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REVIEW in POLISH BOTANY CENTENNIAL

Zapiski bryologiczne by Kazimierz Szafnagel and His Herbarium in the Historical Context of Bryological Studies in Lithuania and Adjacent Regions

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Abstract

Zapiski bryologiczne, a book written by Kazimierz Szafnagel, is a report on the author's bryological studies conducted between 1882 and 1885 in the territories of present-day Belarus, Lithuania, Poland, and Ukraine. The book was published in 1908 by the Society of Friends of Science in Vilnius after a long period of publishing stagnation caused by the closure of Vilnius University in 1832. Amateur botanist Szafnagel was among the first members to establish the society and was responsible for its botanical collections. In *Zapiski bryologiczne*, Szafnagel provided 245 moss species from the study areas. In 2018, Szafnagel's bryophyte collection, comprising 667 moss specimens, was found at the Vilnius University Herbarium. These voucher specimens cover all the collection sites described in Szafnagel's work. The majority of herbarium specimens (88%) were collected in the territory of Belarus. Szafnagel recognized 225 species in his original collection, but as a result of the current revision, their number decreased to 211 species. This set opened up new possibilities for evaluating the results of Szafnagel's study, such as confirming the exact specimen referred to in his publication, clarifying the species according to modern nomenclatural concepts, and assessing the impact of landscape changes on the distribution and conservation status of rare species. Szafnagel's published work and his herbarium can be considered as common heritage of the history of the natural sciences in Belarus, Lithuania, Poland, and Ukraine.

Keywords

Belarus; mosses; Poland; the Society of Friends of Science in Vilnius; Ukraine; Vilnius University Herbarium (WI)

1. Historical Context

The publication *Zapiski bryologiczne* [Bryological notes] (Figure 1) (Szafnagel, 1908) on the diversity of mosses covering the areas occurring in the contemporary territories of Belarus, Lithuania, Poland, and Ukraine (Figure 2), published 114 years ago, occupies a special place in the history of bryological sciences and botanical research in these territories. This was the first publication specifically dedicated to the moss flora of the region, and no less important is the historical context in which it was published.

In this region, botanical research was always associated with the development of educational institutions in Vilnius (Bieliński, 1899–1900; Grębecka, 1988, 1998). At the end of the eighteenth century, Professor Jean Emmanuel Gilibert (1741–1814) at the Principal School of Grand Duchy of Lithuania, in his compendium of *Flora lituanica inchoata* (Gilibert, 1781, 1782), mentioned 81 species of bryophytes from

