

DISTRIBUTION OF THE LICHEN SPECIES *CETRARIA ACULEATA* IN HUNGARY

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Cetraria aculeata became legally protected in Hungary in 2005. Though for several decades it was known from a few localities only, recently it turned out that it is more frequent than previously ascertained. However, its range of distribution is insufficiently known and the species is still regarded to be rare. The present assessment is based on its specimens from Hungary; the currently known data of occurrences are presented on an updated distribution map. The recent records from the Bakony Mts (Királyszentistván, Sóly), Mecsek Mts (Cserkút, Pécs) and the Velence Mts (Pázmánd) are new to Hungary, and the one from the Gödöllő Hills (Erdőkertes) turned to be a recent confirmation of Boros' old record (1962) at Vácegres locality.

Key words: *Cetraria aculeata*, legally protected, lichen-forming fungi

INTRODUCTION

Cetraria aculeata (Schreb.) Fr. is a terricolous, fruticose lichen species, rare in Hungary. It is a typical vagrant species, its branches forming spherical thalli that are transported by wind or animals relatively easily in open areas (Fig. 1). Earlier it was treated under three other generic names (*Cetraria*, *Cornicularia*, *Coelocaulon*) by various authors (BOROS 1963, KÄRNEFELT 1986, KÁRPÁTI and KÁRPÁTI 1954a, b, KÖFARAGÓ-GYELNIK 1937, PRÉCSÉNYI and OPAUSZKY 1979, VERSEGHY 1975, 1994); its specimens from Hungary were identified as either *Cornicularia aculeata* (Schreb.) Ach. or *C. steppae* Savicz, and its identity with *C. muricata* (Ach.) Ach. was also considered (J. Poelt, A. Vězda, pers. comm.). VERSEGHY (1975) mistakenly identified this lichen as *C. steppae* by microcrystal test.

When discussing related genera in his monograph, KÄRNEFELT (1986) carried out detailed investigations on the secondary chemistry of this species. According to his TLC analysis of some Hungarian samples (Vácrátót: Tece, 1986), their identity with *C. aculeata* was confirmed. This result was also supported by our recent HPTLC studies on specimens from additional localities. In

recent papers published world-wide, the species is studied from various aspects (DOMASCHKE *et al.* 2012, 2013, FERNÁNDEZ-MENDOZA *et al.* 2011, GIELWANOWSKA and OLECH 2012, NADYEINA *et al.* 2013, PÉREZ-ORTEGA *et al.* 2012).

According to previous literature sources only two populations were known in Hungary (VERSEGHY 1975, 1994): 1. Göd–Vác–Vácegres–Vácrátót region (as *Cornicularia steppae*), 2. Velence Mts (as *Cornicularia aculeata/tenuissima*). This was the reason why it was included in the Hungarian lichen red list proposal as a critically endangered species (LÖKÖS and TÓTH 1997). In 2005 *Cetraria aculeata* was suggested for legal protection on the basis of its extreme rarity within Hungary. For the proposal of its conservation, all herbarium and literature records were considered (FARKAS and LÖKÖS 2004, 2005, 2006, 2007). As a result of the detailed documentation and justification, *C. aculeata* has become legally protected in 2005 (MK 2005, 2008, 2013). Fostering a deeper knowledge of the Hungarian populations became necessary for conservation purposes, therefore



Fig. 1. General habit of *Cetraria aculeata*.

we decided to revisit the earlier localities and search for possibly new ones with the prospect that we can produce a more accurate range map of the species. The results, encompassing the old and new records and observations on its habitat conditions, are hereby presented.

MATERIAL AND METHODS

Specimens were studied in Hungarian herbaria (BP, EGR, JPU, SZE, VBI), fresh collections (after 2005) were deposited in herbaria BP, BTM and VBI (abbreviations mainly follow the Index Herbariorum online; THIERS 2014).

For the distribution map (Fig. 2) a computer program for geographic information system (QGIS 2.6 Brighton, 2014) was applied where grid cells follow the Central European mapping system (cf. NIKLFELD 1971). Since 2005, the locality data have been measured by Garmin Etrex Vista C GPS (WGS84).

Detailed morphological characterisation and a preliminary distribution map were provided by FARKAS and LÖKÖS (2007).

