DOI: 10.17110/StudBot.2022.53.2.113 Studia bot. hung. 53(2), pp. 113–135, 2022

DISTRIBUTION OF *XANTHOPARMELIA PULVINARIS* (PARMELIACEAE) IN HUNGARY

Norbert Bauer[1], Annamária Hüvös-Récsi[2], László Lőkös[3], Gábor Matus[4], Mónika Sinigla[5] and Edit Farkas[6]

[1]*Department of Botany, Hungarian Natural History Museum, H–1089 Budapest, Könyves Kálmán krt. 40, Hungary; bauer.norbert@nhmus.hu*
[2]*Christian Reformed High School of Tata, H–2890 Tata, Kossuth tér 10–11, Hungary,*
[3]*Department of Botany, Hungarian Natural History Museum, H–1089 Budapest, Könyves Kálmán krt. 40, Hungary; lokos.laszlo@nhmus.hu*
[4]*Department of Botany, Institute of Biology and Ecology, Faculty of Science and Technology, University of Debrecen, H–4032 Debrecen, Egyetem tér 1, Hungary; matus.gabor@science.unideb.hu*
[5]*Bakony Museum, Hungarian Natural History Museum, H–8420 Zirc, Rákóczi tér 3–5, Hungary; sinigla.monika@nhmus.hu*
[6]*Institute of Ecology and Botany, Centre for Ecological Research, H–2163 Vácrátót, Alkotmány u. 2–4, Hungary; farkas.edit@ecolres.hu*

Bauer, N., Hüvös-Récsi, A., Lőkös, L., Matus, G., Sinigla, M. & Farkas, E. (2022): Distribution of Xanthoparmelia pulvinaris (Parmeliaceae) in Hungary. – *Studia bot. hung.* **53**(2): 113–135.

Abstract: A synthesis on the distribution of the protected lichen species *Xanthoparmelia pulvinaris* in Hungary is provided. In addition to summarising the herbarium and published data, we have significantly increased the number of known occurrences with systematic field mapping and clarified the distribution pattern of the species in Hungary. The species occurs in the sandy areas of the Great Hungarian and the Little Hungarian Plains, in the southern and southeastern margins and sporadically in the inner hilly landscapes of the Transdanubian Mountain Ranges. *Xanthoparmelia pulvinaris* is a characteristic species of the open steppe habitats, further important evidence of the plant-geography and historical vegetation development relationships between the sandy grasslands of the plains and the limestone and dolomite rocky grasslands of the middle mountains. Its stronger stands persisted on the eastern edge of the Vértes Mts and in some sand steppes of good natural condition of the Great Hungarian Plain. Most of its mapped occurrences represent small, vulnerable populations.

Key words: distribution pattern, flora mapping, lichen-forming fungi, nature conservation, Pannonicum, plant geography, steppe element

INTRODUCTION

Xanthoparmelia pulvinaris (Gen.) Ahti et D. Hawksw. (Parmeliaceae, Lecanorales, Ascomycota) is a species of soil-dwelling lichen-forming fungi described from the sand dunes of the Danube–Tisza Interfluve of Hungary (Gyelnik 1931*a*, *b*). It was previously handled as a Pannonian endemism (Verseghy

1994), but in the last thirty years, it has been reported in several other Eurasian countries (from Mongolia to Spain) from dry grassland habitats (Huneck *et al.* 1992, Pérez-Ortega and Elix 2007, Khodosovtsev *et al.* 2013), thus, presumably, it can be a more widespread steppe element with a disjunct area. Most of its specimens (including the types) have been collected in Hungary (Farkas and Lőkös 2006); it was recently found at the southeastern edge of Austria, on the dolomite hills belonging to the Pannonicum floristical province (Bauer *et al.* 2022).

Xanthoparmelia pulvinaris is a legally protected lichen species in Hungary (Farkas and Lőkös 2006, MK 2005, 2008, 2013). Although the species had previously been collected from several spots in the Great Hungarian Plain (mainly from the Danube–Tisza Interfluve), the Little Hungarian Plain, and the Transdanubian Mountain Range, at the time of the declaration of its protected status, there has been recent data (after 1975) from only two flora mapping grids. Since then, several of its previous collections have been confirmed, and some new data have also become known (Farkas *et al.* 2014, Farkas and Lőkös 2015, Sinigla *et al.* 2016). Unexpectedly, it was also found in an open sandy grassland locality of the Dél-Nyírség area (Matus *et al.* 2015).

Nevertheless, there were many open questions regarding its distribution in Hungary. Since its habitats were destroyed or degraded in many places and most of its previous data were still awaiting confirmation, we decided to clarify the distribution of the species with systematic mapping in Hungary. Within the confines of that work, in addition to the field verification of data found in the archives, we tried to expand the number of known occurrences with fieldwork focusing on the potential habitats of the species. In this paper, we provide a synthesis of the herbarium, the published and the new data, discussing the localities by geographical regions. Our goal is to contribute with our data to preserve the Hungarian populations of this valuable species and protect the natural areas containing its habitats.

MATERIALS AND METHODS

For the collection of Hungarian occurrences of *X. pulvinaris*, data of all relevant literature and herbarium specimens (255 specimens) of the following collections were checked: BMCRY, BP, DE, EGR, JPU, SZE, SAMU, VBI (herbarium acronyms mostly follow the Index Herbariorum (Thiers 2015), BMCRY is for the Natural History Museum of Bakony Mountains, Zirc, Hungary). Morphological and chemical features of all available voucher specimens under various names

(*Parmelia conspersa*, *P. hypoclysta*, *P. pseudohungarica*, *P. stenophylla*, *P. taractica*, etc.) were thoroughly investigated and revised. Chemical substances of all collected specimens were checked with standard thin layer chromatographic analysis (HPTLC) (Arup *et al.* 1993, Molnár and Farkas 2011). Some specimens were also studied by high resolution liquid chromatography and mass spectroscopy (LC-MS) method for confirming the presence of norstictic acid (Farkas *et al.* 2015). Standard molecular genetic investigations were carried out for sequences nrITS, nrLSU, and nrSSU in the case of newly collected specimens from the Bakony Mts (Molnár *et al.* 2012).

During the fieldwork, we checked the current occurrences of the species in the known locations, further we visited similar habitat patches in neighbouring and distant areas. Mapped occurrences were recorded by a GPS device (Garmin Etrex Vista C, MobileMapper 60 Spectra Geospatial) in WGS 84. An approximate number of thalli were recorded, and phytosociological relevés were also taken. The results of our latter work will be published in the future. New samplings collected by the authors in the last years have been deposited in herbaria BMCRY, BP and DE.

In the enumeration, data are grouped by the Hungarian vegetation geographical regions (Molnár *et al.* 2008), within the records are reported in chronological order. For a better overview of the data, the localities in the Danube–Tisza Interfluve have been grouped by small geographical districts according to the slightly more detailed classification of Dövényi (2010).

The computer program QGIS 2.18 (QGIS Development Team 2018) was used to create the distribution map, where grid cells of 5 km × 6 km follow the Central European mapping system (Niklfeld 1971).

The names of vascular plants follow the Euro+Med PlantBase (Euro+Med 2006), and plant association names follow Borhidi *et al.* (2012).

RESULTS

Xanthoparmelia pulvinaris has been found in a number of flora mapping quadrates from which there were no data before, and several old occurrences have been confirmed or reconfirmed (Fig. 1). Most of its data are known from the sand steppes of the Danube–Tisza Interfluve, but we did not find it there in several old-reported sites, while we enriched our inventory with a couple of new sites. Currently, most of its known habitats are located on the eastern slopes and forelands of the Vértes Mts, but it has been found at quite a few sites in the Bakony Mts, the Balaton Uplands, and the Mezőföld region.

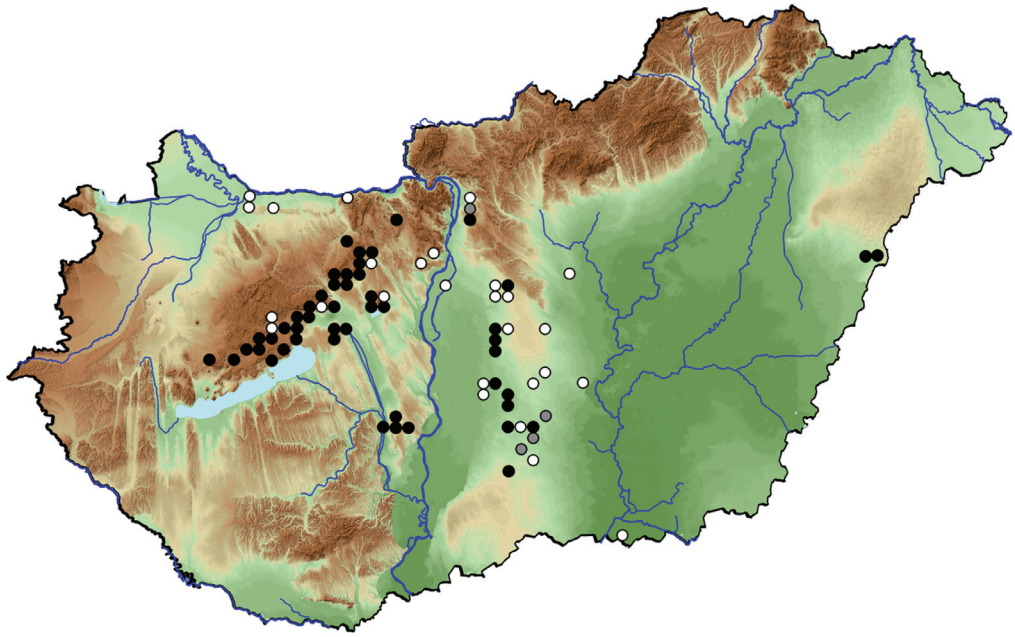

Fig. 1. Distribution map based on specimens of *Xanthoparmelia pulvinaris* collected in Hungary. (Legend: white circles: unconfirmed old data (before 1975); grey circles: found/confirmed from 1976 to 2010; black circles: recent data, found/confirmed from 2011 to 2022).

