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Bielański Forest in Warsaw as the object of the oldest floristic and mycological research in Mazovia (Central Poland)

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Abstract

This paper offers a critical analysis of the flora of the Bielański Forest in Warsaw (central Poland), originally documented by Erndtel in 1730. It examines the historical and natural conditions that established the Bielański Forest as one of the earliest botanical research sites in the region and in the country. The analysis identified 36 plant species reported from this location, with 35 species given modern classifications. The findings included one moss, one fern and 33 flowering species. Of these, 15 are common species currently found in the Bielański Forest. An additional seven species were reported in the 19th and early 20th centuries, though they are now only known from other areas in Warsaw and its surroundings. The remaining 13 species have not been observed in the Bielański Forest since Erndtel's time. The study also discusses fungi and lichens documented in the 17th and 18th centuries from Warsaw and its vicinity. Notable plant species identified by Erndtel include *Aruncus sylvestris* Kostel., *Bupleurum longifolium* L., *Phyteuma orbiculare* L. and *Silaum silaus* (L.) Schintz & Thell., which are uniquely located in Bielany and have not been reported elsewhere in Mazovia. Among others, reported in the 19th century in the area, was *Cypripedium calceolus* L., which is very rare in central Poland. The Bielański Forest, one of the most extensively studied natural sites in Mazovia, may serve as a model for understanding the historical transformations of flora. The initial review of Erndtel's list by Hryniewiecki in 1954 now requires verification and correction, and a comprehensive evaluation of Erndtel's work is expected to provide further valuable insights into the history of the region's flora.

Key words

Christian Erndtel, history of science, historical flora of Warsaw, vascular plants, fungi, lichens, 17th and 18th centuries flora, pre-Linnaean plant names

Introduction

Bielański Forest is one of the most valuable and interesting protected sites in Warsaw and Mazovia, both in terms of nature and history. Its natural conditions and the history of ownership and use have created a particularly favourable combination of conditions for conducting scientific research in its area. This resulted in this site becoming one of the first places of botanical and mycological research in Poland. The first documented

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data from its area date back to 1730. Later, Bielański Forest was visited by researchers in increasing numbers and more often. To this day, it is one of the most attractive natural research sites in the region (Baum and Trojan 1982; Łaszek and Sendzielska 1989; Jakubowski et al. 2010; Luniak 2010).

In the recently published monograph (Obidziński 2023), which highlights 100 natural objects investigated by the pioneers of Polish geobotany, the Bielański Forest (Kapler et al. 2023) is featured alongside other significant locations in the Mazovia region, including the renowned Kampinos Forest, which is protected as a national park (Kębłowska et al. 2023). This comprehensive study positions the Bielański Forest among the top 10 sites with the earliest documented botanical research in Poland, following renowned areas such as the Karkonosze Mountains (Matthioli 1565), Babia Góra (Marcin z Urzędowa 1595), the Masłów area in Lower Silesia (Hermann 1711) and the Great Masurian Lakes region (Helwing 1712). Notably, documented floristic studies in the Bielański Forest predate those in other famous locations, such as the Tatras and Pieniny (Herbarium of Brother Cyprian from the Red Monastery – 1766) and the Białowieża Forest (Gorski 1829). Unfortunately, in the aforementioned monograph (Obidziński 2023), the history of geobotanical research in the Bielański Forest is described briefly due to the restrictions on the volume allocated to each site.

The natural exploration of objects with a long history of research is essential for understanding the mechanisms behind ecosystem transformations (e.g., Bakker et al. 1996; Kapfer et al. 2017; Bello et al. 2020). Gathering information on the historical composition of phytocoenoses, such as through herbarium collections or archival records, or by critically revising previously published data, constitutes a valuable aspect of such research. This approach not only aids in interpreting current findings, but also inspires additional research topics of this kind. Bielański Forest, one of the most extensively studied natural areas in Mazovia, serves as an exemplary model in this regard. Therefore, the objective of this work is to present, as accurately as possible, the earliest floristic and mycological studies conducted in the forest up to the end of the 18th century, along with a critical analysis of the existing studies. In addition, the natural context and history of Bielański Forest, which have influenced both the state of its phytocoenoses and the scope of research conducted there, are discussed. In the floristic domain, this study encompasses bryophytes, vascular plants, fungi and lichens.

Material and methods

The central focus of this work is a discussion of Christian Henryk Erndtel's 1730 study on the flora of the Warsaw area, which notably marked the first mention of the Bielański Forest in its species descriptions. This study predates the systematic development of Latin names for plants and animals by Carl Linnaeus in 1735. During Erndtel's time, descriptive names were the norm, often assigned uniquely by individual botanists. This practice resulted in a multitude of synonyms, which is why Erndtel typically provided several names while citing the authors who established them. However, some of the species names used by Erndtel in 1730 remain ambiguous today, even for professional botanists; so, at times, it can be challenging to ascertain the species that a given historical name may refer to.