RESULTS AND DISCUSSION

With 12 localities, approximately 60 specimens of *C. aculeata* are found in historical collections of the Hungarian lichen herbaria (recorded under various

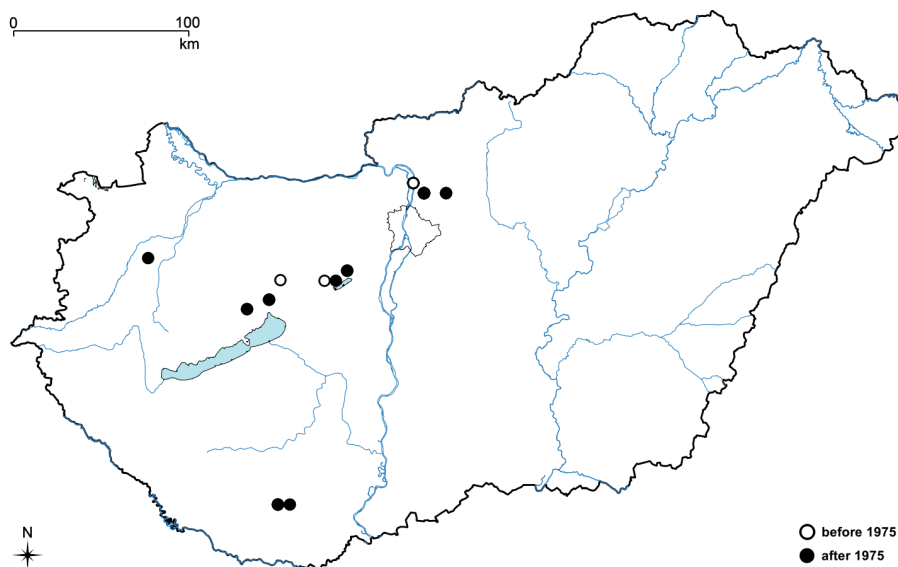


Fig. 2. Localities of *Cetraria aculeata* in Hungary.

names, i.e. *Cetraria aculeata*, *Coelocaulon aculeatum*, *Cornicularia aculeata*, *Cornicularia odontella*, *Cornicularia steppae*, *Cornicularia tenuissima*). Most of the collecting sites are located in the Göd–Vác–Vácegres–Vácrátót region, concentrating on the sand dune area in the surroundings of Sződ. The first specimen was collected by György Timkó at “Katonai gyakorlótér” at Vác in 1912 (FHE 1914, TIMKÓ 1925). Most of the localities (4) were discovered by Ádám Boros (BOROS 1918, 1920, 1949, 1962). Records from the Velence Mts were reported by Gábor Fekete (FEKETE 1954, 1956).

In the 1980s our attempt to revisit these earlier known localities was largely without success. Its best known locality in “Tece” protected area at Vácrátót was checked from time to time, where its presence was continuous, but fires (the largest one in 2005) and occasional motocross activities led to its decrease and these hazards still pose a real threat to this population. Since precise details of the locality on older herbarium labels were usually absent, our efforts to locate its occurrences at Öskü and in the Velence Mts were unsuccessful. Most of the old localities were destroyed or totally altered, e.g., “Katonai gyakorlótér” at Vác, or Csekély-hegy (= Cseket-hegy) in the Velence Mts.

After our publication (FARKAS and LÖKÖS 2007) came out, several new localities were discovered in recent years: four in the Bakony Mts/Balaton-felvidék (Királyszentistván: Ugri-hegy, Litér: Mogyorós-hegy; Veszprém: Tekeres-völgy; Sóly), two from the Mecsek Mts (Cserkút; Pécs: Sülevölgy), one each from the Vasi-Hegyhát area (Ostffyasszonyfa: farakodó) and one from the Velence Mts (Pázmánd: Zsidó-hegy). Among these populations two are of considerable size – at Cserkút and Ugri-hegy, while the other localities are characterised by rather scattered/sporadic occurrence only. The population at Vácegres was revisited several times and finally it was located (today the site belongs to Erdőkertes: Háromház, Erdőkertesi-homokpuszta). The size and vitality of this population is really good, the conditions at this habitat seem to be even better than the other nearby population (Vácrátót: Tece). In contrary to the fading hopes with extinctions in former habitats, the discovery of previously unknown localities raises some hope for the survival of *C. aculeata* in Hungary.

