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STOMATAL ANATOMY ALLOWS CLARIFICATION OF HISTORICAL COLLECTIONS OF *BUXBAUMIA* SPECIES IN HUNGARY

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Abstract: *Buxbaumia aphylla* and *B. viridis* differ in the situation of their stomata with respect to the outer surface of the capsule wall. In *B. aphylla* stomata are deeply immersed (cryptopore), whereas in *B. viridis* they are only very shallowly immersed and thus nearly superficial (phaneropore). This feature is illustrated and was used to revise the historical collections of the two species in BP. It proved successful in particular in those cases where poor material of the sporophytes did not allow a certain determination using standard morphological characters. Among these critical specimens some had been formerly revised by Beáta Papp, but these revisions are herewith rejected. The distribution based on the revised historical collections of the two species is shown in two maps.

Key words: *Buxbaumia aphylla*, *Buxbaumia viridis*, cryptopore stomata, phaneropore stomata, illustrations, distribution maps, revision of specimens

INTRODUCTION

Information on the stomata in the sporophyte of the two species of *Buxbaumia* Hedw. occurring in Europe, *B. aphylla* Hedw. and *B. viridis* (Moug. ex Lam. et DC.) Brid. ex Moug. et Nestl., is not normally included in floras and handbooks (missing e.g. in Mönkemeyer 1927, Smith 1978, Frahm and Frey 1983, 2004, Wiklund 2006, Schofield 2007). When stomata are mentioned, the stomata of *B. aphylla* are characterized as immersed (cryptopore), whereas those of *B. viridis* are described as superficial (phaneropore) (Limpricht 1895, Warnstorf 1903–1906, Brotherus 1923, Nyholm 1981, Sauer 2000, Smith 2004). However, a different character state is attributed to *B. viridis* by Lawton (1971: 29 'stomata immersed') and by Cros *et al.* (2007: 140 'estomas criptóporos'). Illustrations of the stomata are even more rarely encountered. In Nyholm (1981: 650, Fig. 425) drawings of the surface view of stomata of both *Buxbaumia*

species can be found, Landwehr (1984: Pl. 17) displays a stoma of *B. aphylla*, and in Crum and Anderson (1981: Fig. 614 D) a portion of the capsule wall of the same species with two stomata in surface view is shown. In the overview of stomata of British bryophytes by Paton (1957: Fig. 8), an instructive illustration of a vertical section through the immersed stoma of *B. aphylla* is displayed. We have not found any illustrations of the stomata of *B. viridis* in section.

In most cases, the sporophytes of the two species can be easily told apart on the basis of their shape, colour and other morphological details (e.g. the partial peeling off of the epidermis in *B. viridis*, producing a feature commonly called indusium, which is not observed in *B. aphylla*), but there may be cases when it is less straight-forward to make a specific determination, e.g. when sporophytes are immature, damaged or otherwise abnormal. In these cases, stomatal anatomy can provide an additional clue.

Some of the historical collections of *Buxbaumia* species in the bryophyte collection of the Hungarian Natural History Museum, Budapest (BP) were recently the subject of controversial interpretation. In 2014, J. Csiky examined the *Buxbaumia* collection of BP. He found that some of the *B. viridis* specimens had been revised as *B. aphylla*, although, according to his field experience, the original determinations had been correct. However, he did not annotate the specimens, but brought his findings to the attention of the curators and of P. Erzberger in the same year. It was therefore thought useful, to examine these specimens with respect to their stomatal anatomy.

MATERIAL AND METHODS

All historical collections (1949–1966) of *Buxbaumia aphylla* and *B. viridis* collected in present-day Hungary and housed in the bryophyte collection of the Hungarian Natural History Museum, Budapest (BP) were revised, in critical cases by studying stomatal anatomy. For this purpose, a sporophyte was detached and boiled for some minutes in tap water or 2% aqueous KOH solution, until the tissues were soft and could be easily sectioned using a razor blade. After cutting the urn in halves and removing internal tissue from the neck, the portion containing stomata was mounted on a slide with the external surface upside for inspection. In superficial view, the stomata appear more transparent than the surrounding cells due to the air cavity in the underlying tissue. Deeply and shallowly immersed stomata can be easily distinguished by differential focussing. If necessary, longitudinal sections were prepared manually. Drawings were made using a Leitz drawing apparatus, photomicrographs were prepared with a Nikon Eclipse E-200 microscope and a QImaging MicroPublisher 3.3 RTV camera.

Distribution maps were prepared on the basis of the Central European mapping scheme (Király *et al.* 2003, Bartha *et al.* 2015).

