of the Duna-völgy (Danube Valley). However, annual temperature regime with considerable temperature differences is closer to that of the continental lowland due to the combined basin and highland effects. (Since this description characterises the Gödöllői-dombság, and our study site is located at the edge of this region, the above climatic characteristics might not be completely accurate). The distribution of annual precipitation (550–600 mm) shows a continental character, though slight Submediterranean patterns can also be traced in some years. Maximum precipitation of early summer (May–June) is followed by a dry (semiarid) period (PÉCSI 1958, ZÓLYOMI 1958, FEKETE 1965).

In phytogeographical terms the study area belongs to the *Neogradense* floristic district of the *Matricum* (North Hungarian Mountains) (SOÓ 1964, PÓCS 1981). The potential vegetation of calcareous sand covering the valleys and lower parts of the hills is assumed to be similar – not identical – to the sand grasslands of the Duna–Tisza köze, whereas that of sandstone slopes is similar to the steppe vegetation that we find on the southern slopes of the North Hungarian Mountains. This

assumption is also confirmed by the information collected from the Somlyó-hegy near Fót, which has similar conditions (FEKETE and KOVÁCS 1982).

We could not find earlier records on the vegetation of the surveyed area.

The map of the study area is shown in Figure 1.

METHODS OF SURVEY

Since we could not find considerable semi-natural woodland, we concentrated our efforts during the fieldwork (in 1986, 1994 and 2004) on the grasslands (about 12 hectares on the Öreg-hegy and 4–5 hectares on the Juhász-halom), with special emphasis on the distribution and estimated population size of protected plants (Table 1). As a result, the species list (Table 2) is far from being complete, several common and weedy species are missing from this list, though new records on the occurrence of rare plants can never be excluded.

We used the scale devised by NÉMETH and SEREGÉLYES (1989) to assess the naturalness/degradation status of vegetation. Data on species' distribution in Hungary is based on SOÓ (1964–1980) and FARKAS (1999). Phytogeographical (distribution type) and coenosystematical (phytosociological) assessment of species follows the works of SOÓ and BORHIDI published in FLORA database 1.2 (HORVÁTH *et al.* 1995), we used as reference for the nomenclature of species as well. The nomenclature for phytosociological units follows BORHIDI (2003). Nomenclature of vegetation units follows DEVILLERS *et al.* (2000).

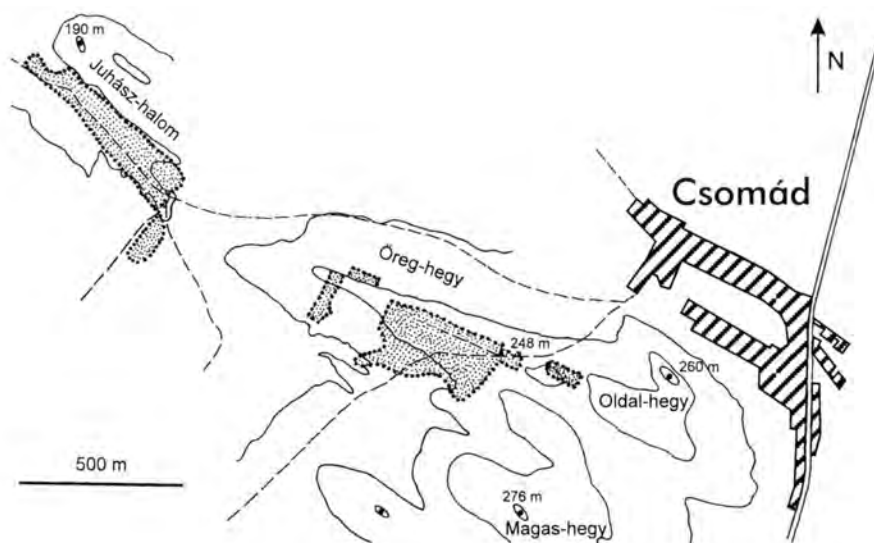


Fig. 1. Map of the study area.

RESULTS AND DISCUSSION

Vegetation of the Öreg-hegy

Grasslands

On the plateau (250–235 m) and on the slopes facing south-southwest (250–200 m), where sandstone is not covered by sand deposits, closed steppe vegetation occurs that is threatened by intensive invasion of shrubs. Sandy grasslands and pastures occur at lower parts (up to 220–240 m), where a shallow or deeper sand mantle covers the sandstone. They are also threatened by the spread of shrubs.

Table 1. Protected plants on Öreg-hegy and Juhász-halom and their population size.

Species name	Estimated population size	
	Öreg-hegy	Juhász-halom
<i>Achillea ochroleuca</i>	50–100	–
<i>Adonis vernalis</i>	1000–3000	–
<i>Alkanna tinctoria</i>	1–10	–
<i>Allium moschatum</i>	1–10	–
<i>Allium paniculatum</i> subsp. <i>marginatum</i>	50–100	–
<i>Allium sphaerocephalon</i>	10–50	30–50
<i>Astragalus excapus</i>	300–500	100–200
<i>Centaurea arenaria</i>	1–10	–
<i>Centaurea sadleriana</i>	100–500	500–700
<i>Colchicum arenarium</i> (strictly protected)	50–100	1000–2000
<i>Dianthus collinus</i>	10–50	–
<i>Dictamnus albus</i>	500–1000	–
<i>Festuca</i> × <i>wagneri</i>	–	10–?
<i>Gypsophila fastigiata</i> subsp. <i>arenaria</i>	1–10	–
<i>Helichrysum arenarium</i>	10–50	100–200
<i>Inula oculus-christi</i>	10–50	–
<i>Iris pumila</i>	1000–3000	100–200
<i>Iris variegata</i>	1–10	–
<i>Linum flavum</i>	–	10–50
<i>Linum hirsutum</i>	–	1–10
<i>Linum tenuifolium</i>	–	1–5
<i>Onosma arenarium</i>	1–10	–
<i>Orchis morio</i>	–	25–30
<i>Phlomis tuberosa</i>	10–50	–
<i>Pulsatilla pratensis</i> subsp. <i>nigricans</i>	50–100	–
<i>Ranunculus illyricus</i>	300–500	50–100
<i>Scabiosa canescens</i>	50–100	–
<i>Stipa borysthena</i>	100–500	300–500
<i>Stipa joannis</i>	10–50	–
<i>Stipa tirsia</i>	1–10	–
<i>Vinca herbacea</i>	300–500	10–50

Table 2. List of species recorded at the investigated sites on the Öreg-hegy and the Juhász-halom. (**bold** = protected species, ws = steppe woodland species, ? = indicates taxa (two *Helictotrichon*/*Avenula* species) where the names could not be given correctly due to incongruence and discrepancy between different identification keys).

