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Contributions to the fern flora of Hungary with special attention to built walls

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Summary: The aim of this study is to provide supplementary distribution records for fern species to the "Flora Atlas" of Hungarian vascular plants, published in 2015. Most of the data came from grid cells (according to the Central European Flora Mapping System) in the territory or in the surroundings of Budapest. During the work, special attention was paid to the man-made stone constructions (walls of buildings, stone fences, ruins etc.), because these objects are the most characteristic to the main study area of the survey. The survey resulted in new biogeographical records for 15 fern species with altogether 54 new occurrences concerning 18 grid cells. Among the species, five are legally protected in Hungary: *Asplenium adiantum-nigrum*, *A. scolopendrium*, *Gymnocarpium robertianum*, *Polystichum aculeatum* and *Thelypteris palustris*, and further six are native members of the flora. Species with highest numbers of new records are *Asplenium ruta-muraria* (9), *Asplenium trichomanes* (7), *Dryopteris filix-mas* (7) and *Polystichum aculeatum* (7) (numbers in brackets indicate the number of grid cells from where the given species was first reported). Surprisingly, four exotic fern species were also found: *Adiantum capillus-veneris*, *Cyrtomium falcatum*, *Pteris cretica* and *Pteris* cf. *multifida* appearing on walls of clinker brick buildings, permanently heated during the winter period (in the present cases in old public hospitals). Based on the results man-made stone constructions, especially the older ones, seem to be suitable habitats to establish for a wide variety of ferns, including rare and protected species. Therefore, these anthropogenic habitats deserve special attention during regional flora mapping projects.

Introduction

During the first period of exploration of the Hungarian flora, the focus was on flowering plants, and cryptogams received very little attention. This approach is well reflected by the best-known Hungarian flora book of the era – Waldstein

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and Kitaibel: *Descriptiones et icones plantarum rariorum Hungariae* – which presented 280 species, but none of them was a pteridophyte (cf. Hortobágyi 1997).

In the second half of the 19th century, interest in cryptogamic plants has increased, thus pteridophytes and especially ferns among them received more and more attention. The first checklist of ferns in Hungary came from Vince Borbás's pen, listing about 35 species (Borbás 1875). In his next enumeration, he reported on about 30 fern species collected in the contemporary area of Hungary, by thoroughly reviewing the herbarium of archbishop Lajos Haynald, the greatest collector of the era (Borbás 1877). (The exact number of species listed is difficult to give because the distinction of taxa differed from the recently used system.) Two decades later, in another considerable floristic report by Aladár Richter, the precise documentation of geographic distribution of ferns was explicitly emphasized (Richter 1896). He reported detailed records of 25 species in his enumeration, most of them from Northern Hungary, and he was a pioneer in publishing abundance and dominance data for ferns (by using a five-grade scale).

In the meantime, several short reports appeared on the occurrences of certain fern species from various localities of the country. For example, Wiesbaur (1877) added *Ophioglossum vulgatum* to the list published by Borbás. Staub (1879) found new localities for three species: *Cystopteris fragilis*, *Dryopteris filix-mas* and *Polypodium vulgare* from the capital city, Budapest, and also mentioned a teratological form for the latter one. In another case, ethno-pharmacological report on usage of Hart's tongue fern (*Asplenium scolopendrium*) leaves gave indirect evidence on the species presence at Kisfalud in Somogy County (Buza 1889).

The incomplete knowledge on the fern flora of Hungary in the end of the 19th century was well indicated by the remark of Vince Borbás in the regular meeting of the Hungarian Botanical Society, on January 8, 1896. He congratulated to László Hollós who collected *Aspidium spinulosum* (syn. *Dryopteris carthusiana*) for the first time from the Great Hungarian Plain and recalled that in the era of József Sadler (1791–1849) only one fern species was known from the region and only four further ones (2 terrestrial and 2 aquatic ferns) were added prior to Hollós' discovery (Borbás 1896).