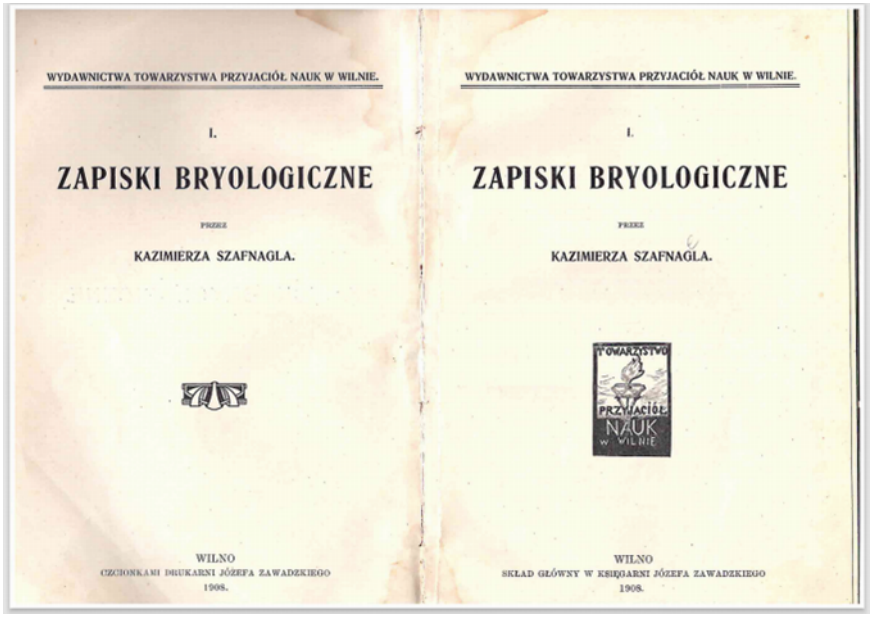

Figure 1 Title pages of *Zapiski bryologiczne.*

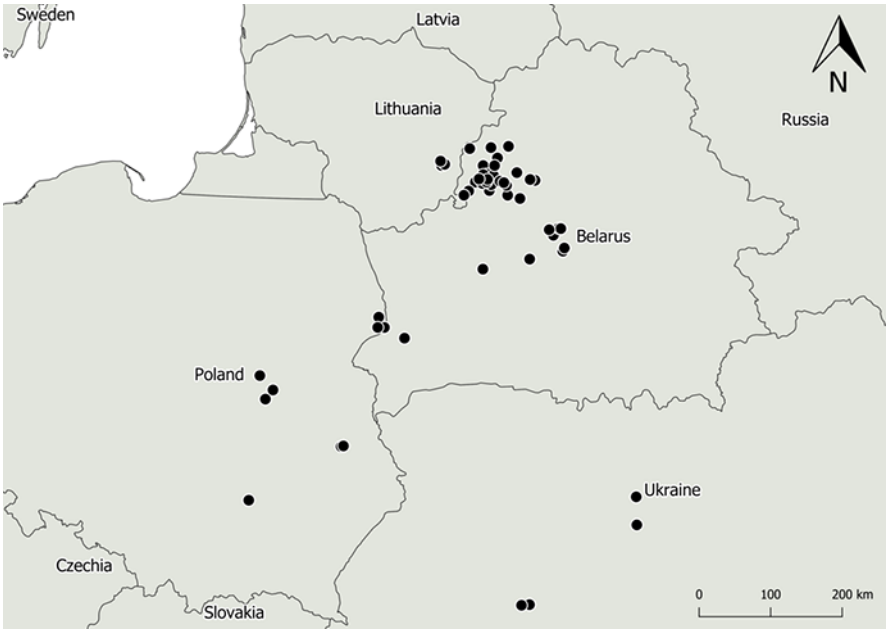

Figure 2 Map showing the locations explored by K. Szafnagel.

around Grodno. After returning to France in 1873, he published another compendium for plants with the title *Exercitia phytologica*, in which of the 1,200 plant species from the Grand Duchy of Lithuania (GDL), he listed 67 species of bryophytes (Gilibert, 1792). However, Gilibert did not consistently employ the Linnaean system of binary nomenclature for species; therefore, *Flora lituanica* and *Exercitia phytologica* are listed in Appendix VI "Opera utique oppressa" of the *International Code of Nomenclature for Algae, Fungi, and Plants* (McNeill, 2006; McVaugh, 1949). Further information on bryophytes comes from Stanisław Bonifacy Jundziłł (1761–1847), a professor of natural sciences at Vilnius University (Vilnius Principal School and Imperial Vilnius University) and head of the Botanical Garden. In the compendium *Opisanie roślin w Prowincyi W. X. L., naturalnie rosnących, według układu Linneusza* [Description of naturally growing plants in the Province of Grand Duchy of Lithuania according to the Linnaeus system] (S. B. Jundziłł, 1791)

and its second edition *Opisanie roślin litewskich według układu Linneusza* [Description of Lithuanian plants according to the Linnaeus system] (S. B. Jundziłł, 1811) covering Lida, Shchuchyn (present-day Belarus), and Vilnius (present-day Lithuania), he reported 49 and 35 species of bryophytes, respectively.

The most valuable early information on bryophytes from the territory around present-day Lithuania was from the 1820s and was presented by Józef Jundziłł (1794–1877), a professor at Imperial Vilnius University, head of the Department of Botany and Botanical Garden. He was a pupil and the successor of S. B. Jundziłł. In 1821, J. Jundziłł performed a physiographical expedition from Vilnius to the Baltic Sea. During this expedition, he authored reports that included lists of plants recorded in the places he visited. Therefore, unlike those of his predecessors, J. Jundziłł's lists were linked to particular sites. These reports are currently stored in the Lithuanian State Historical Archives under signature F. 721, Inventory 1, File 101. They were also published in the periodical issued by the Pharmaceutical Department of the Vilnius Society of Medicine *Pamiętnik Farmaceutyczny Wileński* (J. Jundziłł, 1821a, 1822). In the same periodical, J. Jundziłł also published a list of mosses from around Vilnius (J. Jundziłł, 1821b). After some time, J. Jundziłł published the book *Opisanie roślin w Litwie, na Wołyniu, Podolu i Ukrainie dziko rosnących, iako i oswoionych: podług wydania szesnastego układu roślin Linneusza* [Description of wild and cultivated plants in Lithuania, Volhynia, Podolia, and the Ukraine: Based on the sixteenth edition of Linnaeus plants] (J. Jundziłł, 1830), in which he recorded 160 species of bryophytes. This publication may be considered the most comprehensive compendium of bryophytes from the former GDL in the nineteenth century. Jundziłł's data is valuable because it was a specimen-based catalogue, and the voucher herbarium specimens are currently stored in the herbarium at the W. Szafer Institute of Botany, Polish Academy of Sciences in Kraków (KRAM) (Jukonienė, 2018; Köhler, 1995).