Species name	Öreg-hegy	Juhász-halom
<i>Acer campestre</i> L.	+	
<i>Achillea collina</i> J. Becker	+	+
<i>Achillea nobilis</i> L. subsp. <i>neilreichii</i> (Kern.) Vel.	+	
<i>Achillea ochroleuca</i> Ehrh.	+	
<i>Achillea pannonica</i> Scheele	+	+
<i>Achillea setacea</i> W. et K.	+	
<i>Acinos arvensis</i> (Lam.) Dandy	+	
<i>Adonis vernalis</i> L.	+	
<i>Agrimonia eupatoria</i> L.	+	
<i>Agropyron intermedium</i> Host	+	+
<i>Agropyron repens</i> (L.) P. B.	+	+
<i>Agrostis stolonifera</i> L. subsp. <i>gigantea</i> (Roth) Soó	+	+
<i>Ailanthus altissima</i> (Mill.) Swingle	+	+
<i>Ajuga genevensis</i> L.	+	
<i>Alkanna tinctoria</i> (L.) Tausch	+	
<i>Alliaria petiolata</i> (M. B.) Cavara et Grande	+	+
<i>Allium flavum</i> L.	+	
<i>Allium moschatum</i> L.	+	
<i>Allium paniculatum</i> L. subsp. <i>marginatum</i> (Janka) Soó (ws)	+	
<i>Allium sphaerocephalon</i> L.	+	+
<i>Alyssum alyssoides</i> (L.) L.	+	
<i>Anchusa officinalis</i> L.	+	
<i>Anthericum ramosum</i> L.	+	
<i>Anthoxanthum odoratum</i> L.	+	
<i>Anthyllis vulneraria</i> L.	+	
<i>Apera spica-venti</i> (L.) P. B.	+	+
<i>Arenaria procera</i> Spr. subsp. <i>glabra</i> (Williams) Holub (ws)	+	
<i>Arenaria serpyllifolia</i> L.	+	
<i>Artemisia campestris</i> L.	+	+
<i>Asparagus officinalis</i> L.	+	
<i>Asperula cynanchica</i> L.	+	
<i>Aster linosyris</i> (L.) Bernh.		+
<i>Astragalus austriacus</i> Jacq.	+	
<i>Astragalus cicer</i> L.	+	
<i>Astragalus excapus</i> L.	+	+
<i>Astragalus glycyphyllos</i> L.	+	
<i>Astragalus onobrychis</i> L.	+	+
<i>Berberis vulgaris</i> L.	+	
<i>Bothriochloa ischaenum</i> (L.) Keng	+	+
<i>Brachypodium pinnatum</i> (L.) P. B. (ws)	+	
<i>Brachypodium sylvaticum</i> (Huds.) R. et Sch.	+	
<i>Briza media</i> L.	+	
<i>Bromus erectus</i> Huds.	+	+

Table 2 (continued)

Species name	Öreg-hegy	Juhász-halom
<i>Bromus inermis</i> Leyss.	+	+
<i>Bromus squarrosus</i> L.	+	
<i>Bromus sterilis</i> L.	+	+
<i>Bromus tectorum</i> L.		+
<i>Bupleurum affine</i> Sadler	+	
<i>Calamagrostis epigeios</i> (L.) Roth	+	
<i>Camelina microcarpa</i> Andr.	+	+
<i>Campanula bononiensis</i> L. (ws)	+	
<i>Campanula glomerata</i> L.	+	
<i>Campanula persicifolia</i> L.	+	
<i>Campanula rotundifolia</i> L.	+	
<i>Campanula sibirica</i> L.	+	
<i>Carduus nutans</i> L. subsp. <i>macrolepis</i> (Peterm.) Kazmi	+	
<i>Carex caryophyllea</i> Latour	+	
<i>Carex flacca</i> Schreb.	+	
<i>Carex humilis</i> Leyss. (ws)	+	+
<i>Carex liparicarpus</i> Gaud.	+	+
<i>Carex michelii</i> Host (ws)	+	
<i>Carex praecox</i> Schreb.	+	
<i>Carex supina</i> Wahlbg.	+	
<i>Carlina vulgaris</i> L.	+	
<i>Celtis occidentalis</i> L.	+	
<i>Centaurea arenaria</i> M. B.	+	
<i>Centaurea micranthos</i> S. G. Gmel.	+	+
<i>Centaurea pannonica</i> (Heuff.) Simk.	+	
<i>Centaurea sadleriana</i> Janka	+	+
<i>Centaurium erythraea</i> Rafn.	+	
<i>Cerinthe minor</i> L.	+	
<i>Chondrilla juncea</i> L.	+	
<i>Chrysanthemum leucanthemum</i> L. subsp. <i>leucanthemum</i>	+	
<i>Chrysopogon gryllus</i> (Torn.) Trin.	+	+
<i>Clinopodium vulgare</i> L.	+	
<i>Colchicum arenarium</i> W. et K.	+	+
<i>Coronilla varia</i> L.	+	
<i>Crataegus monogyna</i> Jacq.	+	+
<i>Cruciata laevipes</i> Opiz.	+	+
<i>Cynodon dactylon</i> (L.) Pers.	+	+
<i>Cynoglossum officinale</i> L.	+	
<i>Dactylis glomerata</i> L.	+	
<i>Dianthus collinus</i> W. et K. (ws)	+	
<i>Dianthus pontederæ</i> Kern.	+	+
<i>Dictamnus albus</i> L. (ws)	+	
<i>Draba nemorosa</i> L.		+
<i>Echium vulgare</i> L.	+	+
<i>Eryngium campestre</i> L.	+	+
<i>Erysimum diffusum</i> Ehrh.	+	+