In the first half of the 20th century, the flora exploration activities of Sándor Jávorka and his followers lead to the increase of reliable records on fern species of the country. His most important work, the "Flora of Hungary", includes 54 fern species (Jávorka 1925), however, this species number refers to the territory of historic Hungary, which included most parts of the Carpathians and Croatia as well. Regarding the present territory of Hungary, the occurrence of 28 species is considered justified. From the second half of the 20th century to the present, the knowledge of the Hungarian fern flora expanded rapidly (e.g. Vida 1963, 1965; Szerdahelyi and Hably 1980, Vida and Pintér 1981, Molnár et al.

2007). Table 1 shows the increasing number of known species based on the most significant comprehensive books. In addition to discovering new species, data on the biogeography of ferns has also increased. It was further encouraged by the increase of the nature conservation approach resulting in more intensive studies on rare ferns (e.g. Szerdahelyi 1984, 1986; Nagy et al. 1998). By now, 22 fern species received legally protected or strictly protected status in Hungary.

Table 1. Number of fern species in Hungary as discussed by various comprehensive floristic works, listed in chronological order.
1. táblázat. A Magyarországról ismert páfrány fajok számának változása a nagyobb áttekintő művek alapján. (1) forrásmunka; (2) a forrásmunkában tárgyalt fajok száma

Reference (1)	Number of species (2)
Jávorka (1925)*	28
Jávorka (1952)	36
Jávorka (1962)	38
Soó (1964)	43
Soó-Kárpáti (1968)	43
Simon (1992)	44
Simon (2000)	44
Király (2009)	48
Bartha et al. (2015)	47

* This work reports the flora of the former Historic Hungary of much greater area, but here we give the number of species having valid data for the present territory of the country.

In 2015, a comprehensive book the "Flora Atlas" was published summarizing the biogeographical records for the vascular flora of Hungary (Bartha et al. 2015), showing species distribution on grid maps according to the Central European Flora Mapping System (Niklfeld 1971, Király and Horváth 2000). However, it soon became clear that distribution records of the atlas require improvements for several species. Additions have already been published with hundreds of new records (Molnár et al. 2016, Takács et al. 2016, Aradi et al. 2017). In the present paper, records concerning to the fern species are listed that are new to the "Flora Atlas".

Materials and methods

Data collection for fern occurrences was conducted between September 2013 and October 29, 2017, but the vast majority of data came from October 2016 onwards. Data handling generally agreed with the method described by

Takács et al. (2016), i.e. we did not carry out a complete literature review for the listed species, but in every case, we verified that the new biogeographic record was not reported in the "Flora Atlas" (Bartha et al. 2015).

Most of the data came from grid cells in the territory or in the surroundings of Budapest, however occasional data have also been recorded from other regions of the country. In several cases, the new fern occurrences were verified by voucher specimens, which were deposited in the Pteridological Collection of the Herbarium of the Hungarian Natural History Museum (BP). Photo documentation was made at all sites, containing at least two images: one about the habitat, made from a few meters distance, and a close-up photo of the fern in question (in case of mass occurrence a well-developed, typical individual was photographed).

Nomenclature follows Király (2009) for species native to Hungary, and Hassler and Swale (2003) for exotic ferns.

Results

Our survey provided new biogeographic records for 15 fern species of which five are legally protected members of the Hungarian flora (*Asplenium adiantum-nigrum*, *A. scolopendrium*, *Gymnocarpium robertianum*, *Polystichum aculeatum* and

Table 2. Number of grid cells with fern species records new to Bartha et al. (2016).
2. táblázat. Azon térképezési egységek száma, amelyekből új, a „Flóra Atlasz"-ban nem jelzett előfordulásait találtuk a fajoknak. (1) fajnév; (2) térképezési egységek száma

Species (1)	No. of grid cells (2)
Asplenium ruta-muraria	9
Asplenium trichomanes	7
Dryopteris filix-mas	7
Polystichum aculeatum	7
Asplenium adiantum-nigrum	3
Asplenium scolopendrium	3
Athyrium filix-femina	3
Cystopteris fragilis	3
Gymnocarpium robertianum	3
Thelypteris palustris	3
Pteridium aquilinum	2
Adiantum capillus-veneris	1
Cyrtomium falcatum	1
Pteris cretica	1
Pteris cf. *multifida*	1

Thelypteris palustris). Surprisingly, four exotic ferns were also found: *Adianthum capillus-veneris*, *Cyrtomium falcatum*, *Pteris cretica* and *Pteris* cf. *multifida*. The highest number of new records were detected for *Asplenium ruta-muraria* (9), *Asplenium trichomanes* (7), *Dryopteris filix-mas* (7) and *Polystichum aculeatum* (7) (Table 2).