From the end of the eighteenth century to the middle of the nineteenth century, botanical research, including bryological studies, increased owing to the work by professors at Vilnius University. Botanical studies continued even after the Vilnius University was closed in 1832 due to the November uprising of Poles and Lithuanians against the Imperial Tsarist Government in 1830–1831. The research continued at the Department of Medicine and Surgery, which was related to the natural sciences and reformed to the Vilnius Medical and Surgical Academy (VMSA). Stanisław Batys Gorski (Górski) (1802–1864) taught botany as a subject to future pharmacists and doctors. Although Górski did not publish any contribution on bryophytes in the periodicals, he did collect most of the 1,300 bryophyte specimens from that period, which were in the possession of the Vilnius University Herbarium (Jukonienė et al., 2018).

The situation changed considerably when the VMSA was closed down in 1842. Only some data on bryophytes from contemporary Lithuania were published by amateurs (Łapczyński, 1884; Pabrėža, 1900). The western part of present-day Belarus also remained uninvestigated as it had previously been the subject of investigations mainly by botanists at Vilnius University. After the closure of Vilnius University, a few mentions of mosses from present-day Lithuania and Belarus were provided by Weinmann (1845a, 1845b, 1846). In 1832, the University of Warsaw was closed for the same reasons as Vilnius University (Majewski, 2010), and was then reopened in 1862 as Warsaw High School, after which the Cabinet of Botany began to operate therein. Only a few works unrelated to the University of Warsaw mentioned bryophytes from the Białowieża Forest (Błoński & Drymmer, 1889; Błoński et al., 1888).

With the exception of Central-Eastern Europe, bryological studies in Europe have developed rapidly since the 1830s. The monumental *Bryologia europea* by Bruch et al. (1836–1855) was completed. This was followed by two editions of *Synopsis muscorum europaeorum* (Schimper, 1860, 1876), which were intended to cover moss flora distributed throughout Europe. In addition, several regional floras and taxonomic treatments in Central and Western Europe were published, including work by Chałubiński (1882), De Notaris (1838), Juratzka (1882), Limpricht (1876a,

1876b, 1890, 1895, 1904), Milde (1869), Lindberg (1868, 1878), and Warnstorf (1881).

Botany research was also excelling in other neighboring territories belonging to the Russian Empire. In the territories of present-day Latvia and Estonia, as in Lithuania, bryological research began at the end of the eighteenth century, but in the second half of the nineteenth century, it intensified greatly (Ričkienė & Jukonienė, 2018). This led to not only a greater investigation of the distribution and diversity of bryophytes (Girgensohn, 1860; Winkler, 1877), but also novel qualitatively studies, such as those on the chemical composition of bryophytes (Treffner, 1882) and the taxonomy of individual systematic groups (Russow, 1865, 1890, 1894).

2. The Activity of the Society of Friends of Science in Vilnius

A wide gap in the development of science continued throughout the second half of the nineteenth century in contemporary Lithuania and its surrounding regions. For several decades, no botanical research was published in Vilnius. Therefore, in 1908, after a long period of publishing stagnation, it was welcomed when the Society of Friends of Science in Vilnius [Towarzystwo Przyjaciół Nauk w Wilnie] published the *Zapiski bryologiczne* [Bryological notes] by Kazimierz Szafnagel. Scientific societies in the first 2 decades of the twentieth century began to restore scientific development in Vilnius. The idea of creating the Society of Friends of Science in Vilnius was initiated by Vilnius Poles in October 1906. The Russian authorities approved the Society in January 1907, and in March 1907, the first board was formed. The aims of the society were to develop scientific knowledge, skills, and literature in the Polish language and to study the nature, ethnography, history, and economy of the region. In addition, the society committed to collect manuscripts and other archival material, and accumulate museum funds (Ilgiewicz, 2008). Since 1907, the society has published the periodical *Rocznik Towarzystwa Przyjaciół Nauk w Wilnie* and initiated the series of scientific works *Wydawnictwa Towarzystwa Przyjaciół Nauk w Wilnie*. The first issue of the series, *Zapiski bryologiczne*, was published in 1908. The fact that the first book published by the society was dedicated to the study of bryophytes is surprising. Because of their features, these plants are usually much less studied by naturalists than vascular plants. The author of the publication, Szafnagel, was a member of the Society of Friends of Science in Vilnius since 1907 and was among the first members who established the society (Ilgiewicz, 2008). Szafnagel was responsible for the botanical collections belonging to the Society of Friends of Science in Vilnius (Zahorski, 1908). He also donated his herbarium to the society's collections (Szafnagel, 1908).