Great Hungarian Plain

Danube valley, *Csepel plain*

Specimen examined: Filarszky, N., Bernátsky, J., 1899.09.18., Csepel, BP 10547 [8060.3].

After the first collection of *Xanthoparmelia pulvinaris* by Filarszky and Bernátsky, the species was reported one time from Szigetújfalu on Csepel Island (Boros in Szatala 1929). These are unconfirmed data. It is possible that the former habitats became a built-up area.

Danube–Tisza Interfluve

Öreg-homok (northern and eastern sand areas of the Danube–Tisza Interfluve)

Pest alluvial plain

Specimens examined: Boros, Á., 1916.07.13., Vácz, Sződ állomástól Ny-ra lévő téglagyártól DK-re, BP 98091 [8281.3]; Boros, Á., 1920.03.25., "Lőportár dűlő" infra opp. Vác, BP 21756, T 551 lectotype of *Parmelia convoluta* var. *pseudohungarica* [8281.3]; Boros, Á., 1922.04.04., "Lőportár dűlő" infra opp. Vác, BP 44574 as *Parmelia conspersa* var. *stenophylla*, *Parmelia pulvinaris* [8281.3]; Felföldy, L., 1953.01.01., in collibus arenariis pascuorum "Tece" nominatorum pr. pag. Vácrátót. *Festuca vaginata-Carex stenophylla*-ass., BP 50260 as *Parmelia pulvinaris* [8381.1]; Lőkös, L., 2014.04.21., Fót: Fóti-Somlyó, BP 98117 [8381.3].

Öreg-homok (northern and eastern sand areas of the Danube–Tisza Interfluve)

Pilis-Alpár sand area

Specimens examined: Boros, Á., 1916.06.30., "Balla mjr." prope Vasad, BP 87461 as *Parmelia pulvinaris* [8782.2]; Boros, Á., 1917.07.12., "Gombos-Pótharaszti erdő" pr. pag. Vasad, ad "Haleszi szőlők", BP 86488 as *Parmelia hypoclysta* [8782.1]; Boros, Á., 1917.07.12., Vasad, a cserjés homokpusztán a Balla mjr. és a Haleszi szőllők közt, BP 87466 as *Parmelia pulvinaris* [8782.2]; Boros, Á., 1918.05.18., Vasad, laza homokon a cserjés homokpusztán a Haleszi szőllők mellett, BP 72776 as *Parmelia conspersa*, *Parmelia hypoclysta*, BP 86016 as *Parmelia conspersa*, *Parmelia hypoclysta* [8682.3]; Boros, Á., 1920.08.04., "Gombos-Pótharaszti erdő" pr. pag. Vasad, BP 44576 as *Parmelia stenophylla* [8782.1]; Gyelnik, V., 1925.04.09., Vasad, in Pótharaszti erdő, BP 23436, T 668 lectotype of *Parmelia pulvinaris* var. *hungarica* [8682.3]; Boros, Á., 1928.09.02., "Gombos-Pótharaszti-erdő" prope Nyáregyháza, BP 86504 as *Parmelia pulvinaris* [8782.1]; Boros, Á., 1928.09.02. "Gombos-Pótharaszti-erdő" prope Nyáregyháza, BP 87460 as *Parmelia pulvinaris* [8782.1]; Boros, Á., 1936.06.07. "Nyárfás-erdő" praedii Pusztapótharaszt, BP 86507 as *Parmelia pulvinaris* [8782.1]; Domokos, J., Gyelnik, V. 1936.06.07., Monor, in loco Monor-Pótharaszti erdő, BP 23431 as *Parmelia conspersa* f. *pulvinaris* [8682.3]; Gyelnik, V., 1937.09.15. ad Inárcs, BP 75577 as *Parmelia conspersa* var. *pulvinaris* [8782.1]; Timkó, Gy., 1914.09.20., homokbuczkán a "Szikra erdő" legelő területén Alpár felett, BP 23435, T 1100 type of *Parmelia conspersa* var. *pulvinaris* [9185.2]; Timkó, Gy., 1920.08., ad collem arenosam in territorio "Szikrapuszta" prope pagum Alpár, BP 23432 T 546/a, BP 23434 T 546/b, BP 44581, BP 72578, BP 84564, BP 84605, BP 85321, BP 85400, BP 85406, BP 85428, EGR 5231, JPU, SAMU [9185.2]; Timkó, Gy., 1920.08.19., prope opp. Kecskemét, loco Szikrapuszta, BP 23433, BP 44584 as *Parmelia conspersa* var. *pulvinaris* [9185.2]; Boros, Á., 1918.06.29., Czegléd, legelt homokpusztán Csemő állomástól É-ra, BP 86009 as *Parmelia conspersa*, *Parmelia pulvinaris* [8884.3]; Boros, Á., 1931.12.09., In collibus arenosis ad "Bogárzó-tó" prope Monor, BP 87454 as *Parmelia pulvinaris* [8682.4]; Bauer, N., Hüvös-Récsi, A., 2022.08.27., Monor: Száraz-hegy, BP 98076 [8682.4].

Xanthoparmelia pulvinaris was collected in many places in the northern and eastern sand areas of the Danube–Tisza Interfluve (Öreg-homok, Old sand ridge), although its habitats there, especially in the area of the Budapest agglomeration, were incorporated due to residential expansion and were destroyed at many places. The locus classicus of the species (Gyelnik 1931*a*, Hale 1990, Zahlbruckner 1925) is located on the eastern edge of that area, in the vicinity of Alpár: Szikrapuszta (today: Lakitelek: Szikra), where the habitats of the sand steppe vegetation have been almost entirely forested. Nowadays, the landscape is dominated by *Pinus nigra* and *Robinia pseudoacacia* plantations, and we could not confirm *X. pulvinaris* at its type locality. Boros (1935) indicated the taxon at the Pilis–Alpár sand area from the forest "Nyárfás-erdő" at Nagykőrös, and specimens from his collections are still known from the border between Cegléd–Csemő and Monor. The current occurrences of *X. pulvinaris* in most of these sites are uncertain, new occurrences were found only in a few small patches north of Monorierdő, in the open sandy grassland vegetation of "Száraz-hegy".

Several old data are known from the northern sand areas of the Öreg-homok, the Pest alluvial plain, and the area around Vasad, Csévharaszt, and one from Tápiószecső (Szatala 1929). However, these have not been confirmed so far.

Its habitats in its known old localities north of Budapest, around Vác and Sződ, were destroyed (building, road construction). One stand found by Lajos Felföldy in 1953 near Vácrátót, on the sand steppes of "Tece", still exists today. It was also found by László Lőkös in the same habitat type (*Festucetum vaginatae* association) at the "Somlyó" hill near Fót.

Homokhátság (central and southern sand areas of the Danube–Tisza Interfluve)
Kiskunság sand area

Specimens examined: Mágocsy-Dietz, S., 1902.05.18., Kecskemét, Pósadomb, BP 83165 as *Parmelia conspersa*, *Parmelia pulvinaris* [9084.3]; Szatala, Ö., 1915.05.30., Ad terram arenaceam prope pagum Örkény, BP 44583 as *Parmelia pulvinaris* [8882.4]; Timkó, Gy., 1915.05.30., Gyérfüves mohás homokbuczkán az "Örkényi erdő" tisztásán, BP 21704, T 547 lectotype of *Parmelia laxa* var. *rosettaeformis* [8882.4]; Boros, Á., 1918.06.27., Kecskemét, Ballószeg, homokpusztán a lövöldétől DNy-ra, BP 86017 as *Parmelia conspersa*, *Parmelia pulvinaris* [9183.2]; Boros, Á., 1919.06.25., "Borovicska erdő" ad Sarlósár, prope Tatárszentgyörgy, BP 76808 as *Parmelia conspersa* f. *stenophylla*, BP 85679, BP 86498 as *Parmelia pulvinaris* [8982.3]; Boros, Á., 1920.06.30., "Borovicska-erdő" ad Sarlósár prope pagum Tatárszentgyörgy, BP 44571 as *Parmelia conspersa* var. *stenophylla* [8982.3]; Boros, Á., 1928.05.20., "Uzovicstelep" prope Izsák, BP 87462 as *Parmelia pulvinaris* [9181.4]; Boros, Á., 1950.04.13., in collibus arenosis ad "Kis Izsák" prope Izsák, BP 87463 as *Parmelia pulvinaris* [9181.4]; Boros, Á., 1951.04.14., "Öregbucka" prope Szabadszállás, BP 87458 as *Parmelia hypoclysta* [9181.2]; Verseghy, K., 1977.03.24., Fülöpháza, Solt felé vezető út mentén a homokbuckákon, BP 85681 as *Parmelia pulvinaris* [9182.1]; Veres, K., 2007.07.25., Jakabszállás, on sand, VBI 5161 [9284.3]; Farkas, E., Lőkös, L., 2010.04.09., Táborfalva (Pest megye): Örkény-Tatárszentgyörgy, BP 98092, BP 98093, BP 98096 [8882.3]; Farkas, E., Lőkös, L., 2010.04.09., Tatárszentgyörgy (Pest megye): Borovicska erdő, BP 98094, BP 98095 [8982.3]; Lőkös, L., Varga, N., 2015.05.25., Fülöpháza: Fülöpházi homokbuckák, BP 98122, BP 98123 [9182.1]; Matus, G., 2014.11.22., Fülöpháza: Strázsa-hegytől nyugatra, DE 1333 [9182.1]; Bauer, N., Hüvös-Récsi, A., 2022.07.15., Fülöpháza: Strázsa-hegy, BP 98075 [9182.1]; Bauer, N., Hüvös-Récsi, A., 2022.07.15., Táborfalva: Táborfalvai lőtér, BP 98073 [8882.3]; Bauer, N., Hüvös-Récsi, A., 2022.07.15., Tatárszentgyörgy: Sarlóspuszta, BP 98074 [8982.3]; Bauer, N., Hüvös-Récsi, A., 2022.07.29., Ágasegyháza: Sándor-dűlő, BP 98071 [9182.4]; Bauer, N., Hüvös-Récsi, A., 2022.07.29. Orgovány: Hollós-hegy, BP 98072 [9282.2].