Table 2 (continued)

Species name	Öreg-hegy	Juhász-halom
<i>Euonymus europaea</i> L.	+	
<i>Euonymus verrucosus</i> Scop.	+	
<i>Euphorbia cyparissias</i> L.	+	+
<i>Euphorbia pannonica</i> Host	+	
<i>Euphorbia seguieriana</i> Necker	+	+
<i>Falcaria vulgaris</i> Bernh.	+	+
<i>Festuca pseudovina</i> Hack.	+	+
<i>Festuca rupicola</i> Heuff.	+	+
<i>Festuca vaginata</i> W. et K.	+	+
<i>Festuca valesiaca</i> Schleich.	+	+
<i>Festuca</i> × <i>wagneri</i> Deg., Thaisz et Flatt		+
<i>Filago arvensis</i> L.	+	
<i>Filipendula vulgaris</i> Lam.	+	+
<i>Fragaria viridis</i> Duch.	+	
<i>Fraxinus ornus</i> L.	+	
<i>Fumana procumbens</i> (Dun.) Gren. et Godr.	+	
<i>Galium aparine</i> L.	+	+
<i>Galium glaucum</i> L.	+	+
<i>Galium verum</i> L.	+	+
<i>Geranium pusillum</i> Burm. f.	+	
<i>Glechoma hederacea</i> L.	+	
<i>Globularia punctata</i> Lap.	+	
<i>Gypsophila fastigiata</i> L. subsp. <i>arenaria</i> (W. et K.) Dom.	+	
<i>Gypsophila paniculata</i> L.	+	+
<i>Helianthemum ovatum</i> (Viv.) Dun.	+	
<i>Helichrysum arenarium</i> (L.) Mönch	+	+
<i>Helictotrichon praeustum</i> (Rchb.) Tzvelev (?)	+	+
<i>Helictotrichon pratense</i> (L.) Bess. (?)	+	
<i>Helictotrichon pubescens</i> (Huds.) Pilger	+	
<i>Hesperis tristis</i> L.	+	
<i>Hieracium bauhini</i> Schult. ex. Bess.	+	
<i>Hieracium echioides</i> Lumn.	+	
<i>Hieracium hoppeanum</i> Schult.	+	
<i>Hieracium pilosella</i> L.	+	
<i>Hypericum perforatum</i> L.	+	+
<i>Hypochoeris maculata</i> L. (ws)	+	
<i>Inula oculus-christi</i> L. (ws)	+	
<i>Iris pumila</i> L.	+	+
<i>Iris variegata</i> L. (ws)	+	
<i>Kochia laniflora</i> (S. G. Gmel.) Borb.	+	
<i>Koeleria cristata</i> (L.) Pers.	+	+
<i>Leontodon hispidus</i> L.	+	
<i>Lepidium campestre</i> (L.) R. Br.	+	
<i>Ligustrum vulgare</i> L.	+	
<i>Linaria angustissima</i> (Lois.) Re	+	
<i>Linaria vulgaris</i> Mill.	+	

Table 2 (continued)

Species name	Öreg-hegy	Juhász-halom
<i>Linum austriacum</i> L.	+	
<i>Linum flavum</i> L. (ws)		+
<i>Linum hirsutum</i> L.		+
<i>Linum tenuifolium</i> L.		+
<i>Lithospermum officinale</i> L.	+	
<i>Lotus corniculatus</i> L.	+	
<i>Luzula campestris</i> (L.) Lam. et DC.	+	
<i>Medicago falcata</i> L.	+	
<i>Melandrium album</i> (Mill.) Garcke	+	
<i>Melandrium viscosum</i> (L.) Celak.	+	+
<i>Melica ciliata</i> L.	+	
<i>Melica transsylvanica</i> Schur	+	
<i>Melilotus albus</i> Desr.	+	
<i>Minuartia verna</i> (L.) Hiern.	+	+
<i>Minuartia glomerata</i> (M. B.) Deg.	+	
<i>Muscari comosum</i> (L.) Mill.	+	
<i>Muscari racemosum</i> (L.) Mill.	+	
<i>Myosotis sparsiflora</i> Mikan	+	
<i>Nonea pulla</i> (L.) Lam. et DC.	+	
<i>Ononis spinosa</i> L.	+	+
<i>Onosma arenarium</i> W. et K.	+	
<i>Orchis morio</i> L.		+
<i>Orlaya grandiflora</i> (L.) Hoffm.	+	
<i>Ornithogalum umbellatum</i> L.	+	
<i>Petrorhagia prolifera</i> (L.) Ball et Heyw.	+	
<i>Phleum phleoides</i> (L.) Karsten	+	+
<i>Phleum pratense</i> L.	+	
<i>Phlomis tuberosa</i> L. (ws)	+	
<i>Pimpinella saxifraga</i> L.	+	+
<i>Pinus nigra</i> Arnold	+	
<i>Plantago arenaria</i> W. et K.	+	
<i>Plantago lanceolata</i> L.	+	
<i>Plantago media</i> L.	+	
<i>Plantago stepposa</i> Kuprianova	+	
<i>Poa angustifolia</i> L.	+	+
<i>Poa bulbosa</i> L.	+	+
<i>Polygonatum latifolium</i> (Jacq.) Desf.	+	
<i>Polygonum arenarium</i> W. et K.	+	
<i>Populus alba</i> L.	+	
<i>Potentilla arenaria</i> Borkh.	+	
<i>Potentilla heptaphylla</i> L.	+	
<i>Potentilla impolita</i> Wahlbg.	+	
<i>Potentilla recta</i> L. (ws)	+	
<i>Prunella laciniata</i> (L.) Nath.	+	
<i>Pulsatilla pratensis</i> (L.) Mill. subsp. <i>nigricans</i> (Störck) Zamels	+	