To identify the listed taxa and establish their contemporary nomenclature, we thoroughly analysed the descriptions prepared by Erndtel, as well as the descriptions and illustrations included in the works referenced by Erndtel (Tab. 1). Based on the collected features, individual species were identified using contemporary taxonomic keys (Tutin et al. 1964–1980; Rutkowski 2004). In addition, descriptions and illustrations were cross-referenced in the works cited by authors mentioned by Erndtel (e.g., Gerard 1636). Historical species names and their synonyms were then verified in Linnaeus's work (1753) and in the current plant synonym databases, including the World Checklist of Vascular Plants (Govaerts 2024), the Global Biodiversity Information Facility and the Euro+Med PlantBase. The Polish folk names and Latin designations utilised by pharmacists in Warsaw during that period, as cited by Erndtel, were also taken into consideration. The resulting diagnoses were verified against the geographic distribution of the identified species, examining both historical sources (Szubert 1824; Rostafiński 1872) and contemporary references (Sudnik-Wójcikowska 1987; Zając and Zając 2001). The contemporary names assigned were aligned with the critical lists currently employed in Poland for various taxonomic groups: vascular plants (Mirek

Table 1. Publications to which Erndtel referred when naming the species found in Bielany, and which were used to identify the nomenclature used

Erndtel's way of citing	Author	Year of publication	Customary abbreviation of the title*	Number of citations
Bernitus	Martin Bernhardi	1652	*Catalogus Plantarum*	3
C.B. Prodr.	Caspar Bauhin	1620	*Prodromus theatri botanici…*	1
C.B.P. / C.B.Pin.	Caspar Bauhin	1623	*Pinax theatri botanici…*	19
Camer. Ep.	Rudolf Jakob Camerer	1694	*De sexu plantarum Epistola*	1
Clusii Hist. Rar.	Carolus Clusius	1601	*Rariorum plantarum historia…*	4
Cord.	Valerius Cordus	1561	*Historiae plantarum…*	3
Dalechampii	Jaques Dalechamps	1586	*Historia generalis plantarum…*	1
Dioscor.	Pedanius Dioskurydes	50–70	*De materia medica…*	1
Dodon. Pempt.	Rembert Dodoens	1583	*Stirpium historiae pemptades…*	17
Gesn.	Conrad Gesner	1555	*Opera botanica…*	1
J.C. Buxbaum in Enum. Plant.	Johann Christian Buxbaum	1721	*Enumeratio plantarum…*	3
J.B.	Johann Bauhin	1651	*Historia plantarum universalis…*	14
Joh. Loselii	Johann Loesel	1703	*Flora Prussica…*	3
Lobel. Icon.	Matthias de L'Obel	1591	*Icones stirpium seu Plantarum…*	8
Matthioli, Oper. Magn. Venet.	Pietro Andrea Matthioli	1571	*Compendium de Plantis Omnibus…*	2
Morison. Hist. 2.	Robert Morison	1715	*Plantarum Historiae Universalis…*	1
Oelhafii in Elench.	Mikołaj Oelhaf	1643	*Elenchus plantarum…*	1
Riv./Rivini.	Augustus Rivinus (Bachmann)	1699	*Ordo Plantarum* (…) *Pentapetalo*	7
Riv./Rivini.	Augustus Rivinus (Bachmann)	1690	*Ordo Plantarum* (…) *Monopetalo*	4
Riv.	Augustus Rivinus (Bachmann)	1691	*Ordo Plantarum* (…) *Tetrapetalo*	1
Rivini ap. Heucherum	Johann Heinrich Heucher	1713	*Novi povenientis Horti medici…*	1
Ruppium Flor. Jenens.	Hainrich Bernard Ruppius	1721	*Flora Jenensis…*	3
Tabernaem. Herbar. Germ.	Hieronymus Bauhin	1664	*New vollkommenlich Kräuter-Buch…*	1
Tabernaemontani Icon	Jacobus Theodorus (Tabernaemontanus)	1590	*Eicones plantarum…*	3
Targi.	Hieronymus Bock (Targus)	1546	*Kreuterbuch…*	1
Thalii Sylv. Harc.	Johann Thal	1588	*Sylva Hercynia…*	1
Tournefort. Inst.	Joseph Pitton de Tournefort	1700	*Tournefort Institutiones rei herbariæ…*	5
Volckamerus in Flora Norimb.	Johann Georg Volckamer	1700	*Flora Noribergensis…*	1
Officinarum	Technical names used in pharmacy			5
Poloni	Common names used in the Polish folk language			11

* – The full title is given in References.

et al. 2020), bryophytes (Ochyra et al. 2003), lichens (Fałtynowicz 2003) and fungi (Wojewoda 2003; Chmiel 2006; Mułenko et al. 2008).

Erndtel has not left any known herbarium sheets to date. However, he provided many important morphological details about plants and made precise references to some of the best publications of his time (Tab. 1). Thus, many of the species he described are distinctive and easy to recognise. Several names he used are still applicable today, such as *Polypodium vulgare*. In these

instances, we can be confident in the accuracy of both the original designations and their current identifications. However, some difficulties arose when recognising certain species and finding their modern synonyms. We indicated them as probable and marked them with a question mark, explaining the uncertainties surrounding their identification.