Cetraria aculeata is characterised by a rather wide ecological amplitude throughout its distributional range in Europe. In the boreal temperate regions the most typical habitats are ocean-influenced, either basic or acidic heathlands (with *Calluna vulgaris*, *Deschampsia flexuosa*, *Festuca ovina*, *Corynephorus canescens*, *Aira praecox*), and it also occurs in less disturbed coastal sand dune areas dominated by *Carex arenaria* or *Ammophila arenaria*. In southern Europe it is found in various types of calcareous steppes (KÄRNEFELT 1986). The Hungarian occurrences are located in either calcareous or acidophilous sandy or rocky grasslands (Figs 3A–B). Very few information on its habitat preferences is available



Fig. 3. *Cetraria aculeata* in open, calcareous, sandy habitat together with grasses (A), and together with other lichens on acidic rocky grassland (B).

in the Hungarian phytosociological literature. A detailed survey on the periodical aspects of the calcareous sandy grassland association (*Festucetum vaginatae danubiale*) was carried out in the environs of Vác-rátót in 1952 (KÁRPÁTI and KÁRPÁTI 1954a, b). Although *Cetraria aculeata* was included in this study among other terricolous lichens in the Lichenes-Bryophyta aspect (*Cladonia-Syntrichia* phase), the aspect values were analysed only for higher plants. Occurring in habitats with semi-desert characters *Cetraria aculeata* was considered by ZÓLYOMI (1958, 1987) as a member of the Fulgensio-Psoro-Toninion synusium growing especially in the degraded forms of the association *Festucetum vaginatae danubiale*. *Cetraria aculeata* was also mentioned from the plant association class Koelerio-Corynephoretea (BORHIDI 2003, BORHIDI *et al.* 2012), but no exact Hungarian locality data or ecological considerations were given. It is still rather difficult to explain why it is totally absent from its potential habitats, i.e. from calcareous sandy grassland associations in the areas of the Great Hungarian Plain or the Small Hungarian Plain. The ecological requirements and the life strategy of this species, as well as the environmental conditions of its habitat in Hungary are still not clearly understood. These should be further studied so that its potential habitats could be explored with a greater chance of probability. In addition, implementing investigations on the species' population dynamics would be important, useful and necessary for effective conservation.

Hungarian locality records of *Cetraria aculeata* (Fig. 2)

The original label text is cited in the following enumeration. Literature sources related to the specimens, if they exist, are given in square brackets.

Bakony Mts – Litér (Veszprém megye): W side of hill Mogyorós-hegy, among bryophytes in open rocky grassland area. Alt.: 190–200 m a. s. l. Coll.: Lőkös, L., Lőkös, D. and Farkas, E., 14.11.1998. (BP 94491, VBI) [FARKAS and LŐKÖS 2007, FARKAS *et al.* 2014]. – Litér: Mogyorós-hegy, mészkősziklagyepben. Lat.: 47° 06' 06.4" N, Long.: 18° 01' 21.2" E, Alt.: 220 m a. s. l. Leg.: Farkas, E., Lőkös, L. and Şenkardeşler, A., 2006.11.11. (VBI) [FARKAS *et al.* 2014]. – Ad terram humosam inter muscos sub monte "Bérhegy" supra pag. Öskü, comit. Veszprém; alt. *cca.* 250 m. Leg.: Timkó, Gy. (5237), 1926.05.21. (BP 91007). – Veszprém: Tekerés-völgy pereme, Sas-hegy, Vilmapusztá, mészkősziklagyepben. Leg.: Farkas, E. and Lőkös, L., 1993.06.22. (BP, VBI) [FARKAS and LŐKÖS 2007]. – Veszprém: Tekerés-völgy pereme, Sas-hegy, Vilmapusztá, mészkősziklagyepben. Leg.: Farkas, E. and Lőkös, L., 199?. (BP, VBI) [FARKAS and LŐKÖS 2007]. – Hungary. Veszprém County, Bakony Mts, Mt Sas-hegy, *ca* 4 km W of Veszprém, on the W-facing slope of valley "Tekeres-völgy" near Vilmapusztá, on calcareous soil in open rocky grassland. Lat.: 47° 05' 28.6" N, Long.: 17° 51' 46.2" E, Alt.: *ca* 265 m a. s. l. Coll.: Farkas, E. and Lőkös, L., 3 April, 2010. (BP 93943). – Comit. Veszprém, ad terram, in graminosis siccis (solo dolomitico), prope pag. Sóly. Alt. *cca.* 170 m s. m. Lat.: 47° 08' 11.38" N, Long.: 18° 02' 39.56" E. Coll.: Sinigla, M., 19.04.2013. (BTM Sóly/14). – Comit. Veszprém, ad terram, in graminosis siccis (solo dolomitico), in montis "Mogyorós-hegy",