Table 2 (continued)

Species name	Öreg-hegy	Juhász-halom
<i>Quercus cerris</i> L.	+	
<i>Quercus pubescens</i> Willd.	+	
<i>Ranunculus illyricus</i> L. (ws)	+	+
<i>Ranunculus polyanthemus</i> L. (ws)	+	
<i>Reseda lutea</i> L.	+	
<i>Rhamnus catharticus</i> L.	+	
<i>Robinia pseudo-acacia</i> L.	+	
<i>Rosa canina</i> L.	+	
<i>Rosa gallica</i> L. (ws)	+	
<i>Rumex acetosella</i> L.	+	
<i>Salvia austriaca</i> Jacq.	+	+
<i>Salvia nemorosa</i> L.	+	+
<i>Salvia pratensis</i> L.	+	+
<i>Sanguisorba minor</i> Scop.	+	+
<i>Saponaria officinalis</i> L.	+	
<i>Scabiosa canescens</i> W. et K. (ws)	+	
<i>Scabiosa ochroleuca</i> L.	+	
<i>Scorzonera austriaca</i> Willd.	+	
<i>Sedum acre</i> L.		+
<i>Sedum maximum</i> (L.) Hoffm. (ws)	+	
<i>Senecio integrifolius</i> (L.) Clairv. (ws)	+	
<i>Seseli annuum</i> L.	+	+
<i>Seseli varium</i> Trev.	+	+
<i>Sideritis montana</i> L.	+	
<i>Silene conica</i> L.	+	
<i>Silene nutans</i> L. (ws)	+	
<i>Silene otites</i> (L.) Wiebel	+	+
<i>Silene vulgaris</i> (Mönch) Garcke	+	
<i>Solidago canadensis</i> L.	+	
<i>Stachys recta</i> L. (ws)	+	
<i>Stellaria media</i> (L.) Vill.	+	
<i>Stipa borysthena</i> Klokov	+	+
<i>Stipa capillata</i> L.	+	+
<i>Stipa joannis</i> Celak.	+	
<i>Stipa tirsia</i> Stev.	+	
<i>Teucrium chamaedrys</i> L. (ws)	+	+
<i>Thalictrum minus</i> L. (ws)	+	+
<i>Thlaspi perfoliatum</i> L.	+	
<i>Thymus pannonicus</i> All. (incl. <i>T. marschallianus</i> Willd.)	+	+
<i>Tragopogon dubius</i> Scop.		+
<i>Tragus racemosus</i> (L.) All.	+	
<i>Trifolium alpestre</i> L. (ws)	+	+
<i>Trifolium arvense</i> L.	+	+
<i>Trifolium campestre</i> Schreb.	+	
<i>Trinia glauca</i> (L.) Dum.	+	
<i>Turritia glabra</i> L.	+	+

Table 2 (continued)

Species name	Öreg-hegy	Juhász-halom
<i>Ulmus minor</i> Mill.	+	
<i>Valerianella locusta</i> (L.) Lateralade	+	
<i>Verbascum lychnitis</i> L.	+	
<i>Verbascum phoeniceum</i> L.	+	+
<i>Veronica chamaedrys</i> L. subsp. <i>vindobonensis</i> M. Fischer	+	
<i>Veronica prostrata</i> L.	+	
<i>Veronica spicata</i> L.	+	
<i>Vicia tetrasperma</i> (L.) Schreb.	+	
<i>Vinca herbacea</i> W. et K. (ws)	+	+
<i>Viola hirta</i> L. (ws)	+	+
<i>Xeranthemum annuum</i> L.		+

Most of these grasslands are secondary in nature, they are former pastures that were created by clear felling the original woody vegetation. Based on the information derived from the map of the Second Military Survey of Hungary (1842, Sectio no.: 49, Colonne XXXIII; The Cartographic Collection of the Maproom of the Hungarian Institute and Museum of Military History, Budapest) large parts of the southern slopes of the Öreg-hegy – including the patches of the described valuable grasslands – were covered by grape-yards (“Öreg Szöllő”). These grasslands were grazed until recently. Expansion of shrubs has been intensified in the past 10 years. *Crataegus monogyna* dominates with *Ligustrum vulgare*, *Rosa canina*, *Berberis vulgaris* as other important shrubs. Regarding their conservation value, most of the grassland patches are in the range of semi-natural to intermediately degraded, since, in spite of the presence of natural associate species, the share and number of weeds and disturbance tolerants is rather high. However, there is a high variation in the quality of different patches (from semi-natural to intermediately degrade, or even recently disturbed highly degraded).

Both composition and structure of the vegetation indicate secondary origin and former disturbances, like intensive grazing. Besides high abundance of *Botriochloa ischaemum*, there are obvious signs of degradation in the structure of the grassland: general dominance of grasses; coarse-grained structure of the grassland, *i.e.*, hardly any species can establish in the patches dominated by a single species. Such dominant grasses include *Festuca rupicola*, *Stipa capillata*, and – in certain patches – *Chrysopogon gryllus*. Similar patches can be formed after severe disturbance (*e.g.*, rooting place of wild boar) by *Anthoxanthum odoratum* and *Botriochloa ischaemum*. Many other species can be locally abundant on disturbed sites: *Bromus squarrosus*, *Lepidium campestre*, *Rumex acetosella*, *Trifolium arvense*, *Cynodon dactylon*, *Teucrium chamaedrys*, *Thymus pannonicus*, *Eryngium campestre*, *Hypericum perforatum*, *Cruciata laevipes*, *Salvia pratensis*.

The distribution of major communities follows that of the bedrock: on relatively shallow rendzina-like soils rich in sand and gravel developed on weathered sandstone meadow-steppe (*Cleistogeni-Festucetum sulcatae* ZÓLYOMI 1958) occurs, whereas on deeper sand calciphile sand steppe (*Festucetum vaginatae* RAPAIKS ex SOÓ 1929 em. BORHIDI 1996), or – at the lower part of the southerly slope – sand meadow-steppe (*Astragalo austriaci-Festucetum sulcatae* SOÓ 1957) is the characteristic association.