RESULTS AND DISCUSSION

In the sporophytes of both *Buxbaumia* species, the stomata are restricted to a narrow zone at the junction of the capsule neck to the seta. In Figures 1 and 2 the stomata of the two *Buxbaumia* species are shown in surface view (photomicrographs) and in section (drawings). The stomata of *B. aphylla* (Figs 1A, 2A) are deeply immersed, appearing even more so, as the surrounding epidermal cells rise well above the general level of the epidermis. The term 'cryptopore' perfectly describes this situation. The stomata of *B. viridis* (Figs 1B, 2B), on the other hand,

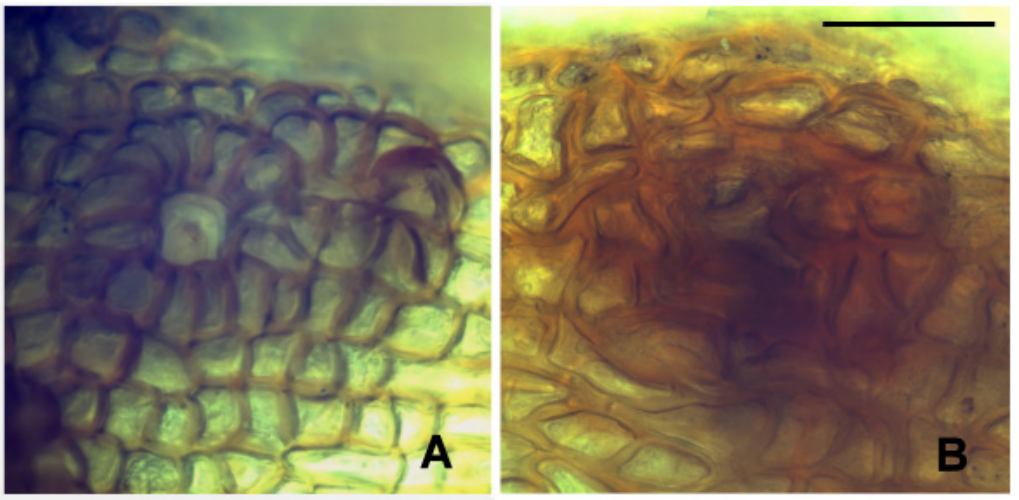

Fig. 1. Stomata of *Buxbaumia* in surface view. – A = *Buxbaumia aphylla* (Erzberger 24170); B = *Buxbaumia viridis* (Erzberger 9492). Scale bar: 20 μm.

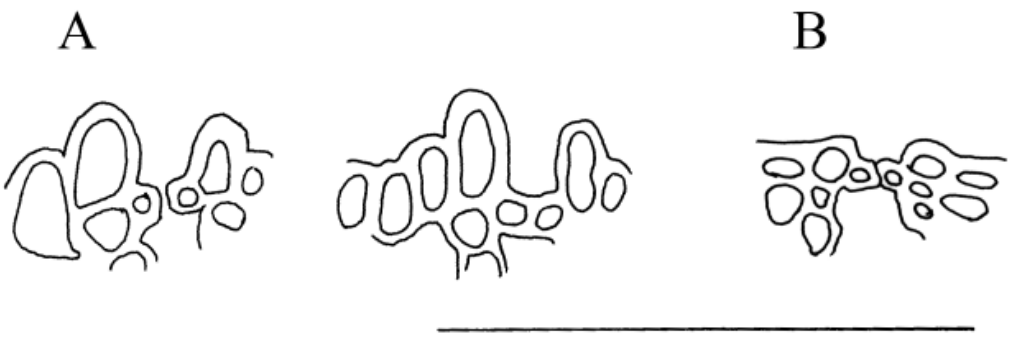

Fig. 2. Stomata of *Buxbaumia* in longitudinal section. – A = *Buxbaumia aphylla* (Erzberger 19608); B = *Buxbaumia viridis* (Erzberger 19609). Scale bar: 200 μm.

differ at first glance, since they are nearly at the same level as the surrounding epidermal cells. However, they are not quite exactly superficial, and the term 'phaneropore', although denoting the essential difference with respect to *B. aphylla*, is a slight over-simplification. The terms 'deeply' and 'shallowly immersed', respectively, describe the difference between the species more precisely. However, since the stomata of *B. viridis* are only very slightly immersed, in contrast to the deeply immersed stomata of *B. aphylla*, the traditional use of phaneropore for the former may still be justified. Strictly speaking, the statements of LAWTON (1971) and CROS *et al.* (2007) that the stomata of *B. viridis* are immersed or cryptopore cannot be disproved, although without further elaboration they are somewhat misleading.

At the time of this revision, 75 specimens of *Buxbaumia* collected in present-day Hungary were inserted in BP, mostly collected by Á. Boros and L. Vajda in the 20th century (1949–1966), and 4 specimens collected between 1999 and 2000 by B. Papp. Since the present account deals only with the historical collections, the 4 recently collected specimens are not evaluated here. All specimens examined could unambiguously be named to species level. 61 specimens correspond to *B. aphylla*, and 10 to *B. viridis*. Details can be found in Appendix 1.