Altogether 54 new distribution data were registered during the survey (Appendix). The new records involved 18 mapping units (grid cells) of which nine units were in Budapest or its surroundings. Ten was the highest number of new fern occurrences in a certain mapping unit (in grid cells 8480.3 and 8580.2; Table 3).

The majority of previously unknown fern occurrences were discovered in anthropogenic habitats, like on walls of buildings, ruins of castles and churches, stone fences and old wells. The new records related to man-made habitats counted 94%, whereas the remaining 6% were found on natural sites.

Table 3. Number of new fern species in certain grid cells according to the Central European Flora Mapping System.
3. táblázat. Az egyes Közép-Európai Flóratérképezési (KEF) cellákból újként előkerült páfrányfajok száma. (1) újként előkerült fajok száma, (2) térképezési egység sorszáma, (3) a térképezési egység által érintett földrajzi helyek.

Number of new species (1)	Grid cell number (2)	Geographic locality* (3)
10	8480.3	Budapest I; II; III; XII: Szent János Hospital; Margitsziget
10	8580.2	Budapest IX: Szent István Hospital
6	8580.1	Budapest I: Castle of Buda, Nap-hill; VIII: Klinikák
4	8375.4	Tata (southern part of the town)
4	8480.4	Budapest XIV
3	8479.4	Budapest II: Szépjuhászné
2	8169.2	Mosonmagyaróvár
2	8274.4	Komárom
2	8375.2	Tata (northern part of the town)
2	8480.1	Budapest III: Aquincum
2	8482.1	Gödöllő: Erzsébet-park
1	8279.2	Nagymaros
1	8379.1	Pilisszentkereszt: Canyon
1	8380.1	Szentendre: Templom square
1	8479.1	Nagykovácsi
1	8480.2	Budapest IV
1	9392.2	Békéscsaba
1	9786.4	Szeged

* The Roman numerals indicate administrative districts within Budapest.

Discussion

The majority of new fern floristic records were found, unexpectedly, on man-made stone constructions, old clinker brick buildings and old stone fences being the most typical among them. Reports on the fern flora of anthropogenic habitats are already known from the international literature. Rishbeth (1949) studied the walls of buildings in Cambridge and listed seven fern species: *Asplenium adiantum-nigrum*, *A. ruta-muraria*, *A. scolopendrium*, *A. trichomanes*, *Dryopteris filix-mas*, *Polypodium vulgare* and *Pteridium aquilinum*, of which, apart from *Polypodium*, the others were also found in our study. *Asplenium scolopendrium*, *Dryopteris filix-mas* and *Pteridium aquilinum* were also mentioned from walls of south-eastern Essex (Payne 1978). A recent study, investigating stone structures of 63 railway stations in Central Europe (mostly in Germany) listed 11 fern species, *Dryopteris filix-mas*, *Asplenium ruta-muraria* and *A. trichomanes* being the most common (Wittig 2002).

From Hungary, occasional reports were published about ferns growing in anthropogenic habitats (Boros 1930, Zólyomi 1931, Pénzes 1942, Vojtkó 2008, Csiky et al. 2009, Horváth 2013, Jakab 2013, Bátori et al. 2014, Molnár et al. 2016, Takács et al. 2016, Aradi et al. 2017), and a detailed study focusing on the spontaneous fern flora of Buda Castle also appeared (Czúcz 2004). However, as far as we are aware, present work is the first extensive report on the fern flora of the built environment in and around Budapest.

The close relation has long been known between certain anthropogenic habitat types and groups of plant species. Enlarged geographical distribution of arable weeds parallel to the increased area of cultivated lands worldwide, provides a good example of this. Greenhouse weeds can serve a further example what is already linked to the built environment (Galera and Ratyńska 1999). Based on the numerous literature data from the past and on the results of our recent survey, ferns can definitely be linked to the walls of old buildings and to other man-made stone constructions of human settlements, thus serving another example of the relation between a species group and an anthropogenic habitat. It is worth emphasizing that this relation is not limited to the well-known cliff inhabiting ferns (like *Asplenium ruta-muraria* or *A. trichomanes*) but also valid for several rare and endangered species naturally growing in forests or shady valleys (cf. Wittig 2002). The latter group is likely gains benefit from the gorge-like light climate of narrow streets between tall buildings.