The initial identification of species listed by Erndtel was conducted and published by Hryniewiecki in 1954. Unfortunately, he assigned contemporary names that bore no relation to those used by Erndtel. Moreover, he did not provide details regarding his methodology or the bibliographic sources he likely consulted to reconcile the names. So, Hryniewiecki's work is discussed later in this article as part of the historical context of research on the Bielany Forest. From a methodological standpoint, it serves as an auxiliary source, and the species diagnoses presented in his work from Bielany were also verified.

Object characteristics

Usage history

The present-day area of Bielany was originally part of the village of Polków, which belonged to the Dukes of Mazovia. In 1526, it was designated as royal property. Since the Middle Ages, the forests in this region have served as a ducal hunting ground, likely known as the Polkowski Forest. In 1639, King Władysław IV transferred the adjacent Polkowska Mountain to the Camaldolese Order. This foundation was officially sanctioned by the parliament in 1641, leading to the arrival of Camaldolese monks from Bielany in Kraków, who began constructing the first buildings of the monastery. Following the death of Władysław IV, the construction continued under the guidance of King John Casimir, who reaffirmed the Order's privileges and allocated additional funds. On his initiative, plans were also set to construct a church. The location near Warsaw, initially called Polkowska Mountain, eventually became known as Royal Mountain. Over time, the area was renamed Bielany due to the distinctive white habits of the monks, and this name evolved to encompass later this entire district of Warsaw (Kosacka 1963; Brykowska 1982a,b; Chojnacki et al. 2010; Zieliński 2010).

In the 17th century, the Bielański Forest was home not only to a monastery and church, but also to a complex of royal court buildings. In 1733, this manor was handed over to the monks and was later demolished. The monks inhabited the enclave granted to them, while royal hunts continued to be organised in the surrounding area throughout the 17th and 18th centuries. Following the partition of the Polish–Lithuanian Commonwealth, the Bielański Forest came under subordinated to Russia government administration in 1796 (Kosacka 1963). In the times of the so-called Kingdom of Poland, a significant part of the forest (approximately 112 ha) was transferred to the Agronomic Institute in Marymont, established in 1816 (Połujański 1854). After the fall of the January Uprising (1864), the tsarist authorities began the gradual liquidation of the Camaldolese Order, which was completed at the beginning of the 20th century. Earlier, after the November Uprising (1831), the Russian military began to reside in the Forest and its outskirts. For military control over the city, the Warsaw Citadel was built at that time south of Marymont (ca. 3 km of the Forest), while a colony of houses for Russian officers of units stationed in the Citadel was built on the outskirts of the Bielański Forest. The camp buildings were located mainly along the then Zakroczym road, that is, at the western edge of the forest. In the 1880s, Fort Bielany, belonging to the outer ring of forts of the Warsaw Fortress, was built on the northern edge of the Forest (Królikowski 2002). The Fort had earthen ramparts surrounded by a dry moat and brick barracks. The combat elements of the Fort were destroyed during the liquidation of the Fort at the beginning of the 20th century, and the barracks were dismantled after World War II. The presence and activity of the military resulted in selective cutting of trees and degradation of the natural phytocoenoses of the Forest (Chojnacki et al. 2010; Nowakowska 2010) as well as the penetration of alien species, as the military houses were accompanied by gardens with ornamental trees and shrubs. These houses were dismantled during World War I, and the accompanying trees and shrubs were almost destroyed. The destruction of herbaceous vegetation and tree and shrub undergrowth in the Forest was also contributed to by the grazing cattle and goats (Kobendza 1929).

In the first half of the 19th century, Bielany Forest also began to serve as a recreational area for the residents of Warsaw. A new paved road was built along the former Zakroczym road, as well as a second new road was built along the Vistula. Along with the territorial

and demographic development of Warsaw, intensive traffic to Bielany and further to Młociny was started on new roads throughout the 19th century. Trips to Bielany became very popular at that time, and the number of visitors on days off reached few thousand carriages and several thousand pedestrians. From the beginning of the 19th century, Bielany was also reached by water. Over time, trips along the Vistula gained popularity, partly due to traffic disruptions related to the construction of the Citadel and partly due to the development of navigation after the introduction of steamships. In the second half of the 19th century, forest authorities began to issue the first-order regulations to protect the Forest from devastation. However, they did not have much effect at the time. A similar situation continued at the beginning of the 20th century. Until 1915, the Forest was managed by military authorities, and it still served recreational functions. In 1934, the entire Forest came under the management of the city authorities. In the 1930s, efforts were made to protect the Bielany Forest. The actions implemented at that time were not very rigorous, not always successful, but generally observed. After World War II, in 1950, the first recreational park in Poland was established in Bielany. It was a place of mass leisure for Warsaw residents, and the anthropopressure associated with it was very intense. The idea of protecting the Forest was implemented in 1973 when a nature reserve was established, and then the liquidation of the Culture Park began, which was finally closed in 1986. Currently, Bielański Forest is managed by the Warsaw Municipal Forests and combines protective and recreational functions (Gail and Kobendza 1932; Baum and Stasiak 1963; Kosacka 1963, 1982; Baum et al. 1982; Nowakowska 2010).