3. Biographical Sketch of Kazimierz Maksymilian Szafnagel

Kazimierz Maksymilian Szafnagel (Szafnagl) (1858–1923) (Figure 3) owned the Kuszlany (Bel. Kushlyany) manor in Oszmiana (Bel. Ashmyany) Powiat. He was a descendant of German merchants born in Berdyczów (Ukr. Berdychiv) (Northern Ukraine). His father had connections to the January Uprising (Pol. *powstanie styczniowe*; Lith. *1863 metų sukilimas*) of 1863, and for this reason, he was exiled to Siberia. Consequently, Szafnagel grew up with his aunt, who was from the famous and noble Radziwill (Pol. Radziwiłł, Lith. Radvilos) family (Butkiewicz, 2021). Szafnagel spent his childhood in a manor named Annopol (Bel. Anopal') located near Minsk (Belarus), which belonged to the Radziwill family. He studied at Warsaw Gymnasium and graduated with a gold medal. In 1875, he began studying in the Chemistry Department of Riga Polytechnic Institute (present-day Latvia). During his studies, he was an active member of the Polish Youth Corporation, Arkonia. In 1880, he graduated from the Chemistry Department of Riga Polytechnic Institute. After his studies, Szafnagel moved to Oszmiana Powiat and settled in Kuszlany. Szafnagel was interested in different fields, such as literature, botany, and agriculture, and was an active participant in the cultural and social life of the region. Szafnagel published social and political articles in the newspapers *Kurjer Litewski* and *Kuryer Wileński*, and supported the activities of agricultural groups and other organizations (Butkiewicz, 2021; Mowszowicz, 1987; Szwejcerowa, 1970). He participated in the

Figure 3 Kazimierz Maksymilian Szafnagel (1858–1923) (Butkiewicz, 2021).

creation of the Society of Friends of Science in Vilnius and was the first chairman of the Belarusian Scientific Society (Ilgiewicz, 2017). It is important to note that in various reports and newspaper notes, he signed interchangeably as either "Kazimierz Szafnagel" or "Kazimierz Szafnagl." The same spelling of the surname was provided by Jankowski (1896): "At present Kazimierz Szafnagl who got married with Marja, the only daughter of Konstanty Sulistrowski permanerntly lives in Kuszlany." Some Polish authors (e.g., Mowszowicz, 1987; Szymkiewicz, 1925) have spelled his name in the Polish version as "Szafnagiel."

Szafnagel actively participated in the activities of the Physiographical Commission of the Class of Mathematics and Natural Sciences (Butkiewicz, 2021), which acted within the Academic Society of the Cracow (1815–1872) and later as a part of the Academy of Sciences and Letters (ASL) (since 1919, Polish ASL) (Fedorowicz, 1971, Köhler, 2002). While Szafnagel was a member of the commission, other members included prominent Polish botanists, such as the well-known geobotanist Antoni Rehman (1840–1917), a professor at the University of Lviv, and Józef Rostafiński (1850–1928), a professor at Jagiellonian University (Ferdynand, 1911; Köhler, 2002). Work in the commission with famous plant researchers motivated Szafnagel as a self-taught botanist. The knowledge he acquired helped him to manage the botanical collections of the Nature Section of the Museum of Society of Friends of Science in Vilnius, part of which consisted of his own herbarium.

4. *Zapiski bryologiczne*

The book is a report on the bryological trips made by Szafnagel to various places in the country in 1882–1885. Initially, he planned to publish his data on bryological research in *Pamiętnik Fizyjograficzny* – a Polish periodical dedicated to the natural sciences, issued in Warsaw in 1881–1922. However, when the Society of Friends of Science in Vilnius started to publish a series, there was an opportunity to publish this work as a separate book. On October 17, 1907, *Kurjer Litewski* (No. 232) was informed that the Society of Friends of Science in Vilnius was ready to publish Szafnagel's work on mosses. The following year, on April 12, 1908 (No. 85), the same newspaper stated that the book had already been published.

The introduction of *Zapiski bryologiczne* shows Szafnagel's visible erudition, his preparation for this work, and his enthusiasm. Despite being an amateur, he was well acquainted with the study of bryophytes in various European countries, stating: "Every province of England, France, Germany and Scandinavia have very detailed summaries and descriptions of cryptogamous plants, growing there, thanks to hundreds of specialists, amateurs, among whom we can see professors and teachers, doctors and priests, pharmacists, landowners, etc." Because his research was

Table 1 Szafnagel's data on bryophyte diversity in the regions investigated by him in 1882–1885.

Territory (following *Zapiski bryologiczne*)	Number of bryophyte species provided in the book (according to Hodgetts et al., 2020)	Number of herbarium specimens in the collection	Number of species in the collection	
			Named by Szafnagel	Following revision
Vilnius–Minsk region	209(211)	592	210	192
Białowieża Forest	73(72)	17	11	9
Volhynia	78(77)	17	8	8
Podolia	52(51)	21	14	18
The environs of Pilawa, Wilga, and Otwock	45(45)	5	3	5
The environs of Szydłów	14(14)	5	2	4
The environs of Milejów	6(6)	10	3	4

conducted in a region where moss research was poor, to follow the examples in other countries, Szafnagel introduced a book with the most essential bryological literature for beginners, referring to Filipowicz's (1883/1884) popular book on mosses and Kummer's (1880) book on microscopy. He also mentioned works by famous bryologists, such as Milde (1869), Girgensohn (1855), and Heugel (1865). *Synopsis Muscorum Europaeorum* (Schimper, 1876) was cited as the most monumental work.