Figures 3 and 4 show the distribution of *B. aphylla* and *B. viridis* in Hungary, respectively, according to the results of the present revision.

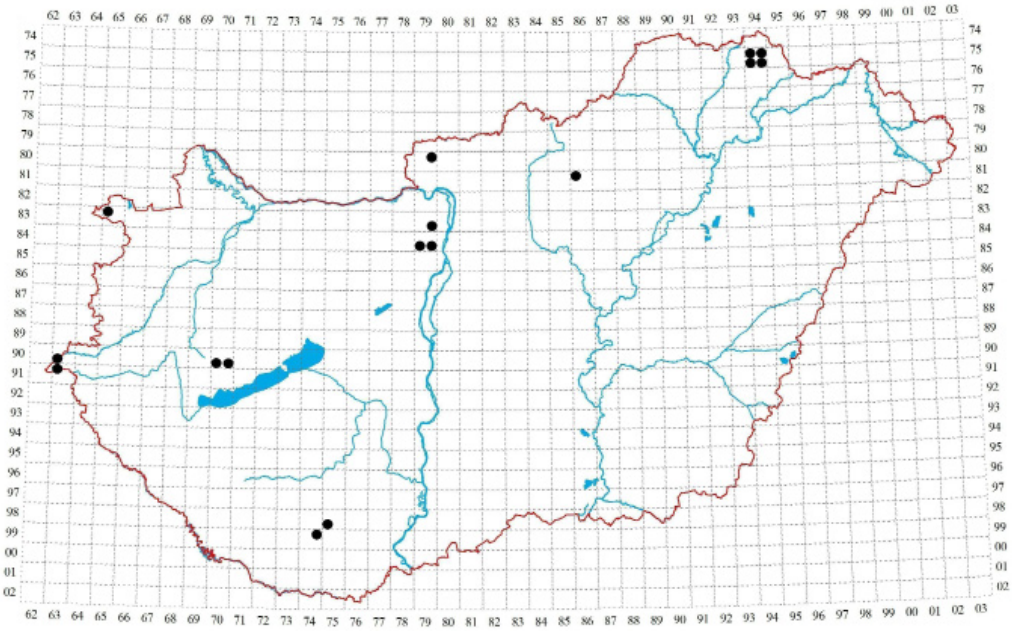

Fig. 3. Distribution of *Buxbaumia aphylla* in Hungary based on revised historical collections (1949–1966) in BP.

When these results are compared with the original determinations effected by the collectors, it turns out that all ten specimens of *B. viridis* were correctly named. Similarly, 60 specimens of *B. aphylla* had the correct determination, whereas a single specimen of *B. aphylla*, collected and determined by L. Vajda as *B. indusiata* Brid., was originally misidentified.

However, during a revision carried out in 2001, eleven historical specimens originally determined as *B. viridis* were annotated by Beáta Papp, and in these annotations, four specimens were redetermined as *B. aphylla*, whereas three more specimens were considered doubtful; only three specimens were confirmed as *B. viridis*, and in one case (BP 47586), the annotation is not conclusive. It is evident from the annotations that the presence of an indusium was assumed to be essential for the sporophyte of *B. viridis*, and that a coarsely papillose seta would indicate *B. aphylla*. These characters, however, should not be over-estimated. The indusium is best developed during spore maturation, but is not yet seen in young, unripe capsules. The papillosity of the seta, on the other hand, is a difficult character, since the seta of *B. aphylla* is very coarsely papillose, whereas that of *B. viridis* is moderately to coarsely papillose.

Papp and Ódor (2006) analysed the distribution of *B. viridis* in Hungary on the basis of the specimens housed in BP. Based on an earlier publication (Papp *et al.* 2003) and the revision as detailed above (see Appendix 1), they claim that