Natural conditions

Bielański Forest is located on the left bank of the Vistula, partly on a glacial plain and partly in the river valley. The plain is separated from the valley by the Bielański Escarpment running through the forest. The area of the plain is referred to as the high terrace – Bielański. Below the edge of the plain, there are three valley terraces descending successively towards the Vistula: dune, middle and flood terrace. The area of the plain is crossed by an erosion ravine of the former Bielański Stream bed. On the dune terrace, there are three fragments of dune ridges rising up to 6 m above the terrace level. The Rudawka stream flows through the flood terrace. The difference in elevation between the Vistula Valley (79 m above sea level) and the highest part of the plain (100 m above sea level) is 21 m. The Escarpment itself reaches a height of about 15 m in the highest places. In geomorphological terms, the terrain here is, therefore, highly diversified in a relatively small area. Such a specific location of the Forest determines a large natural diversity of habitats and soils. It has also been significantly changed in some places by human activity. In addition to the previously discussed military activity and recreational use, the natural water regime in this area had changed quite a long time ago. The lowest part of the forest was already intersected by drainage ditches in the first years of the 19th century. The drainage network was later expanded and deepened. Then, the inflow of water to the forest from surface streams was eliminated. Groundwater supply in the catchment areas of the Bielański Stream and Rudawka also decreased because of the development of the neighboring housing districts, that is, Bielany and Marymont. In the years 1926–1927, a Vistula flood embankment was built, cutting off the Forest from the river and its natural floods, and in the 1970s, the Wisłostrada highway embankment, which fixed this cutoff, was built. Water conditions here were, therefore, constantly deteriorating, which resulted, among other things, in the constant lowering of groundwater levels (Czechowicz 1963; Jakubowski 1982; Trojan 1982; Chojnacki and Mróz 1984).

The current forest communities in this area primarily consist of various forms of oak–hornbeam forests, specifically *Tilio–Carpinetum*, characterised by their trophy and moisture content, as well as elm–ash forests, referred to as *Ficario–Ulmetum*, which exhibit diversity along the moisture gradient. In the western and north-western regions, beyond the reserve, former military settlement sites have given rise to spontaneously developed substitute forest communities dominated mainly by black locusts. In addition, throughout the entire forested area, small patches of red oak, ash-leafed maple and larch can also be found (Solińska-Górnicka et al. 1997).

Despite the aforementioned anthropogenic impacts, the Bielański Forest, situated within a nature reserve that protects its core area, exhibits a relatively high degree of naturalness. It is regarded as a remnant of the ancient forest that once spanned the Mazovia region

until the 14th century (Sudnik-Wójcikowska 1982; Trojan 1982; Orzełek 1990; Solińska-Górnicka et al. 1997; Chojnacki et al. 2010).

Results

Floristic research

The history of scientific research on the flora of Warsaw and its surroundings can be traced back to the mid-17th century, marked by the publication of the first catalog of plants in the area by Marcin Bernhardi de Bernitz (Bernhardi 1652, after Hryniewiecki 1954). Bernhardi (circa 1625–1682), originally from Lusatia, held various roles including surgeon, physician, librarian and royal secretary to Jan Kazimierz. His work comprises three parts. The first two sections consist of plant lists from gardens at that time, located on Krakowskie Przedmieście and in Ujazdów, compiled by other authors – Italian gardener Bartolomeo Gei and Moravian gardener Jakub Haick. These were further developed by Józef Rostafiński, who provided modern synonyms for historical plant names and offered commentary, thereby popularising them (Rostafiński 1928, after Hryniewiecki 1954). The third and most interesting section for our purposes includes a list of wild plant species found in the vicinity of Warsaw, authored by Bernhardi. Bolesław Hryniewiecki compiled this list, conducting a critical review of the original 697 taxa and ultimately including 477 species in his own list (Hryniewiecki 1954). Although Bernhardi did not specify the exact locations of the species he listed, it can be inferred that, as a royal physician, he likely visited the royal court in Bielany with the king and toured the Bielański Forest during that time, documenting the plants found there. The first documented floristic data from Bielany Forest were also created thanks to the presence of kings and their courts in this area. The lands located on the road from Warsaw to Bielany were acquired at the end of the 17th century by King Jan III Sobieski. Around 1691, he built a small palace on a small hill, which was his summer residence, from where he also traveled with his family and court to Bielany. After the name of Queen Maria Kazimiera, the place was called Marie Mont in French, meaning Mary's Mountain, from where the current name Marymont comes. The estate was then bought from the Sobieskis by King August II the Strong, who thoroughly rebuilt the palace and established a menagerie in the vicinity. At that time, Marymont became a hunting residence, from where the nobles went hunting in Bielany Forest. The court physician of August II the Strong, Christian Henryk Erndtel (1676–1734) from Saxony, who stayed here with the king, developed another flora of the Warsaw area. His work *Warsavia physice illustrata…*, mainly concerning the physiographic conditions of the capital, also contains the catalog *Viridarium vel Catalogus plantarum circa Varsaviam nascentium*, which includes not only a list of species, but also their descriptions and often locations (Erndtel 1730; Hryniewiecki 1954).