Homokhátság (central and southern sand areas of the Danube–Tisza Interfluve)
Bugac sand area

Specimens examined: Boros, Á., 1918.06.24., Bugaczi puszta, gyepes homokbuczkán a Faragó Antal tanyája közelében, BP 87465 as *Parmelia pulvinaris* [9383.1]; Boros, Á., 1936.06.11. "Kisasszony erdeje" praedii Kiskunfélegyházai Jakabszállás, versus Bugac, BP 86004, BP 86007, BP 86492 as *Parmelia hypoclysta*, BP 86505 as *Parmelia pulvinaris* [9284.3]; Boros, Á., 1951.05.21. in collibus arenosis "Nagysivány" prope Bugac, BP 87459 as *Parmelia pulvinaris* [9383.1]; Boros, Á., 1951.05.26., "Bodoglári-erdő" prope Kiskunhalas, BP 87464 as *Parmelia pulvinaris* [9483.4]; Boros, Á., 1959.08.28., "Bodoglári-erdő" prope Kiskunhalas, SZE as *Parmelia pulvinaris* f. *terricola* [9483.4]; Gallé, L., 1965.07.21., Bács-Kiskun, in decl. collium arenosum, ad terram, SZE/1, SZE/2 sub *Parmelia conspersa* var. *stenophylla* [?]; Gallé, L., 1971.09.16., Felsőbugac, in silva "Felsőbugaci-erdő", SZE as *Parmelia conspersa* var. *pulvinaris* [9383.1]; Kiszely, A., Vězda, A., 1975.04.05., Bugac puszta: Ősborókás, EGR 14 as *Parmelia taractica* var. *subdiffluens* [9383.2]; Verseghy, K.,

1981.09.03., Bugac: Juniperus Kutatóház közelében, BP 87596 as *Parmelia conspersa* f. *hypoclysta* [9383.4]; Veres, K., 2007.05.21., Tázlár, BP 98118 [9483.1]; Lőkös, L., 2012.05.26., Kiskunhalas: Felső-Kistelek, BP 98097, BP 98098 [9582.2]; Lőkös, L., Farkas, E., Varga, N., 2018.05.31., Bugac: Bugaci Ősborókás, BP 98121 [9383.2]; Bauer, N., Hüvös-Récsi, A., 2022.07.30., Bócsa: Bócsai-erdő, Bócsa-kaskantyúi-homokpuszta, BP 98084, BP 98086 [9382.2]; Bauer, N., Hüvös-Récsi, A., 2022.07.30., Kaskantyú: Bócsai-erdő, Bócsa-kaskantyúi-homokpuszta, BP 98085 [9382.2].

The majority of the sand dunes of the Danube–Tisza Interfluve preserving sandy steppes in good natural condition can be found in the area of the Homokhátság (Southern sand ridge). The oldest record of *Xanthoparmelia pulvinaris* from the Kiskunság (collected in 1902 by Mágocsy-Dietz) related to "Pósadomb" at Kecskemét, is unconfirmed. Recent occurrences of several sites are still located in the sand steppes around Táborfalva (Fig. 2), Tatárszentgyörgy, Jakabszállás, and Fülöpháza. The most robust stand of the Kiskunság area presumably exists in the sandy area of Strázsa-hegy near Fülöpháza. During our mapping, we also detected a few new occurrences with a smaller number of thalli in the open sandy grasslands of Ágasegyháza and Orgovány. Unfortunately, a wildfire between 18–20 August, 2022 destroyed the sandy steppes of the shooting range of Táborfalva, an occurrence extremely rich in species, and affected the known sites of *X. pulvinaris* without exception; the future of the species in this area is uncertain.

Fig. 2. Typical habit of *Xanthoparmelia pulvinaris* on sand surface, in an open sandy grassland (15.07.2022. Táborfalva) (photo: N. Bauer).

Although the species has also been known in several localities of the Bugac sand region for a long time (Boros 1973, Gallé 1973, Szatala 1929), at present, some of its very small populations are known in the dunes of Pirtó–Kiskunhalas and in the remnant patches of the conservation area of the juniper reserves of Bugac, which partly burned down in 1976, then heavily burnt down in 2012 and 2017. A rather long post-fire successional process is necessary for the full recovery and recolonisation of terricolous species (Szujkó-Lacza and P. Komáromy 1986).

X. pulvinaris has been found at several new locations in the largest dune area of the Homokhátság, also in the Bócsa-Kaskantyú sand steppes.

Mezőföld

Western Mezőföld area

Specimens examined: Bauer, N., 2020.05.27., Kőszárhegy: Hármas-völgy, BP 98054 [8876.3]; Bauer, N., Hüvös-Récsi, A., 2020.05.29., Polgárdi: Szár-hegy, BP 98055 [8975.2]; Bauer, N., Hüvös-Récsi, A., 2021.02.13., Kőszárhegy: Szár-hegy, BP 98050 [8875.4]; Bauer, N., Hüvös-Récsi, A., 2021.02.13., Kőszárhegy: Szár-hegy, BP 98051 [8975.2] (Fig. 3).

In the Western Mezőföld agricultural area, natural dry grassland habitats occur only on the slopes of loess valleys and on the hills built from Paleozoic

Fig. 3. Old, in winter typically fresh pale green thalli of *Xanthoparmelia pulvinaris* on the soil surface of a limestone rocky grassland (13.02.2021. Kőszárhegy: Szár-hegy) (photo: N. Bauer).

bedrocks standing out from the plains like islands (Gyalog and Horváth 2004). As a result of mapping, only few new occurrences of *Xanthoparmelia pulvinaris* were found in the rocky grasslands formed on the Devonian limestone bedrock of Szár-hegy. At this site the local habitat of the species is a very important relic habitat of the steppe flora, the composition of which is very similar to the rocky grasslands of the Vértes and the Eastern Bakony Mts, with many common species (*Allium moschatum*, *Ornithogalum comosum*, *Paronychia cephalotes*, *Stipa eriocaulis*, *Euphorbia nicaeensis*, *Taraxacum serotinum*). The species of the lowland steppe remnants and of the rocky slope steppes of the upland areas are mixed in this transition zone (Barina 2004, 2008, Bauer 2014, Bauer and Somlyay 2007).

Southern Mezőföld area

Specimens examined: Bauer, N., Kenyeres, Z., 2022.08.11., Bikács: Ökör-hegy, BP 98078 [9378.1]; Bauer, N., Kenyeres, Z., 2022.08.11., Bikács: Szenes-dűlő, BP 98077 [9377.2]; Bauer, N., Kenyeres, Z., 2022.08.11., Németkér: Látó-hegy, BP 98079, BP 98082 [9378.2]; Bauer, N., Kenyeres, Z., 2022.08.11., Németkér: Vendeli-rész, BP 98083 [9278.3].

In the Southern Mezőföld area covered predominantly with loess, a small sandy area (Tengelic sand region) occurs where *Xanthoparmelia pulvinaris* was detected in four grasslands. It was discovered on the border of Németkér and Bikács in open sandy steppe grasslands (*Festucetum vaginatae*, *Festucetum vaginatae stipetosum borysthenicae*) with a species composition very similar to the occurrences in Kiskunság (*Achillea ochroleuca*, *Alkanna tinctoria*, *Dianthus serotinus*, *Festuca vaginata*, *Fumana procumbens*, *Koeleria glauca*, *Stipa borysthenica*, etc.). An occurrence was recorded in an opening patch of a closed sand steppe (*Astragalo austriacae-Festucetum sulcatae*) and in a heavily grazed, depleted sandy grassland of *Cynodon dactylon*. The Southern Mezőföld area was not included in the previous distribution maps of *X. pulvinaris* (Farkas and Lőkös 2006, 2015). The occurrence of the species is still not new for the region since Boros (1959) mentioned it in his work among the species of the dune-tops of Kistápé "very rich in lime" [today part of the settlement of Bikács, CEU: 9378.1].

Northern part of the Great Hungarian Plain

Northern Alföld alluvial fan plain, *Hatvan plain*

Specimen examined: Boros, Á., 1917.09.23., Farmos szikes mezőin, BP 86478 as *Parmelia hypoclysta* [8685.1].

The only record of *Xanthoparmelia pulvinaris* was collected by Ádám Boros, from a saline habitat, presumably a pasture, without confirmation so far.

Nyírség, *Southern Nyírség*

Specimens examined: Matus, G., 2013.10.12., Létavértes: Nagy-legelő, 100 m NE of 110/A forest lot, BP 98103, DE 853 [8597.3]; Lőkös, L., Farkas, E., 2014.03.12., Létavértes, BP 98100, DE [8597.4]; Lőkös, L., Farkas, E., 2014.03.12., Létavértes, BP 98099, BP 98101. BP 98102, DE [8597.3]; Matus, G., 2013.03.12., Létavértes: Nagy-legelő, 100 m NW of 106/R lot, DE 1039 [8597.3]; Matus, G., 2013.03.12., Létavértes: Nagy-legelő, between lots 108/A and 109/H, DE 1055 [8597.3]; Matus, G., 2013.03.12., Létavértes: Nagy-legelő, 100 m N of 108/A lot, DE 1047 [8597.4].

The only but extended occurrence of the species can be found in the vicinity of Létavértes and is stretching to two flora mapping grid units (Matus *et al.* 2015). Screening all other large sandy grasslands in the Southern Nyírség (by Hajdúsámson, Bagamér, Monostorpályi, Hajdúhadház, Hajdúbagos, Vámospércs, and Nyíregyháza, respectively similar habitats in the adjacent Romanian part of the Nyírség) turned out to be negative. Further to the north, the extension of suitable habitats is significantly smaller and these have mostly been forested decades ago or are just under forestation.

At Létavértes open acidic sandy grasslands (mostly *Corynephoretum* and *Festucetum vaginatae*) form the suitable habitat. The species is still frequent, locally abundant but large swathes of potential dune habitats have been forested by *Robinia* and *Pinus sylvestris*, respectively, suggesting a significant population loss.