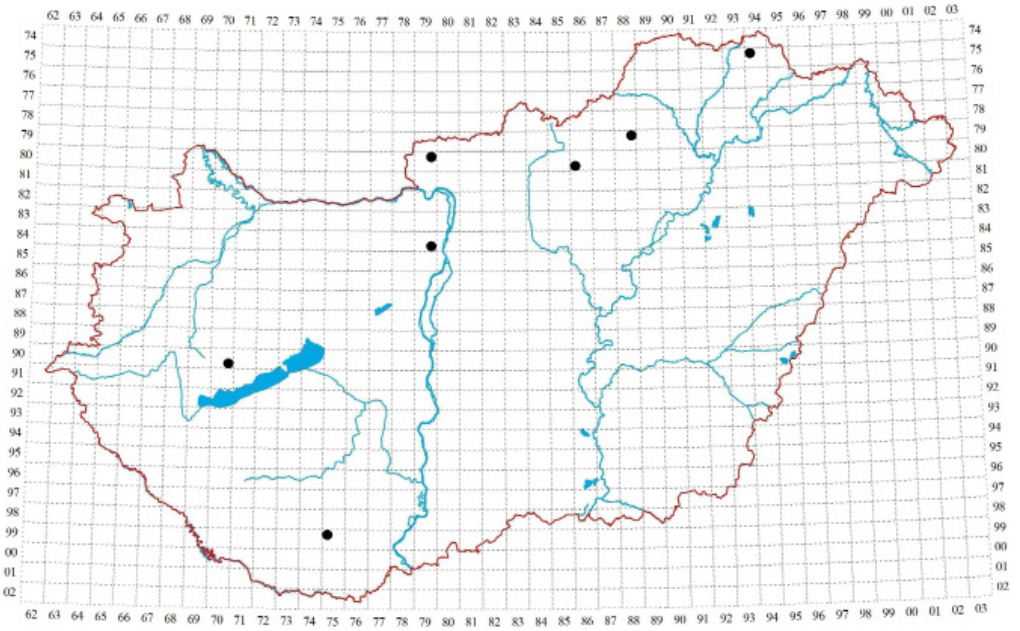

Fig. 4. Distribution of *Buxbaumia viridis* in Hungary based on revised historical collections (1950–1960) in BP.

four among the seven localities where the species was collected earlier cannot be counted, since in two cases (Mátra Mts and Mecsek Mts) the species was misidentified *B. aphylla*, and in two other cases (Börzsöny Mts, Buda Mts) the specimens did not allow a safe determination since the material was inadequate.

As seen in Appendix 1, according to the present revision, the revision of B. Papp must be rejected. This implies also, that some of the statements in publications based on that revision (Papp *et al.* 2003, Papp and Ódor 2006, Papp *et al.* 2014) need correction.

It is very interesting to consider the substrate on which the *B. viridis* specimens were collected. All except one (Bükk Mts) represent terricolous stands of *B. viridis*. It is most significant that this fact was evidently known already to the authors of the standard handbooks on Hungarian bryophytes (Boros 1953, 1968, Orbán and Vajda 1983), yet in their characterisation of the habitat they focus on rotten wood and mention soil as exceptional substrate only ('An faulenden Baumstümpfen und anderen faulenden Unterlagen in Wäldern, sehr selten auch auf humushaltigem Kieselboden in Wäldern mit *B. aphylla*': Boros 1968: 396). Possibly they were influenced by their experience from collecting trips in the Carpathians. This might be suggested by the phrasing in Boros (1953), which partly refers to the spruce zone in higher mountains, absent from present-day Hungary: 'Korhadó fatönkökön, erdei korhadékon, nagyon ritkán sovány erdei talajon is, a fenyőövben is ritka, nálunk nagyon ritka' (Boros 1953: 346, underlined by P. Erzberger).

CONCLUSIONS

All historical collections (1949–1966) of *Buxbaumia viridis* in Hungary except one (Bükk Mts) represent terricolous stands. Since 2014, a project tackled by J. Csiky and co-workers (Deme *et al.* 2017) deals with the recent distribution and habitats of *B. viridis* in Hungary, the results of which will be published soon.

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Összefoglaló: Jelen tanulmány a *Buxbaumia aphylla* és a *B. viridis* spóratokján elhelyezkedő gázcserenyílások anatómiai különbségeit és azok kiemelkedő taxonómiai értékét tárgyalja, különösen az egyéb morfológiai bélyegek alapján nehezen vagy egyáltalán nem határozható herbáriumi példányok esetében. A *B. aphylla* sztómája mélyen ülő, ún. kriptopór jellegű, ezzel szemben a *B. viridis* gázcserenyílása csak alig észrevehetően besüllyedő, ún. faneropór. Fenti differenciális mikroszkopikus bélyegek alapján az elmúlt időszakban revideálásra került a Magyar Természettudományi Múzeum mohagyűjteményének (BP) 1949 és 1966 között gyűjtött historikus *Buxbaumia*-anyaga. Ezen átfogó revízió eredményét közli jelen írás mind enumeráció, mind elterjedési térképek formájában.

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Appendix 1

Specimen details of historical collections (1949–1966) of *Buxbaumia aphylla* and *B. viridis* from Hungary in BP.

The following items are given: Floristical region in Hungary, grid cell according to the Central European mapping scheme (Király *et al.* 2003, Bartha *et al.* 2015), inventory number in BP, species name according to label, original text of label normally giving county, habitat, location and toponym, elevation above sea level (optional), date of collection and name of collector; revisions by B. Papp and P. Erzberger, with details from the annotations where appropriate.

Abbreviations: leg. = collected by; det. = identified by; rev. = revised by; conf. = confirmed by; dupl. = duplicate.