prope pag. Litér. Lat.: 47° 06' 06.72" N, Long: 18° 01' 24.73" E, Alt. cca. 227 m s. m. Leg.: Sinigla, M., 04.09.2013. (BTM L/2) [FARKAS *et al.* 2014]. – Comit. Veszprém, ad terram, in graminosis siccis (solo dolomitico), in montis "Ugri-hegy", prope pag. Királyszentistván. Lat.: 47° 06' 0.41" N, Long: 18° 02' 13.05" E, Alt. cca. 175 m s. m. Leg.: Sinigla, M., 04.09.2013. (BTM Ksz/5, BP 94570) [FARKAS *et al.* 2014].

Duna mente, Vác–Göd–Vácegres region – In herbis arenosis territorii "Katonai gyakorlótér" infra oppidum Vác, comit. Pest. Altit. ca. 110 m. Leg.: Timkó, Gy., 1912.03.22. (BP 25429 sub *Cetraria aculeata* var. *campestris* f. *odontula*) [TIMKÓ 1925 sub *Cetraria aculeata* var. *campestris*, VERSEGHY 1994]. – In herbis arenosis territorii "Katonai gyakorlótér" infra oppidum Vác, comit. Pest. Altit. ca. 110 m. Mens. Mart. 1912. Leg.: Timkó, Gy. (BP 25421, BP 25422, BP 82015, BP 84576, EGR sub *Cetraria aculeata* f. *campestris*, SZE) [FHE 1914, VERSEGHY 1994, FARKAS and LÖKÖS 2007]. – Hungaria. Homokbuckán füves, mohás helyen. Vác mellett a katonai gyakorlótéren. Leg.: Timkó, Gy., 1912.04.14. (BP 33591 sub *Cornicularia steppae*) [VERSEGHY 1994]. – Vác, a Lőportorony és a Szódrákos puszta közti homokpusztán. Alt. s. m. met. ca. 100. Leg.: Boros, Á., 1918.03.30. (BP 45421, sub *Cornicularia odontella*, EGR) [BOROS 1918]. – Comit. Pest, pr. opp. Vác, in pascuis. Leg. et don. dr. Ö. Szatala. (SZE). – Hungaria, Praematrix, in arenosis ad Szöd. Leg.: Degen, Á., 1920.03.21. (BP 25424, BP 45382, sub *Cornicularia tenuissima* f. *campestris*) [KÓFARAGÓ-GYELNIK 1937, sub *Cornicularia tenuissima* f. *campestris*, FARKAS and LÖKÖS 2007]. – Comit. Pest. In arenosis territ. "Lőportár dűlő" infra opp. Vác. Alt. s. m. met. ca. 100. Leg.: Boros, Á., 1920.03.25. (EGR sub *Cetraria aculeata* f. *campestris*) [BOROS 1920]. – Comit. Pest. In arenosis territ. "Lőportár dűlő" infra opp. Vác. Alt. s. m. met. ca. 110. Leg.: Boros, Á., 1921.03.11. (BP 25423, BP 45383 sub *Cetraria aculeata* f. *campestris*) [BOROS 1921–22, VERSEGHY 1994, FARKAS and LÖKÖS 2007]. – Comit. Pest. In arenosis territorii "Lőportár dűlő" infra opp. Vác. Alt. s. m. met. ca. 100. Leg.: Boros, Á., 1922.04.04. (EGR sub *Cetraria aculeata* f. *campestris*) [BOROS 1921–22]. – Comit. Pest. In collibus arenosis versus rivum Tece prope Vácrátót. Alt. cca 130 m. Leg.: Boros, Á., 1949.08.27. (EGR, sub *Cornicularia (Cetraria) aculeata* f. *campestris*) [BOROS 1949]. – Comit. Pest. In collibus arenosis versus rivum Tece prope Vácrátót. Alt. cca 130 m. Leg.: Boros, Á., 1949.08.30. (EGR, sub *Cornicularia (Cetraria) aculeata* f. *campestris*) [BOROS 1949]. – Vácrátót (C. Pest, Hungaria) versus Tece, in arenosis. Alt. cca 110 m. Leg.: Péntes, A., 1949.08.30. (BP 85092, BP 85093 sub *Cornicularia steppae*) [BOROS 1949, VERSEGHY 1994]. – Com. Pest. Vácrátót. In colli arenoso. Leg.: Timár, L., 1949.08.31. (SZE, sub *Cornicularia tenuissima* f. *campestris*) [GALLÉ 1960]. – Comit. Pest, prope pagum Vácrátót. In colli arenoso. Leg.: Timár, L., 1949.08.31. (BP, sub *Cornicularia tenuissima* var. *campestris*) [GALLÉ 1960]. – Com. Pest. Vácrátót: in pratis. Substr.: terra arenaria. Alt.: 100 m s. m. Leg.: Fóris, F. (23870), 1948.09.02. (BP 25420 sub *Cornicularia tenuissima* var. *campestris*, BP 55569 sub *Cornicularis steppae*, EGR sub *Cornicularia steppae*) [VERSEGHY 1994]. – Com. Pest. Vácrátót: in collis supra castellum. Substr.: solo arenaceo. Alt. 100 m s. m. Leg.: Fóris, F. (23870), 1948.09.02. (JPU sub *Cornicularia tenuissima* var. *campestris*). – Comit. Pest. In collibus arenosis versus rivum Tece prope Vácrátót. Alt. cca 130 m s. m. Leg.: Boros, Á., 1949.10.01. (BP 45385, EGR sub *Cornicularia aculeata* f. *campestris*) [BOROS 1949, VERSEGHY 1975, 1994]. – Vácrátót, homokos legelön. Leg.: Péntes, A., 1950.11.25. (VBI). – Comit. Pest. In arenosis versus Tece prope Vácrátót. Alt. cca 130 m s. m. Leg.: Boros, Á., 1950.12.02. (BP 48372, EGR sub *Cornicularia aculeata* f. *campestris*) [BOROS 1950]. – Vácrátót-környéki mézskedvelő pusztagyep, *Festucetum vaginatae danubiale*. 14.09.–10.12.1952. [KÁRPÁTI and KÁRPÁTI 1954a, sub *Cornicularia tenuissima*, VERSEGHY 1975]. – Vácrátót–Őrszentmiklós, 1952; Vácrátót, Tece pasture alongside the Hosszúvölgy road, 1952.04.23; Vácrátót, Tece pasture beside the poultry farm, 1952.04.24; Vácrátót, Topolyos, 1952.06.10, 1952.12.10. [KÁRPÁTI and KÁRPÁTI 1954b, sub *Cornicularia tenuissima*, VERSEGHY 1975]. – Vácrátót, degradáltabb homokpuszta. [ZÓLYOMI 1958, 1987, sub *Cornicularia tenuissima*]. – Along the Tece brook near the vil-