One may ask, why ferns are not suppressed by seed plants, although some gymnosperms and hundreds of angiosperms, including woody species are known from walls of buildings and stone fences (Hruška 1987, Czúcz 2005). To answer this question, at least two circumstances should be considered. (a) The physiological character of ferns differs in several aspects from that of seed plants (Ludlow and Wolf 1975, Bannister and Wildish 1982, Sessa and Givnish 2014,

Tosens et al. 2016). (b) Light and humidity gradients along structurally similar walls and fences may create a series of microhabitats with subtle differences among them, where at a certain point of the gradient ferns could gain an advantage over seed plants due to (a). We suggest this subject for further investigations.

Relative frequencies of fern species on walls compared to their abundance in natural habitats also deserve attention. In our survey, *Asplenium adiantum-nigrum*, *A. scolopendrium* and *Polystichum aculeatum* proved to be relatively frequent compared to their sparse occurrences in the wild. In contrast, we found *Athyrium filix-femina* and *Cystopteris fragilis* in rather few localities in man-made habitats in and around Budapest, although these ferns are among the most common ones in natural sites in the surroundings of Budapest. Behind the phenomena the spores' different dispersal ability or differences in sensitivity of the prothallium to environmental stress factors could be considered.

Surprisingly, we found four exotic species, *Adiantum capillus-veneris*, *Cyrtomium falcatum*, *Pteris cretica* and *P.* cf. *multifida* each appearing on walls of clinker brick buildings, permanently heated during the winter period (in the present cases in public hospitals). Their nearest natural or naturalized occurrences are Croatia for *A. capillus-veneris* (Lansdown and Bilz 2013), Madeira for *Cyrtomium falcatum* (Hassler and Swale 2003), Italy, Greece and Germany for *Pteris cretica* (Hassler and Swale 2003, Keil et al. 2009) and Germany for *Pteris multifida* (Hassler 2017). Considering the remoteness of the listed localities from Budapest, it is supposed that the observed specimens are subspontaneous descendants of indoor plants kept in nearby buildings. Apart from *A. capillus-veneris*, for which four data of initial naturalization are known (Soó 1964), for the other three species our survey provided the first records of this kind.

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Kiegészítések Magyarország páfrányainak elterjedési adataihoz, különös tekintettel előfordulásukra kőépítményeken

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Kulcsszavak: antropogén élőhelyek, elterjedési adatok, idegenhonos páfrányok, kőfalak, flóratérképezés, téglafalak, védett páfrányfajok.

Munkánk célja a páfrányfajok tekintetében kiegészítő adatok szolgáltatása Magyarország edényes növényfajainak elterjedési atlaszához. Új florisztikai adataink zömmel a fővárosra és annak agglomerációs övezetére vonatkoznak, de szórvány jelleggel az ország más területeiről is közlünk új adatokat. Mivel a vizsgált terület döntő részére az erős beépítettség a jellemző, ezért külön figyelmet fordítottunk az antropogén élőhelyekre.

Felmérésünk eredményeként 15 fajra nézve találtunk összesen 54 esetben új előfordulási adatot, amelyek 18 flóratérképezési cellára vonatkoztak. Adataink öt védett páfrány faj: *Asplenium adiantum-nigrum*, *A. scolopendrium*, *Gymnocarpium robertianum*, *Polystichum aculeatum* és *Thelypteris palustris* elterjedésének ismeretéhez is hozzájárultak. A legtöbb új adatot a következő fajokra találtunk (zárójelben az olyan térképezési egységek darabszáma áll, ahonnan korábban a faj nem volt ismert): *Asplenium ruta-muraria* (9), *Asplenium trichomanes* (7), *Dryopteris filix-mas* (7), *Polystichum aculeatum* (7). Meglepő módon négy egzóta páfrány: *Adiantum capillus-veneris*, *Cyrtomium falcatum*, *Pteris cretica* és *Pteris* cf. *multifida* szubspontán előfordulását is megtaláltuk, mindegyiket budapesti kórház-épületek télen folyamatosan fűtött falain.