Lower Tisza region

Northern Bánság

Specimens examined: Gallé, L., 1935.04.08., Deszk, in pascuis "Stara Torina", BP 74650 as *Parmelia conspersa* var. *stenophylla* [9887.1]; Gallé, L., 1935.04.08., inter pagos Szőreg et Kübekháza, in pascuis "Stara-Torina", SZE as *Parmelia conspersa* var. *pulvinaris* [9887.1].

We are not aware of the current occurrence of the isolated stand found by László Gallé in the "Stara Torina" vineyard on the outskirts of Deszk.

Little Hungarian Plain

Győr–Tata terraced plain

Specimens examined: Polgár, S., 1920.05.02., Győr. Lőtér homok. Gönyü felé, BP 72729 as *Parmelia conspersa*, *Parmelia pulvinaris* [8372.1]; Polgár, S., 1920.07.06., Győr. Kavicsos buckákon Esztergelő p., BP 72726 as *Parmelia conspersa*, *Parmelia hypoclysta* [8372.1]; Zólyomi, B., 1924.04., Győri homokpuszta (Győrszentiván), BP 21692 as *Parmelia hypoclysta* [8372.1]; Polgár, S., 1930.10.20., Győr, in arenosis ad pagum Bácsa, BP 72725 as *Parmelia conspersa* f. *pulvinaris*, *Parmelia pulvinaris* [8272.3]; Polgár, S., 1940.06.14., ad Nagyszentjános. (Assoc.: *Festuca vaginata*), BP 72796 as *Parmelia conspersa* f. *pulvinaris*, *Parmelia hypoclysta* [8373.1].

Some occurrences of *Xanthoparmelia pulvinaris* in the sandy grasslands around Győr (Győrszentiván, Esztergelő-puszta, Gönyű, Bácsa) were discov-

ered in the 1920s (Boros ap. Szatala 1929, Polgár 1941). Borhidi (1956) also mentioned it (as *Parmelia conspersa*) in some coenological relevés from several points in the Little Hungarian Plain (Ács: Lovad-puszta, Likócs-puszta, Győrszentiván, Komárom: Nagyszentjános, Tét: Betlehem-puszta, Tát, Tárkány: Ölbő-puszta, Bakonyszentlászló, and on the eastern fringe of Kisaföld near Kesztölc [landscape-geographically this locality belongs to the Pilis Mts]), but these data are not confirmed with collected specimens. We have examined the sandy vegetation of this area several times and at several locations (Likócs, Győrszentiván, Gönyű, Nagyszentjános, Ács), but the occurrence of *X. pulvinaris* could not be confirmed. Its current occurrence is doubtful due to the degradation of habitats mainly resulted by the growth of the city of Győr and the surrounding industrial areas.

Transdanubian Mts

Buda Mts and Zsámbék Basin

Specimens examined: György, J.(?), s.d. (*ca* 1830), Budapest: Farkasvölgy, BP 83164 [8579.2]; Gyelnik, V., 1929.09.01., Budapest, in decl. m. Budaörsi hegy, ad terram inter gramineas. Alt. ca. 300 m. s. m., BP 21609 [8579.2]; Gyelnik, V., 1931.08.22., Budaörs, in montibus Csiki Hegyek, loco Sorrento, ad terram inter gramineas, alt. ca. 400 m. s. m., BP 21708, BP 44626 [8579.2]; Degen, Á., 1922.06.24., "Berki legelő" inter Sóskút et Török-Bálint, BP 44572 as *Parmelia conspersa* var. *stenophylla* [8579.3].

Its earlier occurrences from the southern part of the Buda Mts (Sorrento, Budaörsi-hegy) (Gyelnik 1931) were not found during the present mapping. The status of the population documented by Árpád Degen from the eastern border of the Zsámbék Basin, from the pasture "Berki-legelő" near Sóskút, is also uncertain. The latter place has been partially integrated in the residential areas nowadays. It cannot be ruled out that these stands have declined as a result of air pollution (the proximity of the capital and highways).

Pilis Mts

The first mention of the species is known from the southwestern foothills of the Pilis Mts ("In arenosis inter Leányvár et Csév") (Boros in Szatala 1929). No evidence specimen was found in museum collections. Although during the fieldwork a few small patches of open sandy grasslands (*Festucetum vaginatae*) were found, former habitats of *Xanthoparmelia pulvinaris* have largely been destroyed, and there is a motocross racetrack in the area. The above-mentioned locality of *X. pulvinaris* denoted as "Kesztölc" (Borhidi 1956) belongs to the Pilis Mts and is also unconfirmed.

Gerecse Mts

Specimens examined: Boros, Á., 1924.03.23., in graminosis loessaceis ad Ádám-major pr. pag. Dunaalmás, BP 44573 as *Parmelia conspersa* var. *stenophylla* [8276.3]; Bauer, N., 2020.05.24., Epöl: Kőszikla-hegy, BP 98028 [8378.3].

On the western edge of the Gerecse Mts, *X. pulvinaris* was found by Ádám Boros near Dunaalmás, in a loess steppe grassland. During the recent examination of that site, *Xanthoparmelia pulvinaris* was not found; its habitat has been degraded by forestation and has become shrubby spontaneously. Although parts of the shrubland were cleared in the turn of 2018–2019, then were mown, the site has mostly remained ungrazed and the species-rich grassland regenerated only partially.

On the other hand, a new small (< 10 thalli) stand was discovered in the Eastern Gerecse, Mts on the eastern, lower ridge of Fehér-szikla (Kőszikla-hegy) near the village Epöl, in the transition of a slope steppe and limestone rocky grassland. Barina (2006), in his phytogeographical characterisation of the Eastern Gerecse Mts, highlighted the occurrence of the same dry-grassland and forest-steppe species as also typical in Mezőföld, so the emergence of *X. pulvinaris* is not surprising here.

Bársonyos Hills

Specimen examined: Hüvös-Récsi, A., 2020.07.25., Vértessomló: Homok-dűlő, BP 98035 [8476.3].

The western foothill surface of the Vértes Mts is a hilly transitional landscape, bordering the Little Hungarian Plain, used to feature beautiful sandy vegetation (Boros 1954), which extended into the Vértes Mts in the vicinity of Oroszlány, Pusztavám, and Mór. Nowadays, *Pinus nigra* and *Robinia pseudoacacia* plantations can be found in many places, replacing the former sandy grasslands. Ádám Boros could find *Xanthoparmelia pulvinaris* at several locations (Mór, Pusztavám) in the 1930s (Boros 1954, 1973). Annamária Hüvös-Récsi found a single population of *X. pulvinaris* on the western edge of the Vértes Mts in 2016, on the border of Vértessomló, on a small hill with sandy vegetation in good natural condition (*Festucetum vaginatae* association with *Dianthus serotinus*, *Bassia laniflora*, *Fumana procumbens*, *Helichrysum arenarium*, *Koeleria glauca*).

Vértes Mts (Southern Vértes)

Specimens examined: Boros, Á., 1933.05.21., "Homok-tisztás" supra pag. Mór, BP 76788 as *Parmelia conspersa*, *Parmelia hypoclysta* [8675.2]; Boros, Á., 1935.10.06., in arenosis ad pedem montis Hosszú-hegy prope Oroszlány, BP 86005, BP 86013 as *Parmelia pulvinaris* [8576.1]; Boros, Á., 1933.04.30., Kotló-hegy pr. Csákvár, BP 76789 as *Parmelia conspersa* [8576.4]; Boros,

Á., 1934.04.15., "Báracháza" prope Csákvár, BP 76778 as *Parmelia pulvinaris* [8676.2]; Boros, Á., 1934.04.15., versus "Német János völgy" prope Csákvár, BP 76780 as *Parmelia taractica* [8676.2]; Polgár, S., 1934.04.30., Kotlóshegy prope Csákvár, BP 72724 as *Parmelia conspersa* var. *stenophylla* [8576.4]; Boros, Á., 1934.05.20., Badacsony-hegy prope Csákvár, BP 76775 as *Parmelia conspersa* [8676.2]; Boros, Á., 1935.03.25., "Hosszú-árok" prope Vértesboglár, BP 76774 as *Parmelia taractica* [8577.3]; Boros, Á., 1935.04.20., "Hosszú-árok" prope Vértesboglár, BP 76786 as *Parmelia pulvinaris* [8577.3]; Boros, Á., 1936.03.15., supra pag. Csákvár, BP 76771, BP 76776, BP 76792 as *Parmelia conspersa* [8676.2]; Boros, Á., 1936.03.29., sub monte Közép-hegy prope Zámoly, BP 76770 as *Parmelia conspersa*, BP 76793 as *Parmelia taractica* [8676.1]; Boros, Á., 1937.04.25., in pascuis dolomit. versus Kotló prope Csákvár, BP 76785 as *Parmelia pulvinaris* [8576.4]; Boros, Á., 1937.05.17., Kőlik-hegy prope Csákberény, BP 76779 as *Parmelia taractica* [8676.3]; Boros, Á., 1937.06.15., Kotló-hegy prope Csákvár, BP 76772 as *Parmelia conspersa* [8576.4]; Boros, Á., 1938.09.18., "Gránási-hegy" prope Csákberény, BP 76773 as *Parmelia taractica* [8676.1]; Boros, Á., 1942.05.14., "Sas-hegy" ad pagum Szár, BP 76783 as *Parmelia taractica* [8577.1]; Boros, Á., 1953.04.19., "Felső legelő" ad Gánt-Bányatelep, BP 76781 as *Parmelia conspersa* [8676.1]; Boros, Á., 1953.04.19., "Sas-fészek" prope Gánt, BP 76795 as *Parmelia taractica* [8676.1]; Farkas, E., Lőkös, L., 2006.08.19., Csákberény, Kopasz-hegy, BP 98104, VBI [8675.4]; Németh, Cs., 2012.03.17., Csákberény, Kopasz-hegy, BP 94058, BP 94059, BP 94060 [8675.4]; Németh, Cs., 2012.08.17., Csákvár, Kőlik-völgy feletti gerinc, BP 98105 [8676.2]; Németh, Cs., 2012.08.17., Csákvár, Ló-állás-tető, BP 98106, BP 98107 [8676.2]; Békefi, N., Mészáros, G., 2014.03.14., Csákvár, Öreg-hegy, BP 98108 [8676.1]; Bauer, N., Hüvös-Récsi, A., 2018.10.30., Csákvár: Kereszt-haraszt, BP 98011 [8676.1]; Bauer, N., Hüvös-Récsi, A., 2019.11.22., Csákberény: Kopasz-domb, BP 98023, BP 98049 [8675.2, 8675.2] (Fig. 4); Bauer, N., Hüvös-Récsi, A., 2019.11.22., Csákvár: Kereszt-haraszt, BP 98024 [8676.1];

Fig. 4. Young, developing thallus of *Xanthoparmelia pulvinaris* on a mossy soil surface, in a dolomite rocky grassland (22.11.2019., Csákberény: Kopasz-domb) (photo: N. Bauer).