Buxbaumia aphylla

(The only revised specimen is underlined)

Zemplén Mts: **7594.1** – BP 63399 *Buxbaumia aphylla* L. Comit. Abaúj-Torna. In Quercetis supra vallem rivi Osvapatak, prope pag. Telkibánya, montes Sátorhegység, 18.09.1959, leg. L. Vajda. – BP 150793 *Buxbaumia aphylla* L. Comit. Abaúj-Torna. In Vaccinietis silvat. sept. montis Farkas-hegy prope Telkibánya, 500 m s. m., 19.10.1959, leg. Á. Boros. – **7594.2** – BP 27365 *Buxbaumia aphylla* L. Comit. Abaúj-Torna. In Quercetis in decl. montis Hosszúhegy supra vall. Koncvölgy prope pag. Nagybozsva, montes Sátorhegység, 30.06.1954, leg. L. Vajda, dupl. BP 150790. – BP 48535 *Buxbaumia aphylla* L. Comit. Abaúj-Torna. In sylvestribus montis Magas Szőllőskehegy prope pag. Nagybozsva, montes Sátorhegység, 02.09.1956, leg. L. Vajda. – **7594.3** – BP 56766 *Buxbaumia aphylla*

L. Comit. Abaúj-Torna. In Quercetis supra vallem Határvölgy ad Kőkapu, prope pag. Pálháza, montes Sátorhegység, 08.09.1956, leg. L. Vajda (cum *Diphyscium sessile* (Schmid.) Lindb., *Leucobryum, Scapania*). – BP 59953 *Buxbaumia aphylla* L. Comit. Abaúj-Torna. Ad margines sylvarum in decl. montis Sólyomkő supra vallem Susulyavölgy prope Pálháza, montes Sátorhegység, VII 1958, leg. L. Vajda. – **7594.4** – BP 25305 *Buxbaumia aphylla* L. Comit. Abaúj-Torna. In vaccinieto-callunetis Borzás-oldal prope pag. Pálháza, sol. andesit., 3–400 m s. m., 28.06.1949, leg. Á. Boros, dupl. BP 150791, BP 150792. – BP 150789 *Buxbaumia aphylla* L. Comit. Abaúj-Torna. In vaccinieto-callunetis Borzás-oldal prope pag. Pálháza, sol. andesit., 3–400 m s. m., 06.07.1949, leg. Á. Boros. – BP 2604 *Buxbaumia aphylla* L. Comit. Abaúj-Torna. In pinetis montis Borzásoldal prope pag. Pálháza, 03.08.1953, leg. L. Vajda. – BP 48538 *Buxbaumia aphylla* L. Comit. Abaúj-Torna. In pinetis montis Borzásoldal prope pag. Pálháza, montes Sátorhegység, 06.09.1956, leg. L. Vajda. – BP 48537 *Buxbaumia aphylla* L. Comit. Abaúj-Torna. Ad margines sylvarum montis Gillevári erdő, prope pag. Pálháza, montes Sátorhegység, 07.09.1956, leg. L. Vajda (cum *Diphyscium sessile* (Schmid.) Lindb.). – BP 56767 *Buxbaumia aphylla* L. Comit. Abaúj-Torna. In sylvestribus supra vall. rivi Komlóskapatak, prope pag. Pálháza, montes Sátorhegység, 11.09.1956, leg. L. Vajda. – BP 48536 *Buxbaumia aphylla* L. Comit. Abaúj-Torna. Ad margines sylvarum montis Jajhegy supra vall. Kemencevölgy prope pag. Pálháza, montes Sátorhegység, 15.09.1956, leg. L. Vajda. – BP 59954 *Buxbaumia aphylla* L. Comit. Abaúj-Torna. In rupestribus montis Kerekkő Nagyhangyás ad Kőkapu prope pag. Pálháza, montes Sátorhegység, 12.07.1958, leg. L. Vajda. – BP 59939 *Buxbaumia aphylla* L. Comit. Abaúj-Torna. In sylvestribus prope pag. Nagyhuta supra vallem rivi Sompatak, montes Sátorhegység, 20.07.1958, leg. L. Vajda. – **Mátra Mts**: **8186.1** – BP 150794 *Buxbaumia aphylla* L. Comit. Heves. In declivibus silvat. pedis montis Hosszúbérc in valle Ilona-völgy prope Parádfürdő, 300 m s. m., 29.09.1956, leg. Á. Boros (with a note: Vajda L. gyűjtésében tokos példány is van. Boros. (2 setae, coarsely papillose)). – **Börzsöny Mts**: **8079.2** – BP 63400 *Buxbaumia aphylla* L. Comit. Nógrád. In rupibus umbrosis montis Sasfészek supra vall. Rakottyásvölgy, prope Királyháza, montes Börzsöny, 09.05.1959, leg. L. Vajda (cum *Lophozia alpestris* (Schl.) Evans). – **Pilis Mts**: **8379.4** – BP 25302 *Buxbaumia aphylla* L. Com. Pest. In declivibus sept. montis Oszoly ad margines sylvarum, 14.04.1952, leg. L. Vajda. – BP 150795 *Buxbaumia aphylla* L. Com. Pest. In declivibus septentrionalis montis Oszoly prope pag. Margitliget 200–250 m s. m., 14.04.1952, leg. L. Vajda. – BP 39054 *Buxbaumia aphylla* L. Comit. Pest. In fruticetis in decl. sept. montis Oszoly prope Margitliget, 27.03.1955, leg. L. Vajda (cum *Isopaches bicrenatus*, *Cephaloziella Starkei*, *Dicranum scopar.*). – BP 64216 *Buxbaumia aphylla* L. Comit. Pest. In decl. sept. montis Oszoly prope pag. Csobánka, 16.04.1961, leg. L. Vajda. – BP 71243 *Buxbaumia aphylla* L. Comit.