A felmérés eredményei alapján úgy látjuk, hogy a páfrányok flóratérképezése során érdemes alaposan átvizsgálni az épített környezetet is, különösen az elhanyagolt épületek, várromok és más kőből rakott, ember alkotta építmények falait, mert azok alkalmas élőhelyet nyújthatnak a páfrányok megtelepedésére, amelyek között nem ritkán még a védett fajok is felbukkanhatnak.

Appendix. Enumeration of new fern floristic records. Nomenclature follows Király (2009) for species native to Hungary and Hassler and Swale (2003) for exotic ferns. Grid cell numbers are given in square brackets.

Függelék. Az új páfrány-előfordulások jegyzéke. A honos fajok esetében az elnevezések Király (2009) munkáját, míg az egzótákra vonatkozóan Hassler és Swale (2003) művét követik. Szögletes zárójelben a flóratérképezési egységek sorszámát adtuk meg.

Adiantum capillus-veneris L.

[8480.3] Budapest, District XII, in brick wall fugues of building 20 of Szent János Hospital, appr. 30 specimens, and also in brick wall fugues of the Dentistry building, 15–20 specimens.

Asplenium adiantum-nigrum L.

[8480.3] Budapest, District XII, east-facing wall of building 20 of Szent János Hospital, 20–25 specimens, and in crevices of a sandstone wall at the basement of the heating centre's chimney of the hospital, 9 specimens. For the same grid cell, the species was reported by Molnár et al. (2016) from the wall of a building at Széll Kálmán square.

[8480.4] Budapest, District XIV, on the wall facing to Cházár András street of the Rózsafüzér Királynéja Church, and the church garden's stone fence bordering to Cházár András street, on its inner, north-facing side, 4 specimens with sporangia.

[8580.1] Budapest, District I, in the Buda Castle, in an old well in the castle yard south-east of Budapest History Museum, 1 well-developed specimen. Czúcz (2004) also reported the species from a nearby stone wall.

Asplenium ruta-muraria L.

[8169.2] Mosonmagyaróvár, at the main building of the old Castle, on the north-facing and on the south-facing sides of a ruined wall, more than 50 and more than 30 specimens, respectively.

[8274.4] Komárom, on the walls of old military fortifications "Csillag-erőd" and "Igmándi-erőd", several specimens in stone wall joints.

[8279.2] Nagymaros: on a stone wall of a public building at the beginning of Fehérhegy street, 2 well-developed specimens with sporangia, and some young specimens.

[8479.1] Nagykovácsi, on the north-facing side of a sandstone fence; Nagykovácsi, Kossuth Lajos street, few individuals; in the Kastély köz street on the stone wall of the Castle's garden in west-facing exposition, a few dozen specimens.

[8480.1] Budapest, District III, Aquincum, in the ruins of the Roman Amphitheatre on a single wall section, built from a variety of stone types in north-facing exposition 635 specimens were counted. The fern also colonized the other walls of the Amphitheatre with an estimated number of individuals around 10,000 specimens.

[8480.3] Budapest, District I, Szabó Ilonka street 2–4, 40 specimens; District I, Várnegyed, on the ruined walls of Mária Magdolna Church, 8 specimens; District II, Pengő street 2, on limestone fence, 8 specimens; District III, Mátyás-hegy, at the entrance of a natural cave, 1 specimen; around the entrance of Pálvölgyi-cseppkőbarlang, on the natural cliffs, more than 100 specimens; District III, Óbuda, in the Hajógyár street, on the buttress wall of the Zichy-castle, 10 specimens; District III, Óbuda, on the ruined walls of the Military Amphitheatre, more than 1,000 specimens; District XII, Szent János Hospital,

in a stone wall at building no. 19, 23 specimens; District XIV, Városliget, on the wall of Vajdahunyad-castle, 37 specimens; Margitsziget, on the ruined walls of the Dominican Order Monastery, more than 1,000 specimens.

[8482.1] Gödöllő, Erzsébet-park, on the vertical surface of the Queen Erzsébet memorial cliff, 10–15 specimens.