Bauer, N., Hüvös-Récsi, A., 2019.12.29., Csákvár: Nagy-hegy, BP 98007, BP 98009 [8676.2]; Bauer, N., Hüvös-Récsi, A., 2019.12.29., Csákvár: Pap-irtás, BP 98010 [8676.2]; Bauer, N., Hüvös-Récsi, A., 2019.12.29., Csákvár: Szóló-kő, BP 98008 [8676.2]; Bauer, N., Hüvös-Récsi, A., 2020.04.30., Csákberény: Bucka, BP 98016 [8676.1]; Bauer, N., Hüvös-Récsi, A., 2020.04.30., Csákberény: Öreg-hegy, BP 98017 [8676.3]; Bauer, N., 2020.05.10., Gánt: Bányatelep, BP 98025 [8676.1]; Bauer, N., 2020.05.10., Gánt: Sas-hegy, BP 98026 [8676.1]; Bauer, N., Hüvös-Récsi, A., 2020.07.01., Gánt: Gránás, BP 98029, BP 98030 [8676.1]; Bauer, N., Hüvös-Récsi, A., 2020.07.31., Csákvár: Gém-hegy; BP 98034 [8676.1]; Bauer, N., Hüvös-Récsi, A., 2020.11.14., Szár: Nagy-legelő, BP 98040 [8576.2]; Bauer, N., Hüvös-Récsi, A., 2020.11.14., Szár: Szesszionátusok legelője, BP 98038, BP 98039 [8576.2]; Bauer, N., Hüvös-Récsi, A., 2020.12.29., Csákvár: Kotló-hegy, BP 98048 [8576.4]; Bauer, N., Hüvös-Récsi, A., 2021.11.12., Csákvár: Badacsony-hegy, BP 98064 [8676.2]; Bauer, N., Hüvös-Récsi, A., 2021.11.13. Újbarok: Liponya-dűlő, BP 98063 [8577.1]; Németh, Cs., 2015.01.16., Magyaralmás, Tóhely-domb, BP 98109 [8675.4]; Bauer, N., Hüvös-Récsi, A., 2020.06.13. Csákberény: Vörös-kút, BP 98031, BP 98032, BP 98033 [8675.4]; Bauer, N., 2022.10.07., Csákvár: Róka-hegy, BP 98088 [8576.4] (Fig. 5).

Boros (1954) emphasises the common species of dolomite hills and the sand grasslands of the Great Hungarian Plain in his phytogeographical characterisation of the Vértes Mts, highlighting *Parmelia pulvinaris* and *P. pokornyi* (= *Xanthoparmelia pulvinaris*, *X. pokornyi*) of the lichens as well. During his field research, he recorded both taxa in several locations of the latter area (Boros 1973).

Fig. 5. Faded and dried up thalli of *Xanthoparmelia pulvinaris* are typical at the end of summer and in drought periods (07.10.2022., Csákvár: Róka-hegy) (photo: N. Bauer).

Xanthoparmelia pulvinaris is still quite common in the Vértes Mts, in the eastern half of the mountain range, which is one of the range centres of its Hungarian populations located in the settlement boundaries of Csákberény, Gánt, Csákvár, and Szár (Figs 4–5). The species is usually found on the plateau, gentle slopes of the Triassic dolomite hills, in open rocky grassland associations (*Fumano-Stipetum eriocaulis*, *Seselio leucospermi-Festucetum pallentis*).

Velence Mts

Specimens examined: Degen, Á., 1908.05.01., Csúcshegy prope Kápolnás Nyék, BP 76784 as *Parmelia hypoclysta* [8777.2]; Farkas, E., Lőkös, L., 2004.07.03., Pákozd, Telkes-mező, BP 98110 [8777.3]; Farkas, E., Lőkös, L., 2016.08.27., Sukoró: Vízmű domb, BP 98119 [8777.4]; Farkas, E., Lőkös, L., 2016.08.27., Sukoró: Új-hegy, BP 98120 [8777.4]; Matus, G., 2017.08.27., Pákozd: Telkes-mező, 150 m NE of 101/U forest lot, DE [8777.3]; Matus, G., 2017.08.27., Pákozd: Telkes-mező, 100 m SW of 34/A forest lot, DE [8777.3]; Bauer, N., Hüvös-Récsi, A., 2020.03.27., Pákozd: Kis-Fecskés, BP 98021 [8777.3]; Bauer, N., Hüvös-Récsi, A., 2020.03.27., Pákozd: Nagy-Fecskés, BP 98019 [8777.3]; Bauer, N., Hüvös-Récsi, A., 2020.03.27., Pákozd: Ősi-hegy, BP 98022 [8777.3]; Bauer, N., Hüvös-Récsi, A., 2021.12.10., Pákozd: Ősi-hegy, BP 98060 [8777.3]; Bauer, N., Hüvös-Récsi, A., 2020.03.27., Pákozd: Tompos-hegy, BP 98020 [8777.3]; Bauer, N., Hüvös-Récsi, A., 2020.03.20., Pátka: Kilicsán, BP 98018 [8777.1].

The first record of *Xanthoparmelia pulvinaris* from the area collected by Árpád Degen was published by Boros (1954). It can still be found at several points. Being aware of the types of bedrocks (granite, quartzite) making up the hilly area, the occurrence of this species here may seem surprising, because these acidophilic bedrocks are more characterised by the close relative, but rock-dwelling and acidofrequent *X. stenophylla* (Ach.) Ahti et D. Hawksw., which is really common on the rocks of the Velence Mts. *X. pulvinaris* occurs in the marginal areas of this hilly landscape, in the foothills, where the presence of periglacial loess (with high lime content) and sand cover is very significant (Gyalog and Horváth 2004). That provides favourable ecological and soil structure conditions for *X. pulvinaris*. The presence of species common with Pannonian lowland loess and sand steppes (e.g. *Helichrysum arenarium*, *Minuartia glomerata*, *Oxytropis pilosa*, *Peucedanum arenarium*) was also detected in the vascular flora of the Velence Mts (Bauer 2019). These plants are also characteristic accompanying species in the lowland habitats of *X. pulvinaris*.

Balaton Uplands

Specimens examined: Lőkös, L., 1997.12.04., Litér, Mogyorós-hegy, BP 94487 [8874.3]; Farkas, E., 2006.11.11., Litér, Mogyorós-hegy, VBI [8874.3]; Farkas, E., Guttová, A., Lőkös, L., Molnár, K., 2010.05.11., Litér, Mogyorós-hegy, BP 94511 [8874.3]; Sinigla, M., 2013.03.12., Sóly: Győri úti-irtás, BMCRY 000750 [8874.3]; Sinigla, M., 2013.04.19., Sóly: Győri úti-irtás, BMCRY 000751 [8874.3]; Sinigla, M., 2013.09.04., Litér: Mogyorós-hegy, BMCRY 000749 [8874.3]; Sinigla, M.,

2014.09.13., Litér: Mogyorós-hegy, BMCRY 001431 [8974.1]; Sinigla, M., 2015.04.09., Balatonalmádi: Megye-hegy, BMCRY 001555 [8974.1]; Sinigla, M., 2015.05.29., Balatonalmádi: Megye-hegy, BMCRY 001701, BMCRY 002194 [8974.1]; Sinigla, M., 2018.07.17., Királyszentistván: Ugri-hegy, BMCRY 002912 [8874.3]; Bauer, N., Hüvös-Récsi, A., 2020.11.21., Balatonfüred: Nagymező BP 98045 [9073.1]; Bauer, N., Hüvös-Récsi, A., 2020.11.21., Balatonfüred: Tormán-hegy, BP 98046, BP 98047 [9073.1]; Bauer, N., Hüvös-Récsi, A., 2020.11.21., Szentkirályszabadja: Asztag-hely, BP 98044 [8973.4]; Bauer, N., Hüvös-Récsi, A., 2020.12.05., Balatonalmádi: Rom-kúti-völgy, BP 98042 [8974.1]; Bauer, N., Hüvös-Récsi, A., 2020.12.05., Királyszentistván: Felső-hegy, BP 98043 [8874.3]; Bauer, N., Hüvös-Récsi, A., 2020.12.05., Öskü: Péti-hegy, BP 98041 [8874.2]; Bauer, N., Hüvös-Récsi, A., 2021.05.08., Sóly: Séd-völgyi-dombok, BP 98061 [8874.3]; Bauer, N., Hüvös-Récsi, A., 2022.01.07., Balatonalmádi: Részvény-erdő, BP 98068 [8974.1].

In 1997, during a monitoring study, the first record of *Xanthoparmelia pulvinaris* in the Balaton Uplands was found in the dolomite grassland of "Mogyorós-hegy" hill at Litér (Farkas *et al.* 2014.). Its small stand was also reported from "Megye-hegy" above Balatonalmádi (Sinigla *et al.* 2016). Based on mapping in the last few years, *X. pulvinaris* occurs at many sites in the eastern hilly area of the Balaton Uplands (Vilonya Hills sub-region), but it becomes increasingly rare towards the west. Sporadic occurrences on the coastal hills of Balaton have been detected as far as Balatonfüred.