Szafnagel was not only familiar with the bryological literature but also maintained contact with other researchers. He sent a collection of *Sphagnum* to Professor Carl Warnstorf (1837–1921) in Berlin. He was particularly involved with another enthusiastic researcher Tytus Chałubiński (1820–1889) (Szwejcerowa, 1970), a Polish physician and co-founder of the Polish Tatra Society who encouraged him to study bryophytes. Later in *Zapiski bryologiczne*, Szafnagel enthusiastically encouraged everyone to be interested in bryophyte studies: "we should follow the example of the West and in the footsteps of many generations of naturalists."

In the main part of the book, Szafnagel provided data on moss diversity in seven territories. The exploration of the region was not uniform, ranging from exhaustive long-term investigations of the Vilnius–Minsk region to short-term excursions in the Milejów area (Poland) (Table 1). For this reason, the characteristics of the sites themselves and lists of species vary widely within a given scope.

The largest explored territory was the Vilnius–Minsk region, named by Szafnagel as "Wyniosłości Wileński and Miński" [Wilno and Mińsk uplands]. This territory probably corresponds to the region of Minsk and Ashmena (Bel. Asmyany; Lith. Ašmena) uplands. The latter upland stretches from Vilnius to the Western Berezina River in Belarus (Pukelytė, 2001). The territory covered various habitats and was studied from 1882 to 1885, resulting in the most significant number of recorded species. A total of 209 bryophyte species were found in this territory. This is the first list of moss species with precise locations for this area. Although the uplands are referred to by the names of the capitals of Lithuania and Belarus, the investigated area mainly covers the western part of present-day Belarus (Figure 2). In the current list of bryophyte flora of Belarus, ten species are based exclusively on Szafnagel's data (Jukonienė et al., 2022). In Lithuania, the investigations exclusively covered some hills of the city of Vilnius. However, there were four species (*Encalypta streptocarpa*, *Nyholmiella obtusifolia*, *Tortula protobryodes*, and *Trichodon cylindricus*) in addition to those found in present-day Lithuania by J. Jundziłł at the middle of the nineteenth century (Jukonienė, 2018; J. Jundziłł, 1821a, 1821b, 1822, 1830; Köhler, 1995). The diversity of mosses in the Vilnius–Minsk region is presented by providing a description of the scientific structure, such as the genus name, species list within the genus with a precise description of habitats and localities, and notes on fruiting. Szafnagel also has 49 varieties, half of which are *Sphagnum* species. Despite the diligence in the list brown mosses, the list of *Sphagnum* appears to have been written in haste and can give the impression of being a draft.

Notably, when presenting the list of mosses in this area, Szafnagel gives Polish names for mosses of each genus and species, in addition to their Latin names. He coined Polish names for 39 genera. As many as six genera are referred to using these names (Ochyra et al., 2003).

In addition to an exhaustive list of mosses in the study area, the author provided a detailed geological description of the study area, describing every hill, river, lake, mire, and forest by using geological and geographical knowledge, evaluating the bryophyte diversity of every habitat, and explaining local cataclysms (sometimes with deep analysis of the geological processes that have taken place and affected the moss flora and sometimes simply admiring them or remaining apprehensive). Current issues are also discussed by Szafnagel: "It is the habitat of the species, already disappearing in Europe as the result of cutting down old forests, which it liked and without which it cannot live, it finds a safe haven for itself. Is it for long?"

Szafnagel visited six other territories described in his treatment in 1885. Their lists are not as comprehensive as those collected in the Vilnius–Minsk region. The moss diversity in Białowieża Forest is presented in the trip description: he indicated site-specific and habitat-specific moss species. Finally, in most cases, he provided a complete list of them, without precise locations and habitats. Błoński and Drymmer, who visited the place in 1887 and 1888 (Błoński & Drymmer, 1889; Błoński et al., 1888), were usually cited as the first researchers of the Białowieża flora. However, in terms of moss research, Szafnagel was undoubtedly the first to visit the Białowieża Forest in 1885. The species list includes as many as 72 moss species (21 from previously mentioned researchers).