[8580.2] Budapest, District IX, Szent István Hospital, on the wall of building R, 4 specimens.

[9786.4] Szeged, at the cross of Bécsi krt. and Petőfi Sándor avenue, on a fence fund made of bricks, cca. 50 specimens.

Asplenium scolopendrium L.

[8479.4] Budapest, District II, Szépjuhászné, near the ruins of the Budaszentlőrinc Pauline Monastery, in an old well, 1 developed specimen.

[8480.3] Budapest, District I, Várnegyed, on the ruined walls of Mária Magdolna Church, in northwest exposition, 1 small specimen with sporangia; District II, Irgalmasrendi Hospital, on the north-facing wall of the central laundry building shaded by old trees, appr. 50 specimens near to a vertical rainfall drainage pipe; District XII, Szent János Hospital, building 8, near to a vertical rainfall drainage pipe, at the elevation of 11 meters, 1 large specimen with sporangia, and on the wall of building 9, near to a vertical rainfall drainage pipe, 2 young specimens.

[8580.2] Budapest, District IX, Szent István Hospital, on the walls of building C and building H, 5 and 1 specimens, respectively, in both cases near to old vertical water drainage pipes.

Asplenium trichomanes L.

[8169.2] Mosonmagyaróvár, on the northeast-facing side of a ruined wall adjacent to the main building of the Castle, 4 specimens.

[8380.1] Szentendre, Templom square, on the vertical wall of an external stairs made of sandstone adjacent to the Roman Catholic church, about 30 specimens.

[8480.1] Budapest, District III, Aquincum, on the ruins of the Roman Amphitheatre, 4 specimens.

[8480.3] Budapest, District II, at the cross of Csopaki street and Lorántffy Zsuzsanna street, on a stone wall, 300 specimens; District III, Mátyás-hegy, on calcareous natural rock at the entrance of a cave, 5 specimens; between the two entrances of the Pálvölgyi-cseppkőbarlang on natural cliff, 1 specimen; District XII, Szent János Hospital, on a stone wall near to building 19 and on the inner courtyard of the heating centre of the hospital, 9 and 2 specimens, respectively; Margitsziget, Szent Mihály Chapel, 7 specimens.

[8482.1] Gödöllő, Erzsébet-park, on the vertical surface of the Queen Erzsébet memorial cliff, few specimens.

[8580.2] Budapest, District IX, Szent István Hospital, several specimens on the walls of various buildings in the hospital, most of them at dripping water drainage pipes.

[9392.2] Békéscsaba, Szent István square, on the wall of the Downtown Roman Catholic Church, 3 specimens.

Athyrium filix-femina (L.) Roth

[8274.4] Komárom, on the Hungarian side of the Erzsébet Bridge, on the bridge pillar, 1 large specimen.

[8375.4] Tata, at the main entrance of the Castle's yard, on the outer surface of the wall, 1 old specimen with sporangia.

[8480.4] Budapest, District XIV, Thököly street 58, on the northwest wall of the Rózsafüzér Királynéja Church, 2 specimens (in the church's garden a planted specimen was also found).

Cyrtomium falcatum (L. f.) C. Presl

[8580.2] Budapest, District IX, at Building H of the Szent István Hospital, on the wall of a heated building, 1 specimen with sporangia.

Cystopteris fragilis (L.) Bernh.

[8375.2] Tata, Alkotmány street 3/a, in the watermill ditch, cca. 10 specimens.

[8375.4] Tata, in the court of the Castle, on the wall of the north rondella, cca. 30 specimens; at the main entrance of the Castle's court, on the outer surface of the wall, 9 specimens.

[8580.1] Budapest, District I, Nap-hegy, Tigris street 4, in crevices of the retaining wall, 1 specimen.

Dryopteris filix-mas (L.) Schott

[8375.2] Tata, Alkotmány street 3/a, in the watermill ditch, 1 vigorous specimen.

[8375.4] Tata, at the main entrance of the Castle's court, on the outer surface of the wall, 6 specimens.

[8479.4] Budapest, District II, Szépjuhászné, on the ruins of the Budaszentlőrinc Pauline Monastery, 2 specimens; and some further specimens with sporangia in an old well, near the ruins of the Monastery.