Bakony Mts
Eastern Bakony Mts

Specimens examined: Boros, Á., 1918.09.25., "Rátóti nagy mező" prope Veszprém, BP 75911 as *P. pulvinaris* [8873.3]; Gyelnik, V., 1925.08.13., prope pagum Jutas, in declivibus "Grosser Berg", BP 22659 as *Parmelia pulvinaris* var. terricola [8873.1]; Gyelnik, V., 1925.08.13., prope pagum Jutas, in collibus calcareis pascuo, ad terram, BP 21613, T 760 lectotype of *Parmelia pulvinaris* var. *terricola*) [8873.3]; Boros, Á., 1932.08.21., "Borbélyvölgy" prope Várpalota, BP 74839 as *Parmelia conspersa* var. *stenophylla* [8774.4]; Boros, Á., 1932.09.18., "Rátóti nagy mező" prope Jutas, BP 75935 as *P. hypoclysta* [8873.3]; Boros, Á., 1951.04.06., Baglyas-hegy prope Csór, BP 76790 as *Parmelia taractica* [8775.3]; Boros, Á., 1951.04.06., Baglyas-hegy prope Csór, BP 76787 as *Parmelia pulvinaris* [8775.3]; Verseghy, K., 1972.09.29., Mt. Bakony: Várpalota et Királyszállás in pratis siccis, BP 76942 as *Parmelia hypoclysta* [8774.4]; Németh, Cs., Békefi, N., Mészáros, G., 2014.01.01., Várpalota, a Csörget-völgy és a Vár-völgy közötti vonulatok, sziklafüves lejtősztyeppben, dolomiton, BP 98112, BP 98113 [8774.4]; Erzberger, P., Németh, Cs., 2015.03.07., Hajmáskér, Hajmáskéri-sziklák a Séd-patak felett, BP 98111 [8873.4]; Erzberger, P., Németh, Cs., 2015.03.15., Csór, Szenes-horog, BP 98114 [8775.4]; Sinigla, M., 2018.08.27., Csór: Gomba-hegy, BMCRY 003061 [8775.4]; Sinigla, M., 2018.09.06., Hajmáskér: Rác-Halála, BMCRY 002883, BMCRY 003062 [8873.4]; Bauer, N., Hüvös-Récsi, A., 2019.10.18., Csór: Gomba-hegy, BP 98004 [8775.4]; Bauer, N., Hüvös-Récsi, A., 2019.10.18. Csór: Iszka-hegy, BP 98006 [8775.4]; Bauer, N., Hüvös-Récsi, A., 2019.10.18., Csór: Kis-Bácsó, BP 98005 [8775.4]; Bauer, N., 2020.10.03., Várpalota: Vár-völgy, BP 98036 [8774.4]; Bauer, N., Hüvös-Récsi, A., 2020.10.16., Hajmáskér: Látó-hegy, BP 98037 [8874.3]; Bauer, N., Hüvös-Récsi, A., 2021.02.20., Kádárta: Rác-halála, BP 98052 [8873.4]; Bauer, N., Hüvös-Récsi, A., 2021.11.20., Isztimér: Bogrács-hegy BP 98062 [8775.1]; Bauer, N., 2022.05.29., Öskü: Felső-Bánta, BP 98080 [8874.1]; Bauer, N., 2022.05.29., Öskü: Magyalinai-hegy, BP 98081 [8874.1].

Bakony Mts
Southern Bakony Mts

Specimens examined: Farkas, E., Lőkös, L., 1993.06.22., Veszprém, Tekeres-völgy pereme, BP 98115 [8973.1]; Farkas, E., Lőkös, L., 2010.04.03., Mt Sas-hegy, ca 4 km W of Veszprém, on the W-facing slope of valley "Tekeres-völgy", on calcareous soil in open rocky grassland, BP 98116 [8973.1]; Sinigla, M., 2018.05.09., Veszprém: Tekeres-völgy BMCRY 002882 [8973.1]; Sinigla, M., 2018.06.15., Veszprém: Sas-hegy, BMCRY 002914 [8973.1]; Sinigla, M., 2018.06.15., Veszprém: Csatár-hegy, BMCRY 003063 [8973.1]; Bauer, N., Hüvös-Récsi, A., 2019.09.27., Nemesvámos: Tekeres-völgy, BP 98001 [8973.1]; Bauer, N., Hüvös-Récsi, A., 2019.10.04., Veszprém: Csapás-dűlő, BP 98003 [8973.1]; Bauer, N., Hüvös-Récsi, A., 2019.10.04., Veszprém: Tekeres-völgy, BP 98002 [8973.1]; Bauer, N., Hüvös-Récsi, A., 2020.04.24., Nagyvázsony: Hermán-völgy, BP 98013 [8972.3]; Bauer, N., Hüvös-Récsi, A., 2020.04.24., Nagyvázsony: Nőzsér, BP 98012 [8972.3]; Bauer, N., Hüvös-Récsi, A., 2020.04.24., Öcs: Öcs-hegy, BP 98015 [9071.2]; Bauer, N., Hüvös-Récsi, A., 2020.04.24., Öcs: Kőris-tető alja, BP 98014 [9071.2]; Bauer, N., Hüvös-Récsi, A., 2021.11.27., Nagyvázsony: Zabmező, BP 98059 [8972.4]; Bauer, N., Hüvös-Récsi, A., 2021.11.27., Tótvázsony: Öreg-Kátyó, BP 98058 [8972.4]; Bauer, N., Hüvös-Récsi, A., 2022.02.05., Nemesvámos: Szár-hegy, BP 98066 [8972.2]; Bauer, N., Hüvös-Récsi, A., 2022.02.05., Tótvázsony: Kis-Kátyó, BP 98067 [8972.4]; Bauer, N., Hüvös-Récsi, A., 2022.02.05., Tótvázsony: Máj-hegy, BP 98065 [8972.4]; Bauer, N., Hüvös-Récsi, A., 2022.08.05., Sáska: Kecskevár, BP 98069, BP 98070 [9070.2]; Bauer, N., Hüvös-Récsi, A., 2022.10.08., Tótvázsony: Cseri-legelő, BP 98089 [8972.4]; Bauer, N., Hüvös-Récsi, A., 2022.10.08., Barnag: Barnag-dűlő, BP 98087 [8972.4].

Boros (1952) mentioned in his thesis on the phytogeography of the Danube–Tisza Interfluve that the "*P. pulvinaris*" of the sand dunes also occurs on the dolomite rocks of Mt Baglyas-hegy (Eastern Bakony Mts). The formerly collected specimens of the species came from the vicinity of Veszprém and Várpalota, in the Eastern Bakony Mts. *Xanthoparmelia pulvinaris* is still found at a few places in the dolomite rocky grasslands of the Eastern Bakony Mts. However, its frequency and the size of the populations are generally lower than those in the Vértes Mts. In the dry grasslands of the Bakony Mts, from east to west, *X. pulvinaris* becomes increasingly rare along the Nagyvázsony Basin; on the hills of the Southern Bakony Mts we have mapped only its sporadic, minimal number of colonies (a few tens of thalli/locality).

In the Bakony region, the distribution pattern of *X. pulvinaris* is similar to that of some pontic-Mediterranean (*Allium moschatum*, *Euphorbia nicaeensis*) and sub-Mediterranean (*Artemisia alba*, *Plantago argentea*) vascular plant taxa coming from the southeast, from the Great Hungarian Plain (Mezőföld) associated with steppe habitats (Bauer 2014). This suggests a common history of *X. pulvinaris* with the steppe-forest-steppe flora. These species are absent in the Keszthely Mts and in the western part of the Bakony region with a more Atlantic, humid climate. We also tried to find occurrences of *X. pulvinaris* but in vain. It is particularly interesting that, as far as their regional spreads are concerned, the westernmost populations of *X. pulvinaris* and *Plantago argentea* in the Bakony,

already isolated from the rest, are located on the same hill of the Southern Bakony Mts (Sáska: Kecskevár), merely a few metres from one another.

DISCUSSION

Parmelia pseudohungarica was described by Vilmos Gyelnik at the variety level as *Parmelia convoluta* var. *pseudohungarica* (Gyelnik 1931*b*), and later at the species level as *Parmelia pseudohungarica* (Gyelnik 1932). It was combined under *Xanthoparmelia* (as *Xanthoparmelia pseudohungarica*) by Mason E. Hale (Hale 1988). Following Hale's species concept (Hale 1990), i.e. *Parmelia pulvinaris* sensu Zahlbr. 1925 (nomen nudum) was a synonym of *Xanthoparmelia pseudohungarica*, the name *X. pseudohungarica* had been widely used by various (mostly Hungarian) authors for this lichen species of the Pannonian steppe areas until 2008 (Farkas and Lőkös 2006, Orthová-Slezáková 2004, Pérez-Ortega and Elix 2007, Verseghy 1994). Recently Hawksworth *et al.* (2008) made the new combination, *Xanthoparmelia pulvinaris*, validating *Parmelia pulvinaris* with Gyelnik's 'description', and re-synonymised *X. pseudohungarica* under *X. pulvinaris*.

Based on former data and field mapping carried out in recent years, *Xanthoparmelia pulvinaris* occurs in Hungary in basically two types of habitats: in the open sandy grasslands of lowlands and the colline region of the Transdanubian Mts, in rocky grasslands with calcareous bedrock (limestone and dolomite) and open dry grasslands (Boros 1929, 1952, Farkas and Lőkös 2006, Farkas *et al.* 2014, Verseghy 1994). *Xanthoparmelia pulvinaris* is one of the typical soil-dwelling lichens occurring amongst the *Festuca vaginata* grassy patches of the calcareous sand steppe vegetation in the Duna–Tisza Interfluve (Boros 1954), and it is a characteristic element of the soil-dwelling lichen community of the *Festucetum vaginatae* association ("*Cladonia foliacea – Cladonia magyarica – Syntrichia synusium*") (Gallé 1973). Bauer *et al.* (2022) published some relevés of its occurrences in the rocky grasslands with other accompanying lichen species found in this habitat.

Previously, its specimens from Transdanubian dolomite hills were collected under the name of "*Parmelia conspersa*". The name *P. pulvinaris* was used for specimens detected on the quicksand of the Great Hungarian Plain. Boros (1952, 1963) was the first to suggest that the soil-dwelling *Parmelia* of dolomite mountains and calcareous sand steppes is a unique species. Although Gyelnik had collected and labelled a specimen as "*Parmelia pulvinaris* var. *terricola*" in the Bakony Mts, on a dolomite hill near Veszprém ("Grosser Berg"), back in 1925.