In a manner similar to Bernhardi's catalog, Hryniewiecki (1954) developed a list that was updated with contemporary names. However, he was unable to do so for all species, particularly for spore-bearing plants like mosses, as understanding of these organisms was quite limited in the first half of the 18th century. The term 'Muscus', used to refer to these plants, encompasses not only mosses and liverworts, but also lichens, clubmosses, lycopods and algae. In Hryniewiecki's work on the first floras of the Warsaw area (1954) and in his earlier study specifically on bryophytes (1937), the names of mosses from the 17th and 18th centuries were presented in their original forms, while contemporary synonyms were established only partially. It is only recently that a more comprehensive list of contemporary species names has been compiled for this group, incorporating various floras, including the Bernhardi and Erndtel catalogs (Drobnik et al. 2016).

In relation to Erndtel's list, Hryniewiecki (1954) did not specify (as he did to Bernhardi's list), how many taxa he excluded due to his inability of determining their contemporary names. However, Hryniewiecki had to make such a selection here as well. Erndtel's catalog contains over 900 items. After excluding 28 fungi and 31 mosses, as well as entries listing only synonyms without reference to the original descriptions, the count decreases by about 100 items. In Hryniewiecki's (1954) list of contemporary names, there are an additional 200 vascular plant species omitted. A significant drawback of Hryniewiecki's list is that it consists solely of contemporary names, lacking connections to names from the 18th century. This absence complicates comparisons for some species and makes it challenging to access descriptions from the original text.

As additional information, Hryniewiecki's list features Polish names that are occasionally attributed to Erndtel's, along with, in some cases, locations of coniferous trees and shrubs. Hryniewiecki also notes that Erndtel's research primarily focused on the area surrounding Marymont, where he resided with the royal court in a hunting lodge, embarking on excursions to the vicinity of the Camaldolese monastery in Bielany. This general overview was reiterated in a subsequent study of the flora of the Bielański Forest (Sudnik-Wójcikowska 1982), which only assumed that many of the species identified by Erndtel originated from this region. Furthermore, in the following monograph on the flora of Warsaw (Sudnik-Wójcikowska 1987), it was emphasised again that neither Bernhardi nor Erndtel provided specific locations; and in Erndtel's case, that it is only established that his principal area of research was Marymont.

Marymont was certainly Erndtel's main place of work. He himself noted this in the introduction to the part of his work containing flora of the Warsaw area. On the page preceding the introduction, he also included the oldest known view of the residence of King Jan III Sobieski, before its reconstruction. This engraving, with the Latin name Mariae Mons (made by M. Bodenehr based on a drawing by J.S. Mock), now often illustrates works on the history of Marymont. Later in the introduction, Erndtel mentions both this place and the Camaldolese monastery and the large number of plants in the surrounding meadows and forests: *Tandem & hoc monendum, quod pictura illa, quam vides Viridarii [Viridarium Warsaviense] hujus titulo praefixam, MARIAEMONTEM, Palatium campestre Regium repraesentet, quam hic consulto apponere libuit, quia praecipue circa hunc monticulum & post illum ultra ad Camaldulensem Eremum usque, ad quam ex Mariaemonte pulcherrimus patet prospectus, circumcirca in pratis & saltu maxima copia plantarum, propter singularem loci conditionem herbis faventem, invenitur.* ('Finally, I must inform you that the painting you see entitled Greenery [of Warsaw] represents MARIEMONT, the Royal Palace on the plain, which [the king] deliberately decided to place here because, especially around this hill and beyond it to the Hermitage of Camaldulense, which has the most beautiful perspective from Mariamonte, there is the greatest wealth of plants in the surrounding meadows and forests, due to the exceptional condition of this place, which is favorable to herbs.')

The species descriptions in Erndtel's work exhibit a lack of uniformity in both volume and content. Occasionally, they consist solely of the species name, while at other times, they are quite detailed. In the plant descriptions, the author provides location data for only a select number of species, and this information is derived from a limited range of sites. Although Marymont served as the primary research location, it is mentioned in the descriptions only a few times (five). In contrast, Ujazdów positioned on the southern side of Warsaw (eight) and Pułtusk situated at a considerable distance (six) both appear slightly more frequently. Among the species for which the location of occurrence is specified, Bielany is by far the most prominent. This designation appears in various forms across 36 entries in the catalog. The most common references include *Saltu Bielanensi*, often accompanied by a specification of the quantity, such as *in Bielanensi saltu frequens*, and the blooming period, for example, *floret Junio in saltu Bielanensi*. However, in some instances, it is challenging to definitively attribute the sites to the Bielański Forest. It is more appropriate to categorise them under Bielany in general since references pertain to the banks of the Vistula River near Bielany or the surrounding fields (Erndtel 1730; Tab. 2).