lage Vácrátót (about 30 km NNE from Budapest), *Festucetum vaginatae danubiale*. [FEKETE *et al.* 1976, sub *Cornicularia tenuissima*]. – Vácrátót, Tece rét (védett terület), *Festucetum vaginatae*. 16.06.1976, 17.07.1977. [PRÉCSÉNYI and OPAUSZKY 1979, sub *Cornicularia tenuissima*]. – Vácrátót versus Tece, homok, 110 m s. m. Leg.: Farkas, E., 1982.11.02. (VBI 8203/A) [FARKAS and LÖKÖS 2007]. – In *Festucetum vaginatae danubiale* on sandy soil of “Tece” area near Vácrátót, county Pest. Alt.: 110–120 m a. s. l. Leg.: Farkas, E., 20.05.1984. (VBI/8422/A) [FARKAS and LÖKÖS 2007]. – Comit. Pest. In collibus arenosis vallis rivi Egres prope Vácegres (Zsidó). Alt. cca 150 m s. m. Leg.: Boros, Á., 1962.06.22. (BP 55570, EGR sub *Cornicularia tenuissima* f. *campestris*) [BOROS 1962, VERSEGHY 1994, FARKAS and LÖKÖS 2007]. – Hungaria. Montes Cserhát. In collibus arenosis (*Festucetum vaginatae*) ad rivum Egres prope pag. Vácegres (Zsidó), comit. Pest. Alt. cca 150 m s. mare. Leg.: Boros, Á., 1962.06.22. (EGR) [BOROS 1962]. – Hungary. Gödöllői-dombság, Erdőkertes (Pest megye): Háromház, Erdőkertesi-homokpuszta, sand dunes. On sandy soil. Lat.: 47° 39' 52.3" N, Long.: 19° 20' 34.9" E, Alt.: ca 195 m a. s. l. Coll.: Farkas, E. and Lökös, L., 04.05.2013. (BP 94569) (Fig. 3B).