Its occurrences in sandy steppes and rocky grasslands are basically found on basic soils and bedrocks (Boros 1929). That is why the data from the Nyírség

are astonishing, since Matus *et al.* (2015) indicated its occurrence in lightly grazed, open, acidic ($pH_{KCl} = 4.36 \pm 0.36$) sandy grasslands (with the dominance of *Corynephorus canescens* and/or *Festuca vaginata*). Boros (1929, 1932) explains the difference of the sand vegetation of the Nyírség by the lack of calcareous sand species of the Danube–Tisza Interfluve mentioning *X. pulvinaris* ("*Parmelia conspersa*") among these species. The occurrence of *X. pulvinaris* in the Nyírség is even surprising in the light of the fact that in the Tengelic sand region (Southern Mezőföld), where both calcareous and acidified sandy grasslands occur, the species was found only on the calcareous sand patches, but not in the acidofrequent *Corynephorus canescens* grasslands.

The distribution pattern of *Xanthoparmelia pulvinaris* in the Pannonicum shows high similarity with the distribution pattern of steppe species (e.g. *Allium moschatum, Gypsophila fastigiata* subsp. *arenaria, Helichrysum arenarium, Iris humilis* subsp. *arenaria, Minuartia glomerata, Onosma arenaria*) occurring in the sandy grasslands of the Great Hungarian Plain and the rocky habitats of the Transdanubian Middle Mountain Range (http2). Therefore *Xanthoparmelia pulvinaris* joins the ranks of the species whereby the theories describing the complex flora and vegetation developmental relations of the middle mountainous areas (Matricum and Bakonyicum) and of the Great Hungarian Plain was born (Borbás 1900, Kerner 1863), and developed emphasising different details (Zólyomi 1942, 1958, Boros 1958, Borhidi 1997). The occurrence of the species in the Nyírség seems to be an odd one out from the point of view of vegetation history, since the above-mentioned vascular plant species with a broadly similar distribution pattern are mostly missing from the Nyírség. The climatic and historical differences in the vegetation between the Nyírség and the Danube–Tisza Interfluve were also emphasised in numerous papers (Borhidi 1961, Boros 1929, 1932, Pócs 1981, Soó 1933, 1940). The Nyírség may have shown a more forested landscape without natural quicksand surfaces. Another surprising fact is that additional localities fall out of the block-like distribution pattern of *X. pulvinaris*, such as data collected by Boros near Farmos and by Gallé on the border of Deszk, presumably from saline pastures. In these cases, the introduction (e.g. with grazing animals) cannot be ruled out since pastoral grazing was very typical in the Great Hungarian Plain in the past (Szabadfalvi 1984), during which the animals (especially sheep) were herded and grazed in a circle of up to a hundred kilometres. The importance of understanding such seemingly surprising anomalies and the relatively obvious distribution pattern both suggest that the inclusion of lichen taxa (especially taxa with a narrower ecological preference, habitat specialist, or taxa with a smaller range) can be very promising in interpreting plant geography and vegetation-development history.

* * *

Acknowledgements – We would like to thank our colleagues Zoltán Kenyeres (Tapolca) and András Márkus (Pécs) for their help in the fieldwork. We are also grateful to the curators of the herbaria EGR, JPU, SZE, and SAMU for the relevant records, as well as to Csaba Németh (Budapest) for his recent collection from the Bakony and Vértes Mts. The HPTLC analysis of the samples was supported by the project NKFI K 124341 financed by the Hungarian National Research Development and Innovation Fund.

Összefoglaló: A *Xanthoparmelia pulvinaris* magyarországi elterjedését a herbáriumi és publikált adatok feldolgozásán túl szisztematikus terepi térképező munkával állapítottuk meg. Számottevően gyarapítottuk az ismert előfordulási helyek számát, pontosítottuk a korábbi adatok alapján kirajzolódó magyarországi elterjedési mintázatot. A *X. pulvinaris* az Alföld és a Kisalföld kiterjedt homokvidékein egykor gyakori lehetett, a Vértesből és a Keleti-Bakony néhány pontjáról is régóta ismert. Nagyobb telepszámú állományai napjainkban a Vértes keleti peremén és az Alföld néhány jó természetességi állapotú homokpusztáján maradtak fenn. A faj előfordulását kimutattuk a Dél- és Nyugat-Mezőföldön, továbbá a Dunántúli-középhegység peremvidékén és belső dombvidéki tájain is számos helyen előkerült. Hazai elterjedési mintázata nagy hasonlóságot mutat a pannon homokpusztagyepek és középhegységi sziklagyepjeink néhány közös edényes növényfajának (*Allium moschatum, Gypsophila fastigiata* subsp. *arenaria, Helichrysum arenarium, Iris humilis* subsp. *arenaria, Minuartia glomerata, Onosma arenaria*) elterjedési képével. A *X. pulvinaris* a nyílt sztyepp-élőhelyek faja, az alföldi homokpusztagyepek, valamint a középhegységi mészkő- és dolomitsziklagyepek növényföldrajzi-vegetáció-fejlődéstörténeti kapcsolatának fontos bizonyítékaként tekintsünk rá. Feltérképezett előfordulásainak többsége kicsi, sérülékeny állomány.

REFERENCES

Arup, U., Ekman, S., Lindblom, L. and Mattsson, J.-E. (1993): High performance thin layer chromatography (HPTLC), an improved technique for screening lichen substances. – *Lichenologist* **25**: 61–71. https://doi.org/10.1006/lich.1993.1018

Barina, Z. (2006): A Dunántúli-középhegység növényföldrajzának főbb jellemzői. (Characteristics of the phytogeography of Transdanubian Mountains in Hungary) – *Flora Pannonica* **2**(2): 37–55.

Barina, Z. (2008): Adatok a Dunántúli-középhegység és környéke flórájához. (Data on the flora of Hungarian Middle Mountains and neighbouring regions) – *Flora Pannonica* **6**: 3–23.

Bauer, N. (2014): A Bakony-vidék szárazgyepjei – Sztyeprétek és sziklagyepek osztályozása és növényföldrajzi karaktere. Dry grasslands of the Bakony Region – Classification and phytogeographical character of dry and rocky grasslands. – *A Bakony természettudományi kutatásának eredményei* **33**: 1-336.

Bauer, N. (2019): A Velencei-hegység növényföldrajzi és florisztikai kutatásának eredményei. (Results of floristic and phytogeographical research in the Velence Hills /Hungary, Transdanubian Mts/) – *Kitaibelia* **24** (2): 117–152. https://doi.org/10.17542/kit.24.117

Bauer, N. and Somlyay, L. (2007): A Sisymbrium polymorphum (Murray) Roth. és más florisztikai adatok a Nyugat-Mezőföldről. – *Kitaibelia* **12**(1): 52–55.

Bauer, N., Hüvös-Récsi, A., Lőkös, L. and Farkas, E. (2022): A new steppe element in the Vienna Basin, the first record of Xanthoparmelia pulvinaris (Parmeliaceae) for Austria. – *Herzogia* **35**(1): 22–31. https://doi.org/10.13158/heia.35.1.2022.22

Borbás, V. (1900): A Balaton tavának és partmellékének növényföldrajza és edényes növényzete. [The vascular flora and phytogeography of Lake Balaton and its surroundings] – *A Balaton tudományos tanulmányozásának eredményei* **1**, Budapest, 432 pp.

Borhidi, A. (1997): *Gondolatok és kételyek: Az Ősmátra-elmélet.* (Thoughts and doubts: the Ősmátra theory). – Studia Phytologica Jubilaria Dissertaniones in honorem Jubilantis Adolf Olivér Horvát, Pécs, pp. 161–188.

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

Borhidi, A., Kevey, B. and Lendvai, G. (2012): *Plant communities of Hungary.* – Akadémiai Kiadó, Budapest, 544 pp.

Boros, Á. (1929): A Nyírség flórája és növényföldrajza (Rövid kivonat). [Phytogeography and flora of Nyírség (short extract)]. – *Math. Term.tud. Ért.* **46**: 48–59.

Boros, Á. (1932): *A Nyírség flórája és növényföldrajza.* (Die Flora und die Pflanzengeographischen Verhältnisse des Nyírség's). – Budapest, 207 pp.

Boros, Á. (1935): A nagykőrösi homoki erdők növényvilága. – *Erd. Kísérl.* **37**: 1–24.

Boros, Á. (1952): A Duna-Tisza-köze növényföldrajza. – *Földr. Ért.* **1**(1): 39–53.

Boros, Á. (1954): A Vértes, a Velencei-hegység, a Velencei-tó és környékük növényföldrajza. – *Földr. Ért.* **3**(2): 280–309.

Boros, Á. (1958): A magyar puszta növényzetének származása. – *Földr. Ért.* **7**: 33–52.

Boros, Á. (1959): *A Mezőföld növényföldrajza.* [Phytogeograpy of Mezőföld]. – In: Ádám, L., Marosi, S. and Szilárd, J. (eds): A Mezőföld természeti földrajza. Akadémiai Kiadó, Budapest, pp. 365–383.

Boros, Á. (1963): Die Steppenflechten. – *"Die Pyramide", Naturwiss. Zeitung* **2**(11): 59–61.

Boros, Á. (1973): *Florisztikai jegyzetek 1915–1971.* – Magyar Természettudományi Múzeum, Tudománytörténeti Gyűjtemény, Budapest, mscr.

Dövényi, Z. (ed.) (2010): *Magyarország kistájainak katasztere.* – MTA Földrajztudományi Kutatóintézet, Budapest, 876 pp.

Farkas, E. and Lőkös, L. (2006): Védett zuzmófajok Magyarországon. – *Mikol. Közlem., Clusiana* **45**: 159–171.

Farkas, E., Kursinszki, L., Szőke, É. and Molnár, K. (2015): New chemotypes of the lichens Xanthoparmelia pulvinaris and X. subdiffluens (Parmeliaceae, Ascomycota). – *Herzogia* **28**: 679–689.