Many of the characteristic species are the same in these associations, including dominant monocotyledons determining vegetation structure. These species include *Stipa capillata*, *Chrysopogon gryllus*, *Festuca rupicola*, *Botriochloa ischaemum*, *Carex humilis* and their most common associates, *Koeleria cristata* and *Anthoxanthum odoratum*. *Stipa borysthena* is dominant in one patch on sand. These species dominate the vegetation in different combinations and in different proportions. The most typical types are as follows: (1) *Festuca rupicola* and *Botriochloa ischaemum* are codominants; (2, 3) one of them is dominant with the other as subdominant; (4) *Stipa capillata* is monodominant; (5) *Stipa capillata* and *Chrysopogon gryllus* are codominants; (6) *Stipa capillata* and *Festuca rupicola* are codominants; (7) *Stipa capillata* is dominant with *Festuca rupicola* as subdominant; (8) *Chrysopogon gryllus* is dominant with *Botriochloa ischaemum* as subdominant; (9) *Botriochloa ischaemum* is dominant with *Chrysopogon gryllus* as subdominant; (10) *Carex humilis* is abundant with substantial *Botriochloa ischaemum*, *Chrysopogon gryllus*, *Stipa capillata* and *Festuca rupicola*.

Meadow-steppes

This latter type (10, see above paragraph) occurs on shallow colluvial deposits and is different from typical meadow steppes. The grassland is not closed, and there are several species that are not characteristic of (or generally missing from) meadow steppes, but occur both in rock steppe of the mountains and in sand steppe of the plains (ZÓLYOMI 1958, FEKETE and KOVÁCS 1982). *Allium moschatum*, *Fumana procumbens*, *Carex liparicarpos*, *Euphorbia seguieriana*, *Minuartia setacea*, *Alyssum tortuosum*, *Carex humilis* are good examples. *Globularia punctata* is a species more characteristic of rock steppes and it grows on sandstone on the Öreg-hegy. *Scorzonera austriaca*, a species also characteristic of rock steppes but missing from sandy areas, was found in a similar habitat on the ridge of the hill. All these together with the abundance of *Chrysopogon gryllus*, and especially of *Carex humilis* support the idea that these grasslands have some remote relationship with rock steppes (*Chrysopogono-Caricetum humilis* ZÓLYOMI 1958). However, on the Öreg-hegy composition, structure and weathering properties of the bedrock prevented the development of steep rocky slopes that could host this association.

Though these same properties supported the development of this association on other young limestone formations (ZÓLYOMI 1958, KUN 1998). The rock steppe of the Somlyó-hegy near Fót is richer in rocky elements, but even there, the proportion of these elements – quite understandably – is less than in typical mountain rock steppes (FEKETE and KOVÁCS 1982, ZÓLYOMI 1958), since this area is located about at the eastern limit of the distribution of this Submediterranean association (FEKETE and KOVÁCS 1982, KUN *et al.* 2002).

Of the typical meadow steppe species (*Festucion rupicolae*) the occurrence of *Euphorbia pannonica*, *Inula oculus-christi*, *Salvia austriaca*, *Vinca herbacea*, *Hieracium hoppeanum*, *Bupleurum affine*, *Ranunculus illyricus*, *Astragalus austriacus*, *Arenaria procera* subsp. *glabra* is worthy of mentioning. Among more general dry grassland species (*Festucetalia valesiaceae*) *Galium glaucum*, *Campanula sibirica*, *Pulsatilla pratensis* subsp. *nigricans*, *Scabiosa canescens* are important in this area.

There are some similar steppe patches on the north facing slopes surrounded by tree plantations. In these patches *Botriochloa ischaemum*, *Festuca rupicola*, and *Stipa capillata* dominate. The occurrence of *Stipa tirsia*, *Phlomis tuberosa*, and high abundance of *Ranunculus illyricus* together with the presence of *Silene nutans*, *Potentilla recta*, *Lithospermum officinale*, *Campanula glomerata*, *Linum austriacum*, *Chrysanthemum leucanthemum*, *Carex flacca*, *Ajuga genevensis*, *Sedum maximum*, *Vinca herbacea* are important features of these patches.

Sand steppes

There is no abrupt boundary between meadow-steppe and calciphile sand steppe stands. This is attributed to the similarities in soil properties and is manifested in the high number of common species. As a result of former and present-day degrading effects and intensive spread of shrubs, in this area only intermediately/seriously degraded stands of sand steppe could survive. Based on our knowledge on site properties (FEKETE and KOVÁCS 1982, SEREGÉLYES 1990, SEREGÉLYES *et al.* 1993, SZOLLÁT *et al.* 1992) and on sand steppes of the surroundings (Fót, Göd, Szentendre-sziget), we assume that much richer sand steppes had flourished here in the past.

Of the dominant species of this association *Festuca vaginata* and *Stipa borys-thenica* occur in only a few sites, the latter as a truly dominant species found in only one relatively small patch, while *Stipa capillata* is the most abundant. Other characteristic species of the open sand steppe also occur: *Colchicum arenarium*, *Helichrysum arenarium*, *Onosma arnearium*, *Achillea ochroleuca*, *Centaurea arenaria*, *Gypsophila fastigiata* subsp. *arenaria*, *Alkanna tinctoria*, as well as several natural pioneers of disturbed sites: *Silene conica*, *Polygonum arenarium*,

Plantago arenaria, *Kochia laniflora*. *Gypsophila paniculata* increases its abundance as a response to disturbance. In addition, several less specialised dry grassland species – also characteristic to the sand steppes – are present: *Fumana procumbens*, *Erysimum diffusum*, *Carex liparicarpos*, *Silene otites*, *Melica transylvanica*, *Potentilla arenaria*, *Euphorbia seguieriana*, *Alyssum tortuosum*. To our best knowledge several important sand steppe species that occur on the Somlyó-hegy near Fót (FEKETE and KOVÁCS 1982, SEREGÉLYES 1990), the Pesti-hordaléksíkság and on the Szentendrei-sziget (SEREGÉLYES *et al.* 1993, SZOLLÁT *et al.* 1992) are missing. They include: *Corispermum nitidum*, *Dianthus serotinus*, *Iris arenaria*, *Peucedanum arenarium*, *Sedum hillebrandtii*.