Pest. In silvestribus in decl. sept. montis Oszoly, prope pag. Csobánka, 04.06.1966, leg. L. Vajda. – **Buda Mts**: **8479.3** – BP 63816 *Buxbaumia aphylla* L. Comit. Pest. In sylvestribus montis Hosszúhajtáshegy prope pag. Budakeszi, 21.03.1959, leg. L. Vajda. – BP 150785 *Buxbaumia aphylla* L. Comit. Pest. In arenoso-glareosis humosis silvat. sept. montis Hosszúhajtás-hegy pr. Budakeszi, 250–300 m s. m., 21.03.1959, leg. Á. Boros, dupl. BP 150786 (with a note: Spora No 87 *Buxbaumia aphylla* Budakeszi 1959), dupl. BP 150787, BP 71339 *Buxbaumia aphylla* L. Hungaria centr. In betuletis prope pag. Budakeszi. Comit. Pest, 28.03.1965, leg. L. Vajda. – BP 150781 *Buxbaumia aphylla* L. Comit. Pest. In decliv. arenac. silvat. montis Hosszúhajtás-hegy prope Budakeszi, 250 m s. m., 28.03.1965, leg. Á. Boros. – BP 71340 *Buxbaumia aphylla* L. Hungaria centr. Comit. Pest. In sylvaticis prope pag. Budakeszi, 04.04.1965, leg. L. Vajda. – BP 150783 *Buxbaumia aphylla* L. Comit. Pest. In decl. arenac. silvat. montis Hosszúhajtás-hegy prope Budakeszi, 250 m s. m., 04.04.1965, leg. Á. Boros. – **8479.4** – BP 150784 *Buxbaumia aphylla* L. Hungaria centr., com. Pest. In declivibus bor.-or. silvaticis montis Nagyhárshegy supra Hüvösvölgy, Budapest, 300 m s. m., 05.03.1950, leg. L. Vajda. – BP 47586 *Buxbaumia indusiata* Brid. Comit. Pest. In decl. viae cavae sylvaticae montis Hárshegy, supra Hüvösvölgy, Budapest, 10.02.1957, leg. L. Vajda (with a note: a very young capsule, and a strange one with angle Papp B. 2001.06.) Revision: poor material; 1 sporophyte examined: *Buxbaumia aphylla*, stomata cryptopore, rev. P. Erzberger, IV 2015. – BP 47587 *Buxbaumia aphylla* L. Comit. Pest. In decl. viae cavae sylvaticae montis Hárshegy, supra Hüvösvölgy, Budapest, 10.02.1957, leg. L. Vajda. – BP 59641 *Buxbaumia aphylla* L. Budapest, Hárshegy, 01.03.1959, leg. L. Vajda. – BP 71706 *Buxbaumia aphylla* L. Com. Pest. In Quercetis montis Hárshegy, Budapest, 13.11.1966, leg. L. Vajda (*Buxbaumia aphylla*, stomata immersed, conf. P. Erzberger, IV.2015). – **Bakony Mts**: **9070.3** – BP 150777 *Buxbaumia aphylla* L. Comit. Zala. In callunetis glareosis ad rivum Lepence prope Uzsapuszta, 200 m s. m., 18.05.1949, leg. Á. Boros. – BP 150778 *Buxbaumia aphylla* L. Comit. Zala. In Callunetis glareosis vallis rivi Lepence inter pag. Lesenceistvánd et Sümeg, 200 m s. m., 18.05.1949, leg. Á. Boros. – BP 150779 *Buxbaumia aphylla* L. Comit. Zala. In callunetis in collibus glareosis supra rivum Lepence prope Uzsa, 200 m s. m., 07.06.1950, leg. Á. Boros. – (9070.3 or south) BP 25304 *Buxbaumia aphylla* L. Comit. Zala. In callunetis glareosis ad rivum Lepence prope Uzsapuszta, 200 m s. m., 18.05.1949, leg. Á. Boros. – BP 58585 *Buxbaumia aphylla* L. Flora hungarica. Comitat Zala. In callunetis pr. praed. Uzsapuszta, 18.05.1949, leg. Á. Károlyi det. Á. Boros. – BP 150775 *Buxbaumia aphylla* L. Comit. Zala. In callunetis in collibus glareosis prope Uzsa, 200 m s. m., 07.06.1950, leg. Á. Boros (with a note: második, délebbi termőhely l. Fl. jegyz. p. 99.). – BP 26491 *Buxbaumia aphylla* L. Comit. Veszprém. In callunetis prope pag. Uzsa (1 sz. lelőhely), 22.09.1953, leg. L. Vajda. – BP 150780 *Buxbaumia aphylla* L.