Moss surveys of Volhynia (Ukr. Volyn′) and Podolia (Ukr. Podillya) were also considered the first surveys of the bryoflora of these territories (Bachurina, 1984). Briefly mentioning the visited places, he provided a short description of the mosses that were collected. Szafnagel noticed marked differences in the bryofloras of previously studied areas. The objects of his admiration in Volhynia were mosses growing on rocks (*Bartramia pomiformis*, *B. oederi*, *Encalypta ciliata*, *Grimmia commutata*, *G. leucophaea*, *Orthotrichum anomalum*, *O. cupulatum*, *O. patens* and *O. pumilum*). In Podolia, he noticed that "moss vegetation mostly occurs hidden in forests, in Tołtry and in ravines, as is characteristic of the southern zone."

At the time of his investigation, the territories that he studied belonged to the Russian Empire. However, Szafnagel avoids specifying this. At various times, the territories were lands of the former GDL (Vilnius–Minsk region, Białowieża Forest, Volhynia, and Podolia) (Petrauskas, 2022), which he called Litwa (Lithuania) or ethnographic Lithuania. When discussing the diversity of mosses in the Vilnius–Minsk region, he referred to the bryological flora of Lithuania and Belarus. In other territories, Szafnagel used the name of the Kingdom (i.e., the Kingdom of Poland). Research on mosses has not been extensive and has been more random. Notably, during the excursions lasting several days in the Otwock peat bog, he collected materials to compare the mosses growing there with those preserved in peat. Familiar with mosses observed around Milejów and Szydłów during short trips, Szafnagel mentioned several of them in his tour descriptions.

Considering territoriality, *Zapiski bryologiczne* can be compared to J. Jundziłł's last work (1830). However, Szafnagel's research was broader in terms of moss species diversity; he mentioned 245 moss species, while there are 160 bryophyte species in the book by J. Jundziłł.

5. Szafnagel's Bryophyte Collection

As previously mentioned, Szafnagel donated his collection to the Society's Museum (Szafnagel, 1908).

After Szafnagel's death in 1923, the Society's Museum was reorganized. In 1928, natural collections were moved to Stefan Batory University, which functioned in Vilnius between 1919 and 1939. Jakub Mowszowicz (1957, 1987) and Alicja Zemanek (2006) claimed that the interwar herbarium was preserved in the

Figure 4 The labels of the specimens from the bryophyte collection of K. Szafnagel.

Department of General Botany at the Stefan Batory University. However, there is no evidence that any researcher at the university has studied the Szafnagel herbarium.

Antanas Minkevičius (1931), the pioneer of Lithuanian bryological research, emphasized the important contribution of Szafnagel to the knowledge of bryoflora but did not mention the herbarium. The collection of mosses was not known to Lithuanian botanists of later generations. However, for many years, it was nearby, stacked in cardboard boxes, and stored at the Herbarium of Vilnius University. The initial description of the collection stated that it was assembled in the nineteenth century from foreign countries, with the author being an unknown Polish researcher. In 2018, when managing the herbarium funds of Vilnius University and researching old moss collections, attention was given to the collection, which consisted of more than 500 sheets with moss specimens. The collector was not mentioned on the labels, but a detailed description of the localities and habitats was key to ascertaining that Szafnagel was the author of the collection. This accidentally discovered set opened new possibilities for evaluating the results of the Szafnagel study. The collection has been revised from 2016 to 2021.

We found 531 sheets of moss specimens collected by Szafnagel. The specimens of mosses (667) in the Szafnagel collection were generally stored compressed between sheets of paper or in paper envelopes glued to a sheet of thin paper measuring 21 cm × 26.5 cm, and each placed in a sheet of 44 cm × 27 cm paper of the same type folded in half. One to four specimens of different moss species or specimens of the same species, but from different locations, were attached to this sheet of paper. The label was typically located at the bottom. The names of moss species were indicated in Latin, and information about their habitat was provided in Polish. The year was written in Arabic numerals, while the month was written in Roman numerals or alphabetically in Polish. The labels were handwritten in black. The author named nearly all specimens in the collection. They were assigned to 225 species. Only 13 specimens were not named, and eight were identified at the genus level. Notably, the authorships provided for the species differed from those in the book. The herbarium labels are characterized by the most common instructions (author abbreviations in parentheses) (Figure 4).

Specimens were collected over a 4-year period: 1882 (25 specimens), 1883 (235), 1884 (299), and 1885 (100). During the first two years (1882–1883), Szafnagel investigated mosses in and around Kuszlany, where he lived (Figure 5). However, these studies did not conclude later. In 1884, he visited territories further away (Vilnius, the environs of Lake Naroch′, Ilska Forest, etc.). Finally, 1885 was the year

Figure 5 Specimen collected in Kuszlany, the place where K. Szafnagel lived and died (now in Belarus).

on his farthest journey. He visited the Białowieża Forest, Volhynia, Podolia, and the areas west of his place of residence (the environs of Szydłów, Milejów, Pilawa, Wilga, and Otwock). Therefore, the collection covered all territories described in the book (Table 1, Figure 2).