Some common species of meadow-steppes and sand steppes show characteristic habitat preference on the Öreg-hegy. *Globularia punctata* and *Carex humilis* prefer rock steppes on sandstone, whereas *Carex liparicarpos* and *Potentilla arenaria* are more abundant on sand. *Iris pumila* grows mostly on sand, while *Adonis vernalis* has high abundance in meadow steppe but is almost lacking from sand. *Helichrysum arenarium* (otherwise typical sand steppe species) and *Pulsatilla pratensis* subsp. *nigricans* have their only occurrences at the edge of meadow steppe.

There are some sand meadow-steppe patches on the lower part of the southerly slope. *Stipa capillata* dominates in these patches with *Festuca rupicola*, *Botriochloa ischaemum* and *Chrysopogon gryllus* as important grasses. Of the typical sand meadow-steppe species *Astragalus excapus*, *Hieracium echioides*, and *Seseli varium* occur. In addition to the common dry grassland species (not listed here), other valuable species include *Adonis vernalis*, *Iris pumila*, *Carex humilis*, *Vinca herbacea*, *Colchicum arenarium*.

Highly degraded grasslands

The calcareous sandstone plateau between Oldal-hegy and Öreg-hegy is covered by extensive fallow fields that used to have different cultures and were abandoned in different times. Most of them have been invaded by aggressive weeds such as *Solidago gigantea*, *Ambrosia artemisiifolia*. However, some parts have recovered quite well. The most remarkable patch is dominated by grasses (*Stipa capillata*, *Festuca rupicola*, *Botriochloa ischaemum*), with small share, but relatively high species richness of dicotyledons. Besides common species, among others *Adonis vernalis*, *Globularia punctata*, *Allium paniculatum* subsp. *marginatum* occur. The grasslands occurring on the western part of the south-facing slope grow in the openings of declining *Robinia* plantations. These degraded grasslands (partly recovering but also threatened by shrub invasion) are dominated by the competitor *Stipa capillata* and the disturbance tolerant *Botriochloa ischaemum* with some

Festuca rupicola. The presence of dicotyledons is negligible. Protected plants are represented by four abundant species: *Centaurea sadleriana*, *Adonis vernalis*, *Stipa borysthena* and *Iris pumila*. On one location, *Rosa gallica* occurs at the forest edge on the ridge.

Tree plantations, remnants of woods

Most of Öreg-hegy and Oldal-hegy is covered by plantations of non-native tree species mainly of *Robinia pseudo-acacia*, some of them mixed with *Celtis occidentalis*. A few *Pinus nigra* plantations also occur. *Ailanthus altissima* is a relatively common weed tree. According to the information given in a 1:50,000 scale military map from 1944, Öreg-hegy was completely treeless except for a single line of trees running on the ridge.

At the highest point of the Öreg-hegy there is a small remnant woodlot representing the original – once widespread – closed oak woods of these lower hills. This small (< 0.5 ha) wood patch is dominated by *Quercus pubescens* accompanied by other tree species (*Quercus cerris*, *Acer campestre*, *Fraxinus ornus*, *Populus alba*). The shrub layer is rather dense; the herb layer looks almost undisturbed. Besides the most frequent *Polygonatum latifolium*, the occurrence of numerous steppe woodland species, like *Carex michelii*, *Campanula bononiensis*, *Vinca herbacea*, *Arenaria procera* subsp. *glabra*, *Adonis vernalis*, *Dictamnus albus* – mostly at the edges – is worth mentioning. A similar remnant group of trees grows in the western part of the grassland area on the upper part of the slightly south-facing slope. There are a few surviving *Quercus pubescens* individuals surrounded by several *Robinia pseudo-acacia*. These trees grow in a dense shrub layer dominated by *Ligustrum vulgare* and *Crataegus monogyna* with *Rosa canina*, *Euonymus verrucosus* and *Berberis vulgaris*. At the edges of this patch *Dictamnus albus* and *Carex michelii* occur as “well behaving” steppe woodland species, and *Brachypodium pinnatum* (otherwise not frequent here) also forms relatively large patches at these edges.

There are only a few more species in the whole survey area indicating former dry oak woods: *Campanula bononiensis*, *Turritis glabra*, *Lithospermum officinale*, and a few steppe woodland species, like *Dianthus collinus*, *Silene nutans*, *Phlomis tuberosa*, *Viola hirta*.

The values of the flora

From a phytogeographical viewpoint we emphasise the importance of those species that reach their distributional limit, are rare in the *Neogradense* floristical district or in the Gödöllői-dombság, or have some other specialities. *Allium mos-*

chatum has a Pontic–Submediterranean distribution and it does not occur northeast of the Gödöllői-dombság, similarly to the Submediterranean *Fumana procumbens*. Another Submediterranean species, *Globularia punctata* has only two known localities east of the Öreg-hegy (Gyöngyös, Aggteleki-karszt). The also Submediterranean *Orlaya grandiflora* has only two other localities in the Gödöllői-dombság (Mogyoród, Sikáros; Isaszeg, Szentgyörgyi erdő; SZÉNÁSI, V. and CSÁKY, P., *ex verb.*) (and occurs only in the Tokaji-hegység and on Szarvaskő further northeast). *Prunella laciniata* is treated as a locally (Gödöllői-dombság) rare species (CSÁKY, P., *ex verb.*). The Central European species, *Scabiosa canescens*, has only three known localities east of the Gödöllői-dombság (and of the Duna–Tisza köze), and it reaches the eastern limits of its distribution in Hungary and in Poland. *Iris variegata* should also be mentioned among the rare species, since it occurs only at a single location on the southerly slope of the Oldal-hegy, though one would expect much wider distribution of this otherwise not rare species of steppe grassland developing both on sand and on more solid bedrocks. *Astragalus austriacus* is treated as a locally (Gödöllői-dombság) rare species of continental steppes. The occurrence of two Fagitalia species, *Carex sylvatica* and *Corydalis solida* (CSÁKY, P., *ex verb.*) has also local importance. The only strictly protected species of the area, *Colchicum arenarium* is an endemic species that is threatened because of the small size of its population. (The protected plant species occurring in the Öreg-hegy are listed in Table 1).