Comit. Zala. In Betuletis collium glareos. supra vallem Lepence prope Uzsa, 200 m s. m., 22.09.1953, leg. Á. Boros. – BP 150788 *Buxbaumia aphylla* L. Comit. Zala. Ad terram silvaticam in fagetis Kisbakonyi-erdő prope Uzsa, 200 m s. m., 02.05.1954, leg. Á. Boros. – BP 27257 *Buxbaumia aphylla* L. Comit. Veszprém. In sylva Kisbakonyi erdő prope Uzsa, 03.05.1954, leg. L. Vajda. – **9070.4** – BP 62556 *Buxbaumia aphylla* L. Comit. Veszprém. In silvestribus Viszlói erdő prope pag. Tapolca, 02.05.1959, leg. L. Vajda. – BP 150782 *Buxbaumia aphylla* L. Comit. Zala. In glareosis humosis partis occ. silvae Viszlói-erdő prope Tapolca, 180 m s. m., 02.05.1959, leg. Á. Boros. – **Sopron Mts**: **8365.1** – BP 25508 *Buxbaumia aphylla* L. Comit. Sopron. Ad vias sylvarum cum Vaccinium myrtillus in monte Károlymagaslat, prope pag. Sopron, 19.05.1953, leg. L. Vajda (*Pleuridium subulatum* (Hedw.) Rabenh. also present), dupl. BP 150776. – BP 150773 *Buxbaumia aphylla* L. Sopron (Károlymagaslat), II.1953, leg. Héder S. főiskolai hallgató. – **Vendvidék**: **9063.3** – BP 46804 *Buxbaumia aphylla* L. Comit. Vas. In pinetis prope pag. Alsószölnök, 11.07.1955, leg. L. Vajda. – BP 47038 *Buxbaumia aphylla* L. Comit. Vas. In fruticetis prope Götzmajor prope pag. Alsószölnök, 13.07.1955, leg. L. Vajda (zuzmókat det. Szatala, *Cladonia rangiformis*, *C. pyxidata*, *C. bacillaris*). – **9163.1** – BP 150774 *Buxbaumia aphylla* L. Comit. Vas. In apertis glareos. pinetorum montis Stroski-vrch prope Felsőszölnök, 350 m s. m., 09.10.1949, leg. Á. Boros. – **Mecsek Mts**: **9875.3** – BP 25301 *Buxbaumia aphylla* L. Com. Baranya. In Quercetis cum Leucobryum supra vall. Lámpásvölgy ad Hidegkút prope pag. Pécs, 29.06.1952, leg. L. Vajda. – BP 150752 *Buxbaumia aphylla* L. Comit. Baranya. In humosis silvat. acid. ad Hidegkút sub monte Misina prope Pécs, 400 m s. m., 29.06.1952, leg. Á. Boros. – BP 150753 *Buxbaumia aphylla* L. Comit. Baranya. In Querceto-Luzuletis ad fontem Hidegkút vallis Lámpás-völgy pr. Pécs, 400 m s. m., 06.04.1953, leg. Á. Boros. – **9974.2** – BP 22839 *Buxbaumia aphylla* L. Comit. Baranya. In Quercetum siccum in decl. merid. montis Jakabhegy, prope pag. Magyarürög, 05.04.1953, leg. L. Vajda. – BP 150751 *Buxbaumia aphylla* L. Comit. Baranya. In petrosis arenaceis silvat. merid.-or. montis Jakab-hegy prope Pécs, 3–500 m s. m., 05.04.1953, leg. Á. Boros.

Buxbaumia viridis

Zemplén Mts: **7594.1** – BP 63034 *Buxbaumia indusiata* Brid. c. fr. Comit. Abaúj-Torna. In Quercetis montis Nagy-Hemzső-hegy prope pag. Telkibánya, montes Sátorhegység, 19.06.1960, leg. L. Vajda. Revisions: est! B. Papp 06.2001; *B. viridis* conf. P. Erzberger 04.2015 (*Dicranum scoparium* also present; collected on soil). – **Bükk Mts**: **7988.2** – BP 150743 *Buxbaumia indusiata* Brid. Comit. Borsod. Ad lign. putresc. In silvis sept. montis Hollókő prope Nagyvisnyó, 7–800 m s. m., 07.08.1953, leg. Á. Boros. Revisions: est! B. Papp, 06.2001; *B. viridis* conf.