Based on the information from Erndtel's introduction to the flora, as well as the number of species with which Bielany is mentioned (which exceeds the numbers from other locations), it can be assumed that the Bielany Forest and the area around the monastery were the sites of the author's fruitful botanical collections. Information that the Bielany site was mentioned with selected species from Erndtel's list has not been provided in previous 20th-century monographs of flora, both of the Bielany Forest and of Warsaw and its surroundings (Hryniewiecki 1937, 1954; Sudnik-Wójcikowska 1982, 1987).

As a result, Erndtel's work has been revised within this limited area, and a comprehensive list of species mentioned from Bielany is presented here (Tab. 2). The individual columns contain the following information:

1. The name or names from the original, including synonyms given by Erndtel after the authors of earlier works he quoted and, in a few cases, Polish names. The quotations are provided with the original lettering (capitals, italics) and punctuation.

Table 2. List of plant species from Erndtel's list (1730) that he mentioned from Bielany

No.	Original name(s)	Quotes from Erndtnel's species description	Modern plant name*	Comments and doubts	Subsequent species records in Bielany, Warsaw, and Kampinos Forest
1	2	3	4	5	6
1	ANONIS *non Spinosa*, flore purpur. C.B. P*in*. 389. & J.B. *A*nonis mitior prima C*lusii. Hist Rar. Lib. I. p.* 99	frequentissima in saltu Bielanensi ad Vistulae ripam	*Ononis arvensis* L.	The species is also mentioned by Erndtel (1730) as: NATRIX *Riv*. Anonis spinis carens purpur C.B.P. 389. (see no. 21)	Bielany: Karo 1867, Sudnik-Wójcikowska 1982 (rarely), 1987 (around Bielany); surroundings: Szubert 1824, Kobendza 1930 (rarely), Sudnik-Wójcikowska 1987 (quite often)
2	ARTEMISIA III. Dioscor. Leptophyllon *Lobel*. *Icon*. 765	crescit copiose in Salicetis a Pultosk Bielanum ducentibus, ad Vistulae littus	*Artemisia*; *A. campestris* L. (?)	Genus *Artemisia*; the most likely species is *Artemisia campestris* The species was not listed by Hryniewiecki (1954). His list includes only *Artemisia abrothanum*, *Artemisia absinthium,* and *Artemisia vulgaris*	Bielany: Kobendza 1929, Sudnik-Wójcikowska 1982 (quite often), 1987, Solińska-Górnicka et al. 1997; surroundings: Szubert 1824, Kobendza 1930 (often), Sudnik-Wójcikowska 1987 (commonly)
3	ARUM PALUSTRE, radice arundinacea *Gesn*.	in Saltu Bielanensi ad Vistulam	*Calla palustris* L.	Rostafiński (1872) stated that the species given by Erndtel was *Calla palustris*; Hryniewiecki (1954) mentions *Calla paustris* and *Arum maculatum*	Bielany: Błoński 1892, Kobendza 1929; surroundings: Szubert 1824, Karo 1867, Błoński 1892 (Babice), Kobendza 1930 (often), Sudnik-Wójcikowska 1987 (occasionally, two locations)
4	BLATTARIA lutea *J*.B. III *app*. 874. Blattaria altera *Lobel. Icon*.	Flor. Julio: in Bielanensi saltu frequens	*Verbascum blattaria* L. (?)	The species is listed by Hryniewiecki (1954). The species designation may raise some doubts, but its occurrence is probable	Bielany: species not reported later; surroundings: Szubert 1824, Rostafiński 1872 (Zakroczym), Kobendza 1930 (Młociny, and after Jastrzębowski – Zakroczym), Sudnik-Wójcikowska 1987 (occasionally, one location, Vistula riverbank, Wilanów)
5	BUPLEURUM *Riv*. Bupleurum latifol. *Dodon*. *Pempt*. 633	in dumetis invenitur circa Bielanum	*Bupleurum longifolium* L.	There is an error in the citation by Erndtel (1730). It should be *Dodon. Pempt*. 622. Hryniewiecki (1954) mentions another species – *Bupleurum rotundifolium*	Bielany: none of the species were reported later; surroundings: Szubert 1824 gives *Bupleurum longifolium* only with the description 'temperate Europe', while *Bupleurum rotundifolium* – 'near Warsaw', Rostafiński 1872. Both species only from localities in southern Poland; from Warsaw, *Bupleurum rotundifolium* was reported by Cybulski 1895a
6	CALCEOLUS *Rivini*. Calceolus Marianus *Dodon*. *Pempt*. 180	*Floret* Junio in saltu Bielanensi	*Cypripedium calceolus* L.	Hryniewiecki (1954) mentioned this species	Bielany: species later not reported; surroundings: Szubert 1824, Rostafiński 1872 (Babice, and after Berdau – Kampinos)
7	CHRISTOPHORIANA Vulgaris, Christophoriana Dodon, Pempt. 401. Aconitum racemosum an Actea *Plin.* C.*B*.P. 183	in Sylvis & Saltu Bielan. flor *Junio*	*Actaea spicata* L.	There is an error in the citation by Erndtel (1730). It should be *Dodon. Pempt*. 397	Bielany: Rostafiński 1872; surroundings: Szubert 1824, Rostafiński 1872 (Marymont), Błoński 1892, Sudnik-Wójcikowska 1987 (occasionally, two locations: Młociny, Las Kabacki), Głowacki, Ferchmin 2003 (three locations, few specimens)