Most herbarium specimens (88%) were collected from the Vilnius–Minsk region. Only eight species provided in the book for this territory were not supported by

herbarium specimens. We did not find any specimen of the epilithic species *Andreaea rupestris*, which is one of two records of the species in Belarus (Rykovskiĭ & Maslovskiĭ, 2004). A specimen of *Weissia crispula*, currently *Hymenoloma crispula*, supporting the presence of this species in the bryoflora of Belarus, has also not been found. In addition, there were no specimens labelled as *Bryum cirrhatum*, *Dicranella rufescens*, *Hypnum nemorosum*, *Orthotrichum affine*, *Plagiothecium roeseanum*, or *Thuidium delicatulum*; however, these species are listed in *Zapiski bryologiczne*.

Collections from other territories were inferior. The specimens from Podolia represented only 50% of the species provided in the book, and those from Białowieża Forest and Volhynia represented only up to 25%. We found only single specimens collected from contemporary Poland (Table 1). However, the reason for the small number of specimens in these areas remains unclear. It is possible that Szafnagel collected a few specimens in these areas, often only of those species that were not found in the regions studied earlier. However, even in this case, there are no vouchers for the first recording of the species *Barbula muralis* and *Orthotrichum leiocarpum* (Białowieża Forest), *Barbula pulvinata*, *Hypnum sarmentosum* (from Szydłów environs), *Barbula intermedia*, *B. tortuosa*, *Eurhynchium vaucheri*, *Neckera crispa*, *Pseudoleskea catenulata*, *Trichostomum rubellum* (Podolia), *Grimmia commutata*, *G. leucophaea*, *Mnium riparium*, *Orthotrichum cupulatum*, *O. patens* and *O. pumilum* (from Volhynia). Although unlikely, it is possible that some specimens have fallen into other herbarium collections as specimens with an unknown author in the twists and turns of history.

Szafnagel's bryophyte collection allowed us to confirm the exact specimens referred to in his book. After redetermination, the specimens following Hodgetts et al. (2020), were assigned to 211 species. The following species were represented by numerous specimens: *Drepanocladus aduncus* (Hedw.) Warnst. (16 specimens), *Sanionia uncinata* (Hedw.) Loeske (16), *Hypnum cupressiforme* Hedw. (14), *Scorpidium cossonii* (Schimp.) Hedenäs (14), *Cratoneuron filicinum* (Hedw.) Spruce (13), *Calliergonella cuspidata* (Hedw.) Loeske (12), and *Warnstorfia fluitans* (Hedw.) Loeske (12). Following the revision, 142 of the specimens were identified as species other than those indicated on the labels. Due to this redetermination, we found no specimens to support the occurrence of the 24 species listed in *Zapiski bryologiczne* (Table 2). Most of these species were from the Vilnius–Minsk region.

However, following the revision of the specimens, the list of species provided in *Zapiski bryologiczne* was supplemented by the following species: *Dicranella heteromalla* (Hedw.) Schimp., *Hygroamblystegium humile* (P. Beauv.) Vanderp., Goffinet & Hedenäs, *H. varium*, *Paraleucobryum longifolium*, *Philonotis calcarea* (Bruch & Schimp.) Schimp. *Plagiomnium ellipticum* (Brid.) T. J. Kop., *Pohlia filum* and *Pseduscleropodium purum* (Hedw.) M. Fleisch. ex Broth. (Vilnius–Minsk region), *Exsertotheca crispa* (Hedw.) S. Olsson, Enroth & D. Quandt (from Białoweża Forest), and *Trematodon ambiguous* (Hedw.) Hornsch. (Pilawa, Wilga, and Otwock).

The herbarium specimens allowed us to identify the species according to modern nomenclatural concepts. *Sphagnum magellanicum*, treated more broadly in the past,

Table 2 Species listed by Szafnagel (1908) that are not confirmed following the redetermination of the specimens in his collection.

Species names in Szafnagel (1908)	Current names	Species names after the redetermination
Amblystegium radicale (4)	*Pseudocampylium radicale* (P. Beauv.) Vanderp.	*Hygroamblystegium tenax* (Hedw.) Jenn. (1) *Hygroamblystegium varium* (Hedw.) Mönk. (3)
Brachythecium mildeanum (4)	*Brachythecium mildeanum* (Schimp.) Schimp	*Brachythecium rivulare* Schimp. (4)
Brachythecium plumosum (1)	*Sciuro-hypnum plumosum* (Hedw.) Ignatov et Huttunen	*Brachythecium salebrosum* (Hoffm. ex F. Weber & D. Mohr) Schimp. (1)
Bryum pallens (1)	*Ptychostomum pallens* (Sw. ex anon.) J. R. Spence	*Ptychostomum turbinatum* (Hedw.) J. R. Spence (1)