Vegetation of the Juhász-halom

Juhász-halom is a shallow, several hundreds metre long valley northwest of Öreg-hegy. On both sides it is bordered by cultivated lands. Since bedrock is built up by a mixture of calcareous sandstone, sand, gravel and loess silt, vegetation is composed of stands of sand meadow-steppe, sandy pastures and on smaller areas meadow-steppe. The closed grassland vegetation is threatened by intensive invasion of shrubs – mostly of *Crataegus monogyna* – in the whole valley. These grasslands are secondary in nature, and they were grazed until recently. Expansion of shrubs has been intensified since grazing was stopped. The whole valley is rather small, which makes the vegetation more vulnerable, especially if we consider that there is a relatively busy trail, and that two small illegal pits had been opened recently. As a result of all these, most of the vegetation of Juhász-halom could be classified as intermediately degraded, with some patches of seriously degraded secondary grasslands, and with only a few remnants of truly semi-natural grasslands. The dominance of monocotyledons is characteristic of these grasslands as well.

The narrow northeast-facing side of the valley is covered by a mosaic of relatively dense shrubby vegetation with some patches of *Robinia pseudo-acacia* and seriously degraded grassland patches. However, there are also some smaller patches of intermediately degraded grasslands. Under the dense groups of shrubs formed by *Crataegus monogyna* herb layer is composed of nitrophytes (*Bromus sterilis*, *Alliaria petiolata*, *Galium aparine*). In the meadow-steppe patches *Festuca rupicola* is the dominant species, with *Chrysopogon gryllus* and *Stipa capillata* in a few less disturbed patches. *Poa angustifolia*, *Botriochloa ischaemum* and the large patch-forming *Bromus inermis* are also typical. The dominance of monocotyledons is supported by the presence of *Agrostis stolonifera* subsp. *gigantea*, *Phleum phleoides*, *Koeleria cristata*, *Agropyron repens*. On this side of the valley there are more generalists and disturbance tolerants than on the other. Except for the hundreds of *Colchicum arenarium*, protected plants are represented by only the few *Astragalus excapus* and *Vinca herbacea* individuals.

The opposite (southwest-facing) wider side of the valley is mostly covered by intermediately degraded grasslands, turning to seriously degraded shrubby (*Crataegus monogyna*) grasslands toward the bottom. However, some semi-natural species rich patches survived, mostly on sandstone bedrock. *Stipa capillata*, *Chrysopogon gryllus*, *Botriochloa ischaemum*, *Festuca rupicola*, *F. pseudovina* are the typical dominants. In slightly more degraded patches *Festuca rupicola* and *Poa angustifolia*, whereas in seriously degraded ones *Agropyron repens*, *Poa angustifolia*, *Cynodon dactylon*, *Bromus inermis* predominate. *Trifolium arvense*, *Apera spica-venti*, *Teucrium chamaedrys* and *Rumex acetosella* typically grow on recently disturbed sites. Emphasis should be put on the occurrence of the protected *Linum tenuifolium* on a sandstone exposure (PÁNDI, I., *ex verb.*).

Adjoining to the area from the south, there is a smaller, somewhat degraded patch of calciphile sand steppe. In its less disturbed parts *Stipa borysthénica* is dominant, *Festuca vaginata*, *Astragalus excapus* and *Helichrysum arenarium* also occur, while *Orchis morio* and *Festuca × wagneri* only found at this location. (The protected plant species occurring in the Juhász-halom are listed in Table 1).

CONCLUSIONS

Vegetation of the Öreg-hegy and Juhász-halom deserves attention for several reasons. As it was mentioned in the Introduction, this area belongs to one of the largest continuous relic of semi-natural vegetation between Budapest and Vác. Vegetation is rather rich in rare species. By now we have found 33 locally or regionally rare species most of them are protected by law. These 31 protected plant

species themselves represent high conservation value, estimated to worth 50 billion HUF based on abundance estimates and attached values by the Hungarian Conservation Act. For comparison, there are 42 protected plants on the Somlyó-hegy near Fót (CSÁKY, P., *ex verb.*), which is much richer in different habitats. Of the 26 protected species of the Öreg-hegy 23 occurs on the Somlyó-hegy near Fót, but there are only three plant species that grow on Öreg-hegy but not on Somlyó-hegy near Fót (and three other such species on Juhász-halom). It is also worth emphasising that about one-fifth of all Hungarian steppe woodland species occur in this relatively small area where there has been no semi-natural woodlands for at least 50 years (see Table 2).

It is an important feature of the vegetation, that the sand steppe vegetation of the Nagyalföld reaches one of its northernmost outposts here, near Csomád. However, species composition and structure of these grasslands differ from those of typical sand steppes of the lowlands. One of the character species of this association, *Festuca vaginata*, only scarcely appears in this area, and several other important members of the sand steppes are also missing from here. There are at least two reasons for this: climatic and other site characteristics are not the same as in the Duna–Tisza köze. Since several of these “missing” species do occur on the Somlyó-hegy near Fót and at several locations in the Pesti-hordaléksíkság and on the Szentendrei-sziget, degradation must have also played a role in the development of this relatively species poor vegetation. Similar transitional situation could be described for the meadow steppe vegetation of the area. It is poorer in species than in the mountains (Északi-középhegység) and has different structure. Special bedrock and soil forming processes also contributed to the development of the distinctive site properties of this area.

This area is peculiar, because it provides a rare example, where grasslands growing on calcareous sand and on also calcareous solid bedrock (*e.g.* Lajta limestone, dolomite) are in direct contact. This phenomenon is known from several locations in Dunántúli-középhegység (Transdanubia) and from the Somlyó-hegy near Fót. This situation has given the chance of migration for both lowland and upland vegetation as climate changed in the past, hence had high importance in the historical development of vegetation.