Mecsek Mts – Mecsek, Kővágószőlős, Cserkút. Lat.: 46° 04' 15.02" N, Long.: 18° 07' 47.92" E, Alt.: ca 220 m a. s. l. Coll.: Farkas, E., Lökös, L. and Varga, N., 2013.05.18. (BP 94571) (Fig. 3A). – Mecsek, Kővágószőlős, Cserkút. Lat.: 46° 04' 02.47" N, Long.: 18° 07' 26.45" E, Alt.: ca 190 m a. s. l. Coll.: Farkas, E., Lökös, L. and Varga, N., 2013.05.18. (BP 94572). – Mecsek, Kővágószőlős, Cserkút. Lat.: 46° 04' 01.39" N, Long.: 18° 07' 34.40" E, Alt.: ca 200 m a. s. l. Coll.: Farkas, E., Lökös, L. and Varga, N., 2013.05.18. (BP 94573). – Mecsek, Kővágószőlős, Cserkút. Lat.: 46° 04' 03.39" N, Long.: 18° 07' 49.76" E, Alt.: ca 205 m a. s. l. Coll.: Farkas, E., Lökös, L. and Varga, N., 2013.05.18. (BP 94574). – Mecsek, Kővágószőlős, Cserkút. Lat.: 46° 04' 10.24" N, Long.: 18° 08' 14.59" E, Alt.: ca 220 m a. s. l. Coll.: Farkas, E., Lökös, L. and Varga, N., 2013.05.18. (BP 94575). – Mecsek, Pécs, Sülevölgy, in acidophilous forests on acidic soil. Lat.: 46° 04' 48.56" N, Long.: 18° 09' 54.85" E, Alt.: ca 285 m a. s. l. Coll.: Csiky, J., 28.03.2014. (BP 94576).

Vasi-Hegyhát – Ostffyasszonyfa mellett, autót út közelében, talajon, gyeppen. Leg.: Farkas, E. and Lökös, L., 1994. (BP) [FARKAS and LÖKÖS 2007].

Velence Mts – Comit. Fejér. In collibus pr. pag. Nadap, ad terram inter muscos, alt. cca. 220 m s. m. Leg.: Fekete, G., 1953.09.19. (BP 48669 sub *Cornicularia aculeata* var. *spadicea*) [VERSEGHY 1994, FARKAS and LÖKÖS 2007]. – Velencei-hegység: Csekély-hegy, Nadap mellett, *Festucetum sulcatae*-ban. [FEKETE 1954, sub *Cornicularia tenuissima* var. *campestris*]. – Velencei-hegység: Csehélyhegy, auf Quarzit, *Festucetum sulcatae*. Obs.: Fekete, G., 1953.09.19. [FEKETE 1956, sub *Cornicularia tenuissima*]. – Velencei-hegység: Zwischen Kisfalud und Csala, auf Granit, *Festucetum sulcatae*. Obs.: Fekete, G., 1951–55. [FEKETE 1956, sub *Cornicularia tenuissima*]. – Velencei-hegység, Pákozd (Fejér megye): Zsellér-legelő, Telkes-mező. Alt.: ca 130 m a. s. l. Coll.: Farkas, E. and Lökös, L., 03.07.2004. (BP 94568) [FARKAS and LÖKÖS 2007]. – Hungary. Velencei-hegység, Pázmánd (Fejér megye): N side of Mt Zsidó-hegy, open grassland with exposed boulders near the top. On acidic soil, among bryophytes. Lat.: 47° 16' 30.3" N, Long.: 18° 39' 38.4" E, Alt.: 180 m a. s. l. Coll.: Farkas, E. and Lökös, L., 05.05.2013. (BP 94567).

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