P. Erzberger, 04.2015 (collected on rotten wood). – **Mátra Mts**: **8086.3** – BP 47585 *Buxbaumia indusiata* Brid. Comit. Heves. Ad margines sylvarum in valle rivi Köszörűspatak prope pag. Parádvásár, montes Mátra, 01.10.1956, leg. L. Vajda. Revisions: *Buxbaumia aphylla* Hedw. No indusium, seta coarsely papillose B. Papp, 06.2001; *Buxbaumia viridis*, stomata phaneropore conf./rev. P. Erzberger, 04.2015 (*Hypnum cupressiforme*, *Plagiochila porelloides*, *Atrichum undulatum* also present, collected on soil). – BP 150744 *Buxbaumia indusiata* Brid. Comit. Heves. In declivibus silvat. pedis montis Hársas-tető in valle rivi Köszörűs-patak prope Parád, 350 m s. m., 01.10.1956, leg. Á. Boros. Revisions: *Buxbaumia aphylla* Hedw. No indusium, seta coarsely papillose B. Papp, 06.2001; *Buxbaumia viridis*, stomata phaneropore conf./rev. P. Erzberger, 04.2015 (collected on soil). – **Börzsöny Mts**: **8079.2** – BP 63106 *Buxbaumia indusiata* Brid. Comit. Nógrád. In rupibus umbrosis montis Rakottyásbérc supra vall. rivi Bacinapatak prope Királyháza, montes Börzsöny, 08.05.1959, leg. L. Vajda. Revisions: young capsule, doubtful B. Papp, 06.2001; *Buxbaumia viridis*, capsule shape diagnostic, capsule nearly mature in May conf./rev. P. Erzberger, 04.2015. (*Plagiochila porelloides* also present; collected on soil). – **Buda Mts**: **8479.4** – BP 150745 *Buxbaumia indusiata* Brid. Hungaria centr., com. Pest. In Quercetis glareosis in declivibus bor. or. montis Nagyhárshegy supra Hüvösvölgy, Budapest, 05.03.1950, leg. L. Vajda. Revisions: est! cf. capsules young, seta not coarsely papillose B. Papp, 06.2001; *Buxbaumia viridis*, stomata phaneropore conf./rev. P. Erzberger, 04.2015 (*Polytrichum juniperinum*, *Dicranella heteromalla*, *Pohlia nutans*, *Hypnum cupressiforme* also present; collected on soil). – BP 59640 *Buxbaumia indusiata* Brid. Budapest, Hárshegy, 01.03.1959, leg. Á. Boros. Revisions: est! cf. capsules young, seta not coarsely papillose B. Papp, 06.2001; *Buxbaumia viridis*, stomata phaneropore conf./rev. P. Erzberger, 04.2015 (*Dicranella heteromalla* also present; collected on soil). – **Bakony Mts**: **9070.4** – BP 62565 *Buxbaumia indusiata* Brid. c. fr. Comit. Veszprém. In silvestribus Viszlói erdő prope pag. Tapolca, 02.05.1959, leg. L. Vajda. Revisions: est! B. Papp, 06.2001; *B. viridis* conf. P. Erzberger, 04.2015 (*Hypnum cupressiforme* also present; collected on soil). – **Mecsek Mts**: **9975.1** – BP 25303 *Buxbaumia indusiata* Brid. Com. Baranya. Cum *Leucobryum* in valle Égervölgy prope pag. Magyar Ürög, 27.06.1952, leg. L. Vajda. Revisions: *Buxbaumia aphylla* Hedw. No indusium. B. Papp, 06.2001; *Buxbaumia viridis*, stomata phaneropore conf./rev. P. Erzberger, 04.2015 (*Leucobryum* sp., *Dicranum scoparium*, *Polytrichum formosum*, *Hypnum cupressiforme* var. *lacunosum*, *Pseudotaxiphyllum elegans*, *Lepidozia reptans* also present; collected on soil). – BP 150746 *Buxbaumia indusiata* Brid. Comit. Baranya. In humosis silvaticis vallis Éger-völgy prope Magyarürög, 27.06.1952, leg. Á. Boros. Revisions: *Buxbaumia aphylla* Hedw. No indusium. B. Papp, 06.2001; *Buxbaumia viridis*, stomata phaneropore conf./rev. P. Erzberger, 04.2015 (*Plagiochila porelloides*, *Pseudotaxiphyllum elegans* also present; collected on soil).