1	2	3	4	5	6
8	DIGITALIS flore ferrugineo *Riv*.	*flor*. Junio & Julio: & copiose proveniunt hae species in Saltu Bielanensi	*Digitalis*, *Digitalis ferruginea* L. (?)	Genus *Digitalis*; most likely species is *Digitalis ferruginea*. Hryniewiecki (1954) does not mention *Digitalis ferruginea*; however, he does reference *Digitalis purpurea*, although without providing a specific location	Bielany and surroundings: species later not reported
9	DRYMOPOGON, Barba Caprae, floribus oblongis J.*B*. III. 488. Drymopogon I. *Tabernaemontani Icon.* 777	flor. Junio copiose in Saltu Bielan.	*Aruncus sylvestris* Kostel.	Hryniewiecki (1954) does not mention the species, which is an oversight. Rostafiński (1872) had already identified the name and cited the locality from Bielany after Erndtel (1730), along with a quote of the name from the original	Bielany and surroundings: species later not reported; Szubert 1824 mentions the species (as *Spiraea Aruncus*) only from southern Poland ('Galicia'), Rostafiński 1872 (Bielany – after Erndtel 1730), Sudnik-Wójcikowska 1987 (after Rostafiński 1873 – 'woodlands')
10	EVONYMUS Pannonicus, Evonymus II. vel Pannonicus *Clusii Hist. p.*57	Inveni autem hunc frequentissime nascentem in saltu Bielanensi.	*Euonymus verrucosa* Scop.	Hryniewiecki (1954) mentioned this species	Bielany: Kobendza 1929, Sudnik-Wójcikowska 1982 (quite often), 1987, Solińska-Górnicka et al. 1997; surroundings: Szubert 1824, Karo 1867, Kobendza 1930 (rarely), Sudnik-Wójcikowska 1987 (quite frequently)
11	FRANGULA, Alnus nigra baccif. J.B.I. 560. Frangula *Dodon. Pempt.* 787. Polon. *Trosczina*	in Saltu Bielan. frequens, flor. Junio	*Frangula alnus* Mill.	Hryniewiecki (1954) does not mention the species, which is an oversight. In the family Rhamnaceae, he mentioned only *Rhamnus cathartica*	Bielany: Sudnik-Wójcikowska 1982 (quite often), 1987, Solińska-Górnicka et al. 1997; Surroundings: Szubert 1824, Kobendza 1930, Sudnik-Wójcikowska 1987 (often), Głowacki, Ferchmin 2003 (the most numerous shrub species in the Kampinos National Park)
12	HEPATICA *Nobilis Offic.* Trifolium Hepaticum sive Trinitatis Herba, flore coerul. J.B. II. 389. Hepaticum Trifolium & Hepatica rubra *Lobel. Icon. p*. 34. *T. II.* Polonice *Wątrobnik*.	In Saltu Biel. *Maio* mens.	*Hepatica nobilis* Schreb.	Hryniewiecki (1954) mentioned this species	Bielany: species later not reported; surroundings: Szubert 1824, Kobendza 1930, Sudnik-Wójcikowska 1987 (occasionally, one location, Las Kabacki)
13	HYPERICUM elegantissimum, non ramosum, folio lato J.B. III. 383. Hypericum minus erect. *C.B.P.* 279. Hypericum pulchrum *Tragi*.	flor. *Julio*, in saltu Bielan.	*Hypericum montanum* L.	The species is not mentioned by Hryniewiecki (1954). However, he incorrectly named it *Hypericum maculatum* (as *Hypericum quadrangulum*)	Bielany: Kobendza 1929, Solińska-Górnicka et al. 1997; surroundings: Szubert 1824, Karo 1867 (Gocławek), Rostafiński 1872 (Zacisze, after Jastrzębowski – Babice), Błoński 1892 (Wygoda), Kobendza 1930 (rarely), Sudnik-Wójcikowska 1987 (occasionally), Głowacki, Ferchmin 2003 (few)
14	IMPATIENS R*ivini*, Noli me tangere vulgi & J.B. II. 908. Impatiens herba *Dodon. Pempt.* 659. *Bernitius* hanc in Catalogo suo Balsaminam luteam nominat.	Copiose provenit in saltu umbroso Bielanens. & flor. Julio	*Impatiens noli-tange-re* L.	There is an error in Erndtel's (1730) citation. It should read: *Dodon. Pempt.* 649	Bielany: Karo 1867, Rostafiński 1872, Kobendza 1929, Sudnik-Wójcikowska 1982 (quite rarely), 1987, Solińska-Górnicka et al. 1997; surroundings: Szubert 1824, Karo 1867, Rostafiński 1872, Kobendza 1930 (often), Sudnik-Wójcikowska 1987 (quite frequently)