[8480.2] Budapest, District IV, Újpest, Görgey Artúr street 99, on the clinker brick wall of a one-storey house, near to the water drainage pipe, 1 old specimen.

[8480.3] Budapest, District II, on the wall of the Irgalmasrendi Hospital, 2 specimens; District II, Rókushegyi lépcső 9, on a stone fence, 1 specimen; District II, Újlak, Darázs street, on a retaining wall, 3 specimens; District II, Fény street, between buildings number 10 and 12, behind the water drainage pipe, 1 specimen; District II, Fillér street 25, on a sandstone wall, 2 specimens; District XII, Szent János Hospital, near water drainage pipes of several buildings, altogether cca. 20 specimens.

[8480.4] Budapest, District XIV, Stefánia boulevard, on the fence of the sports stadiums, 1 specimen.

[8580.2] Budapest, District IX, Szent István Hospital, near water drainage pipes of several buildings, and on damp walls, altogether cca. 30 specimens.

Gymnocarpium robertianum (Hoffm.) Newman

[8480.3] Budapest, Margitsziget, on the ruined walls of the Dominican Order Monastery, 4 vigorous specimens with sporangia.

[8580.1] Budapest, District I, Nap-hegy, in front of Tigris street 2–4, in crevices of the retaining wall, 5 small sized specimens, one of them with sporangia.

[8580.2] Budapest, District IX, Szent István Hospital, on the walls of Buildings R and H, altogether 3 specimens.

Polystichum aculeatum (L.) Roth

[8375.4] Tata, at the main entrance of the Castle's yard, on the outer surface of the wall, 1 specimen.

[8379.1] Pilisszentkereszt, Canyon, in the left bank of the creek, on calcareous rocky surface under deep shade, 1 specimen.

[8479.4] Budapest, District II, Szépjuhászné, near the ruins of the Budaszentlőrinc Pauline Monastery, in an old well, 1 specimen.

[8480.3] Budapest, District XII, Szent János Hospital, on the walls of Building 2 and 9, and also on the Audiology-Otoneurology building, altogether 5 specimens.

[8480.4] Budapest, District XIV, Thököly street 58, on the wall of the Rózsafüzér Királynéja Church, 2 young specimens.

[8580.1] Budapest, District I, Buda Castle, in an old well at the northwest end of the Royal Palace, 15-20 specimens; on the castle wall next to the Budapest History Museum, 1 specimen. The latter occurrence is mentioned by Somlyay (2011), too (most probably these two observations concern the same fern individual).

[8580.2] Budapest, District IX, Szent István Hospital, on clinker brick walls near to old water drainage pipes of Building C and H, altogether 5 specimens.

Pteridium aquilinum (L.) Kuhn

[8580.1] Budapest, District VIII, Clinical Departments of the Semmelweis University at Üllői avenue, on the clinker brick wall of the Ear-Nose-Laryngeal Clinic, 1 specimen.

[8580.2] Budapest, District IX, Szent István Hospital, behind an old water drainage pipe of Building J, 4 specimens of which 2 were strong and tall individuals with sporangia; on the clinker brick wall of Building H, near to an old water drainage pipe, 2 specimens.

Pteris cretica L.

[8480.3] Budapest, District XII, Szent János Hospital, Building 20, in a wall crack next to the frame of a basement window, 1 young specimen.

Pteris* cf. *multifida Poir.

[8580.2] Budapest, District IX, Szent István Hospital, on the clinker brick wall of Building R under the influence of the more or less continuous steam flow from a nearby ventilation window of the heating centre, cca. 40 specimens, most of them with sporangia.

Thelypteris palustris Schott

[8480.3] Budapest, Margitsziget, on the ruined walls of the Dominican Order Monastery, 2 specimens.

[8580.1] Budapest, District I, Buda Castle, southeast of the Budapest History Museum, on a ruined wall of the courtyard, 1 specimen. Czúcz (2004) also reported a specimen from a nearby section of the castle wall where we have not found it now.

[8580.2] Budapest, District IX, Szent István Hospital, on the wall of Building H near to a water drainage pipe, 3 specimens; on the clinker brick wall of Building R under the influence of the more or less continuous steam flow from a nearby ventilation window of the heating centre, 1 specimen.