Farkas, E., Lőkös, L., Sinigla, M. and Varga, N. (2014): A Mogyorós-hegy (Litér) és az Ugri-hegy (Királyszentistván) zuzmóflórája. (The lichen flora of the hills "Mogyorós-hegy" (Litér, Hungary) and "Ugri-hegy" (Királyszentistván, Hungary)). – *Folia Mus. Hist-nat. Bakony.* **31**: 7–24.

Gallé, L. (1973): Flechtenvegetation der Sandgebiete der Tiefebene Südungarns. – *Móra Ferenc Múzeum Évkönyve* **1972–1973**: 259–278.

Gyalog, L. and Horváth, I. (2004): *A Velencei-hegység és a Balatonfő földtana.* (Geology of the Velence Hills and the Balatonfő). – Magyar Állami Földtani Intézet, Budapest, 316 pp.

Gyelnik, V. (1931*a*): Additamenta ad cognitionem Parmeliarum. I. – *Feddes Repert.* **29**: 149–157.

Gyelnik, V. (1931*b*): Additamenta ad cognitionem Parmeliarum. 2. Continuatio prima. – *Feddes Repert.* **29**: 273–291.

Gyelnik, V. (1932): Additamenta ad cognitionem Parmeliarum. 3. Continuatio secunda. – *Feddes Repert.* **30**: 209–226.

Hale, M. E. (1988): New combinations in the lichen genus Xanthoparmelia (Ascomycotina: Parmeliaceae). – *Mycotaxon* **33**: 401–406.

Hale, M. E. (1990): A synopsis of the lichen genus Xanthoparmelia (Vainio) Hale (Ascomycotina, Parmeliaceae). – *Smiths. Contrib. Bot.* **74**: 1–250.

Huneck, S., Ahti, T., Cogt, U., Poelt, J. and Sipman, H. (1992): Zur Verbreitung und Chemie von Flechten der Mongolei. III. Ergebnisse der Mongolisch-Deutschen Biologischen Expedition seit 1962 Nr. 217. – *Nova Hedwigia* **54**: 277–308.

Kerner, A. (1863): *Das Pflanzenleben der Donauländer*. – Verlag der Wagner'schen Universitäts-Buchhandlung, Innsbruck, 348 pp.

Khodosovtsev, O. Ye., Nadyeina, O. V. and Vondrakova, O. S. (2013): Species of terricolous lichens new for Ukraine. – *Ukr. Bot. Journal* **70**: 386–391.

Matus, G., Lőkös, L., Saraiva, L., Budai, J. and Antal K. (2015): Talajlakó védett Xanthoparmelia fajok (Parmeliaceae) előfordulása a Dél-Nyírségben. In: Barina, Z. (ed.): Növénytani Szakülések. – *Bot. Közlem.* **102**(1–2): 164.

MK (2005): 23/2005. (VIII. 31.) KvVM r. A védett és a fokozottan védett növény- és állatfajokról, a fokozottan védett barlangok köréről, valamint az Európai Közösségben természetvédelmi szempontból jelentős növény- és állatfajok közzétételéről szóló 13/2001. (V. 9.) KöM rendelet módosításáról. – *Magyar Közlöny* **2005**(117): 6371–6404. (2005. augusztus 31).

MK (2008): 18/2008. (VI. 19.) KvVM rendelet. A védett és a fokozottan védett növény- és állatfajokról, a fokozottan védett barlangok köréről, valamint az Európai Közösségben természetvédelmi szempontból jelentős növény- és állatfajok közzétételéről szóló 13/2001. (V. 9.) KöM rendelet módosításáról. – *Magyar Közlöny* **2008**(90): 5435–5439. (2008. június 19).

MK (2013): 83/2013. (IX. 25.) VM rendelet. A védett és a fokozottan védett növény- és állatfajokról, a fokozottan védett barlangok köréről, valamint az Európai Közösségben természetvédelmi szempontból jelentős növény- és állatfajok közzétételéről szóló 13/2001. (V. 9.) KöM rendelet módosításáról. – *Magyar Közlöny* **2013**(156): 67479–67503. (2013. szeptember 25).

Molnár, Cs., Molnár, Zs., Barina, Z., Bauer, N., Biró, M., Bodonczi, L., Bölöni, J., Csathó, A. I., Csiky, J., Deák, J. Á., Fekete, G., Horváth, A., Juhász, M., Kállayné Szerényi, J., Király, G., Magos, G., Máté, A., Mesterházy, A., Molnár, A., Nagy, J., Óvári, M., Purger, D., Sramkó, G., Szénási, V., Szmorad, F., Tóth, T. and Virók, V. (2008): Vegetation-based landscape-regions of Hungary. – *Acta Bot. Hung.* **50** (Suppl.): 47–58. https://doi.org/10.1556/abot.50.2008.suppl.4

Molnár, K., Lőkös, L., Schrett-Major, Á. and Farkas, E. (2012): Molecular genetic analysis of Xanthoparmelia pulvinaris (Ascomycota, Lecanorales, Parmeliaceae). – *Acta Bot. Hung.* **54**: 125–130. https://doi.org/10.1556/ABot.54.2012.1-2.14

Molnár, K. and Farkas, E. (2011): Depsides and depsidones in populations of the lichen Hypogymnia physodes and its genetic diversity. – *Ann. Bot. Fennici* **48**: 473–482. https://doi.org/10.5735/085.048.0605

Niklfeld, H. (1971): Bericht über die Kartierung der Flora Mitteleuropas. – *Taxon* **20**: 545–571. https//doi.org/10.2307/1218258

Orthová-Slezáková, V (2004): The genus Xanthoparmelia, nom. cons. prop. (lichenized Ascomycota) in Slovakia. – *Mycotaxon* **90**(2): 367–386.

Pérez-Ortega, S. and Elix, J. A. (2007): Xanthoparmelia pseudohungarica in Spain. – *Lichenologist* **39**: 297–300. https://doi.org/10.1017/s0024282907006792

Pócs, T. (1981): *Növényföldrajz.* – In: Hortobágyi, T. and Simon, T. (eds): Növényföldrajz, társulástan és ökológia. Tankönyvkiadó, Budapest, pp. 27–166.

Polgár, S. (1941): Győrmegye flórája. Flora comitatus Jaurinensis. – *Bot. Közlem.* **38**: 201–352.

QGIS Development Team (2018): *QGIS Geographic Information System*. – OpenSource Geospatial Foundation Project. http://qgis.osgeo.org

Sinigla, M., Lőkös, L. and Varga, N. (2016): Ritka és védett zuzmófajok a Balaton-felvidék keleti részén. – *Annls Mus. hist.-nat. Hung.* **108**: 231–250.

Soó, R. (1933): A Nyírség vegetációjának ismeretéhez. [Data to the knowledge of Nyírség's vegetation]. – *Debreceni Szemle* **1933**. pp. 251–256.

Soó, R. (1940): Vergangenheit und Gegenwart der pannonischen Flora und Vegetation. – *Nova Acta Leopoldina* **9**: 1–49.

Szabadfalvi, J. (1984): Migrációs jelenségek a magyar pásztorkodásban. (Migration phenomena in Hungarian pastoralism). In: Szabadfalvi, J. (ed.): Tanulmányok a magyar pásztorkodás köréből. (Studies on Hungarian pastoralism). – *Studia Folklor. Ethnogr.* **10**: 131–148.

Szatala, Ö. (1929): Beiträge zur Kenntnis der Flechtenflora Ungarns IV. – *Magyar Bot. Lapok* **28**: 68–81.

Szujkó-Lacza, J. and P. Komáromy, Zs. (1986): Postfire resuccessional process in juniper-poplar wood in Bugac Kiskunság National Park, Hungary. – *Bull. Bot. Surv. India* **28**(1–4): 89–110.

Thiers, B. (2015, continuously updated): *Index Herbariorum: a global directory of public herbaria and associated staff.* – New York Botanical Garden's Virtual Herbarium. http://sweetgum.nybg.org/ih/ [accessed: 10 September 2022]

Verseghy, K. (1994): *Magyarország zuzmóflórájának kézikönyve*. (The lichen flora of Hungary). – Magyar Természettudományi Múzeum, Budapest, 415 pp.

Zahlbruckner, A. (1925): *618. Parmelia conspersa (Ehrh.) Ach. var. pulvinaris A. Zahlbr. nov. var.* – In: Schedae ad "Floram Hungaricam exsiccatam" a sectione botanica Musei Nationalis Hungarici editam. Centuria VII. Budapest, p. 10.

Zólyomi, B. (1942): A középdunai flóraválasztó és a dolomitjelenség. (Die Mitteldonau-Florenscheide und das Dolomitphäenomen). – *Bot. Közlem.* **39**: 209–231.

Zólyomi, B. (1958): *Budapest és környékének természetes növénytakarója*. [Natural vegetation of Budapest and its environs]. – In: Pécsi, M., Marosi, S. and Szilárd, J. (eds): Budapest természeti képe. Akadémiai Kiadó, Budapest, pp. 509–642.

http1 – Euro+Med 2006–: Euro+Med PlantBase – the information resource for Euro-Mediterranean plant diversity. Published on the Internet https://europlusmed.org (accessed 24 Sept. 2022)

http2 – Bartha D., Bán M., Schmidt D., Tiborcz V. 2020: Magyarország edényes növényfajainak online adatbázisa – Soproni Egyetem, Erdőmérnöki Kar, Növénytani és Természetvédelmi Intézet. http://floraatlasz.uni-sopron.hu (accessed 24 Sept. 2022)

(submitted: 17.10.2022; accepted: 15.12.2022)

CORRIGENDA

In the paper from the previous volume, (i.e. RÁCZ, I. (2021): Garden, culture, dendrology – remarks and thoughts following the unexpected passing away of Géza Kósa. – *Studia bot. hung.* **52**(1): 89–114.) the following correction should be considered:

The last sentence of the 2nd paragraph on page 110 should be correctly as:

"Valósággal megrázó arra gondolni, hogy miután e munka szerkesztési stádiumban van, erre a nagyszerű lehetőségre már nem nyílhat lehetőség."

The word "nem" was accidentally omitted in the printed version of the concerning volume.