Continued on next page

Table 2 *Continued.*

Species names in Szafnagel (1908)	Current names	Species names after the redetermination
Bryum pallecens (1)	*Ptychostomum pallescens* Schleich. ex Schwägr.	*Ptychostomum imbricatulum* (Müll. Hal.) Holyoak & N. Pedersen. (1)
Campylopus flexuosus (1)	*Campylopus flexuosus* (Hedw.) Brid.	*Dicranodontium denudatum* (Brid.) E. Britton (1)
Dicranodontium aristatum (1)	*Dicranodontium asperulum* (Mitt.) Broth.	*Paraleucobryum longifolium* (Hedw.) Loeske (1)
Dicranodontium longirostre (1)	*Dicranodontium denudatum* (Brid.) E. Britton	*Paraleucobryum longifolium* (Hedw.) Loeske (1)
Didymodon rubellus (1)	*Bryoerythrophyllum recurvirostrum* (Hedw.) P. C. Chen.	*Didymodon vinealis* (Brid.) R. H. Zander (1)
Eurhynchium confertum (2)	*Rhynchostegium confertum* (Dicks.) Schimp.	*Eurhynchiastrum pulchellum* (Hedw.) Ignatov & Huttunen (2)
Eurhynchium praelongum (5)	*Kindbergia praelonga* (Hedw.) Ochyra	*Hygroamblystegium varium* (Hedw.) Mönk. (1) *Oxyrrhynchium hians* (Hedw.) Loeske (4)
Fissidens incurvus (1)	*Fissidens incurvus* Starke ex Röhl.	*Fissidens bryoides* Hedw. (1)
Hypnum falcatum (4)	*Dichelyma falcatum* (Hedw.) Myrin.	*Drepanocladus sendtneri* (Nees) Lindb. (4)
Hypnum fertile (2)	*Pseudohygrohypnum fertile* (Sendtn.) Jan Kučera	*Hypnum cupressiforme* Hedw. (2)
Hypnum revolvens (7)	*Scorpidium revolvens* (Sw. ex anon.) Rubers	*Hamatocaulis vernicosus* (Mitt.) Hedenäs (1) *Warnstorfia fluitans* (Hedw.) Loeske (6)
Pogonatum aloides (1)	*Pogonatum aloides* (Hedw.) P. Beauv.	*Pogonatum urnigerum* (Hedw.) P. Beauv. (1)
Physcomitrella patens (1)	*Physcomitrium patens* (Hedw.) Mitt.	*Tortula truncata* (Hedw.) Mitt. (1)
Plagiothecium denticulatum (5)	*Plagiothecium denticulatum* (Hedw.) Schimp.	*Herzogiella seligeri* (Brid.) Z. Iwats, (2) *Plagiothecium cavifolium* (Brid.) Z. Iwats, (3)
Pottia intermedia (1)	*Tortula caucasica* Broth.	*Tortula truncata* (Hedw.) Mitt. (1)
Pottia minutula (1)	*Microbryum davallianum* (Sm.) R. H. Zander	*Tortula truncata* (Hedw.) Mitt. (1)
Sphagnum contortum (1)	*Sphagnum contortum* Schultz	*Sphagnum subsecundum* Nees (1)
Trichostomum rigidulum (1)	*Didymodon fallax* (Hedw.) R. H. Zander	*Barbula unguiculata* Hedw. (1)
Webera annotina (1)	*Pohlia annotina* (Hedw.) Lindb.	*Pohlia filum* (Schimp.) Mårtensson (1)
Weisia viridula (1)	*Weissia controversa* Hedw.	*Didymodon vinealis* (Brid.) R. H. Zander (1)

Numbers in parentheses indicate the number of specimens. The current names of the species are based on Hodgetts et al. (2020).

was determined to be *Sphagnum divinum* Flatberg & Hassel (two specimens) and *Sphagnum medium* Limpr. (two specimens) (Hassel et al., 2018).

Finally, precise descriptions of localities and habitats are significant from today's perspective, making it possible to assess the impact of landscape changes on the distribution and conservation status of rare species.

6. Conclusion

From the current point of view, the work *Zapiski bryologiczne* by Szafnagel occupies an especially important place in the history of botanical science as an impressive effort in the study of regional flora. It has also been particularly important in cultural development, since it was published at the beginning of the twentieth century, when there were no scientific institutions in the eastern part of the former Grand Duchy of Lithuania. The discovery of his herbarium has opened up possibilities for using his data in the wider context of modern research, allowing us to specify species distributions and bryophyte checklists in the region, identify species according to current taxonomic concepts, and assess changes in rare species populations in a changing landscape.

Both the published work and the herbarium can be considered as common heritage of the history of the natural sciences in Belarus, Lithuania, Poland, and Ukraine.

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