However, these valuable surveyed areas have never been under protection. Fortunately, they have been nominated recently as parts of the Natura 2000 network. These locally and also regionally valuable sites are threatened by the spontaneous but potentially intensive spread of shrubs and of non-native tree species (*Robinia pseudo-acacia*, *Celtis occidentalis*, *Ailanthus altissima*). Another detrimental factor is the excavation of gravel and sand from the area. On top of all these, it is almost negligible, but still worth mentioning, that after designation as pro-

tected area, grazing, horse riding, coach driving and motocross (typical activities in the area) should be prohibited or controlled.

* * *

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REFERENCES

- BÁLINT, ZS. (2001): *A fóti boglárka taxonómiai helyzete, ökológiája és védelme Magyarországon*. [Taxonomy, ecology and conservation of *Plebejus sephirus* in Hungary]. – In: *Ökológia az ezredfordulón II*. MTA, Budapest, pp. 57–71.
- BORHIDI, A. (2003): *Magyarország növénytársulásai*. [Plant associations of Hungary.] – Akadémiai Kiadó, Budapest, 610 pp.
- DEVILLERS, P., RÉDEI, T., ZIMÁNYI, ZS., BARABÁS, S. and HORVÁTH, F. (2000): *Magyarországi élőhelyek angol-magyar "értelmező szótára"*. [English-Hungarian dictionary of Hungarian habitats]. – MTA Ökológiai és Botanikai Kutatóintézete, Vácrátót. URL: <http://www.botanika.hu/habhun>.
- FARKAS, S. (ed.) (1999): *Magyarország védett növényei*. [Protected plants of Hungary]. – Mezőgazda Kiadó, Budapest, 419 pp.
- FEKETE, G. (1965): *Die Waldvegetation im Gödöllőer Hügelland*. – Akadémiai Kiadó, Budapest, 223 pp.
- FEKETE, G. and KOVÁCS, M. (1982): A fóti Somlyó vegetációja. [Die vegetation des Berges Somlyó bei Fóti]. – *Bot. Közlem.* **69**(1–2): 19–31.
- HORVÁTH, F., DOBOLYI, Z. K., MORSCHAUER, T., LŐKÖS, L., KARAS, L. and SZERDAHELYI, T. (1995): *FLÓRA adatbázis 1.2*. [FLORA Database 1.2]. – MTA Ökológiai és Botanikai Kutatóintézete, Vácrátót, 268 pp.
- KARÁTSZON, D. (ed.) (1997): *Magyarország földje*. [The land of Hungary]. – Pannon Enciklopédia sorozat, Kertek 2000 Kiadó, Budapest, 508 pp.
- KUN, A. (1998): Sziklai növénytársulások az Érd-Tétényi-fennsíkon. [Rocky plant associations on Érd-Tétényi Plateau]. – *Kitaibelia* **3**(1): 65–70.
- KUN, A. *et al.* (2002): A *Carex humilis* dominálta sziklafüves lejtők variabilitása a Dunántúli- és az Északi-középhegységben. [Variation of *Carex humilis* dominated grasslands in the mountains of the Dunántúli- and Északi-középhegység]. – In: SALAMON-ALBERT, É. (ed.): *Magyar botanikai kutatások az ezredfordulón. Tanulmányok Borhidi Attila 70. születésnapja tiszteletére*. Pécsi Tudományegyetem, Pécs, pp. 447–462.
- NÉMETH, F. (1981): A fóti Somlyó. [The Somlyó Hill near Fóti]. – *Bűvár* **36**(8): 342–344.
- NÉMETH, F. and SEREGÉLYES, T. (1989): *Botanikai értékelés*. [Botanical assessment]. – In: Kgl Természetvédelmi munkacsoport (ed.): *Természetvédelmi információs alrendszer, adatlap kitöltési útmutató II. kötet*. Kgl, Budapest, pp. 12–13.
- PÉCSI, M. *et al.* (eds) (1958): *Budapest természeti képe*. [Natural history of Budapest]. – Akadémiai Kiadó, Budapest, 744 pp.

- PÓCS, T. (1981): *Növényföldrajz*. – In: HORTOBÁGYI, T. and SIMON, T. (eds): *Növényföldrajz, társulástan és ökológia*. Tankönyvkiadó, Budapest, pp. 27–166.
- RAINCSÁK, GY.-né (2001): *A budapesti agglomeráció területfejlesztésének mérnökhidrogeológiai megalapozása; földtani térkép, M = 1:50000*. [Geological map of greater Budapest]. – MÁFI, Budapest.
- SEREGÉLYES, T. (1990): *A Főti Somlyó TT növényzete és botanikai értékei*. [The vegetation and botanical values of Somlyó Hill near Fót]. – Budapest, 16 pp. (mscr.).
- SEREGÉLYES, T. *et al.* (1993): *A Szentendrei-sziget növényzete és botanikai értékei*. [The vegetation and botanical values of Szentendre Island]. – Göncöl Alapítvány, Vác, 30 pp. (mscr.).
- SOÓ, R. (1964–1980): *A magyar flóra és vegetáció rendszertani-növényföldrajzi kézikönyve I–VI*. (Synopsis systematico-geobotanica florum vegetationisque Hungariae, I–VI). – Akadémiai Kiadó, Budapest, 589 pp. (1964); 655 pp. (1966); 506 pp. (1968); 614 pp. (1970); 723 pp. (1973); 556 pp. (1980).
- SZOLLÁT, GY. *et al.* (1992): *Természetvédelmi célú botanikai feltáró vizsgálatok Göd környékén*. [Survey of the botanical values near Göd]. – Göncöl Alapítvány, Vác, 12 pp. (mscr.).
- ZÓLYOMI, B. (1958): *Budapest és környékének természetes növénytakarója*. [Die natürliche Pflanzendecke von Budapest und Umgebung]. – In: PÉCSI, M. *et al.* (eds): *Budapest természeti képe*. Akadémiai Kiadó, Budapest, pp. 511–642.

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