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15	KALI SPINOSUM C.B. P*in. p.* 289. Kali *Dodonaei Pempt. p.* 81. Tragon *Matthioli in Oper. Magn. Venet. p.* 1035. Tragon Matthioli ap. *Lobelium Icon. p.* 797. ubi optima ejus figura.	in extremitate pagi PP. Soc. Jes. prope diversorium urbem versus, non procul a littore Vistulae fluvii, via qua a Pultosk Bielanum tendimus.	*Salsola kali* subsp. *ruthenica* (Iljin) Soó	The site is situated on the bank of the Vistula, along the road to Pułtusk, rather than within the Bielański Forest	Bielany: Sudnik-Wójcikowska 1987 (surroundings of Bielany); surroundings: Rostafiński 1872, Kobendza 1930, Sudnik-Wójcikowska 1987 (quite often)
16	LAPATHUM acutum minimum *Lobel. Icon. p.* 284. Meliorem & significantiorem longe figuram exhibet *Tabernaem. Herbar. Germ. edit. Hieron. Bauhin. Basil.* 1664. *p.* 824	Inter Salicera ad littus Vistulae, via Bielanum ducente, copiose inveni crescentem, una cum Aristolochia multiflora *Riv.*	*Rumex* L. (?)	Erndtel, using the name 'Lapathum', lists various species of the genus *Rumex* in other entries. However, the specific species could not be determined, and it remains unclear whether he described a species of this genus in this instance	n.a.
17	ARISTOLOCHIA Vulgaris. Aristolochia Clematis *Clusii Hist. Rar. LXXl . J .B . III.* 560. Aristolochia Clematitis recta *C.*B. *Pin.* 307. Aristolochia multiflora R*iv. Smolnik. Polon.*	ad Vistulae ripam in Salicetis, post Jesuitarum P.P. Villam, Pultosk appellatam,copio-se provenit.	*Aristolochia clematitis* L.	Erndtel included the information about its occurrence 'among the willows on the banks of the Vistula, along the road leading to Bielany' in the description of the Lapathum taxon (see no. 16)	Bielany: Rostafiński 1872; surroundings: Kobendza 1929 (Marymont), Kobendza 1930 (Wilków Nowy, Leoncin, rare), Sudnik-Wójcikowska 1987 (rarely), Głowacki, Ferchmin 2003 (three locations, small patches)
18	LAUREOLA sive Mezereon Germanicum I.B.I. 566. Chamaelaea Germanica *Dodon. Pempt.* 364. Daphnoides flore purpur. *Tabrn. p.* 1482 Thymelaea Laurifol. deciduo, sive Laureola foemina *Tournefort.* I*nst.* 595. Polon. *Wilcze łyko*.	Hanc utplurimum in sylva Bielan. mense Martio	*Daphne mezereum* L.	Hryniewiecki (1954) mentioned this species	Bielany: Rostafiński 1872; surroundings: Szubert 1824, Kobendza 1930 (Grondy Łazowskie; for the Warsaw area very rare), Głowacki, Ferchmin 2003 (five locations, scattered, but in places very abundant, expanding)
19	MARTAGON, Lilium flore nutante ferrugineo J.B. II. 692	floret *Junio*, in Saltu Bielanensi copiose	*Lilium martagon* L.	Hryniewiecki (1954) mentioned this species	Bielany: Rostafiński 1872; surroundings: Szubert 1824, Kobendza 1930, Sudnik-Wójcikowska 1987 (rarely, eight locations), Głowacki, Ferchmin 2003 (14 locations, relatively abundant sites)

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20	MUSCUS PENNATUS MINOR, cauliculis ramosis, in summitate velut spicatus *Joh. Loselii* l.a.	Uterque in sylvis nascitur & Bielanensi saltu	*Abietinella abietina* (Hedw.) M.Fleisch.	Hryniewiecki (1954) does not include this species among the taxa with a recognized modern name. We have provided the name according to Drobnik et al. (2016)	Bielany: five times in studies from the 19th and 20th centuries Ciurzycki 2018, among others Kobendza 1929; surroundings: repeatedly among others Błoński 1890, Kobendza 1930, Ciurzycki 2018
21	NATRIX *Riv*. Anonis spinis carens purpur C.B.P. 389. Anonis non spinosa, purpureo flore I.B. II. 393	In campestribus & pascuis circa Bielanum potiss. invenitur & floret aestate	*Ononis arvensis* L.	The species is mentioned in Erndtel (1730) also as: ANONIS *non Spinosa*, flore purpur. C.B. *Pin*. 389. (see no. 1)	(see no. 1)
22	ONAGRA *Tournef*. Lysimachia lutea Corniculata *C*.B. *in* P*in*. *Append*. 520. Lysimachia lutea, Corniculata, non papposa, Virginiana major *Morison*. *Hist*. 2. 271	Haec quae alibi Hortensis est, abundantissime provenit Bielani, ante ipsam Eremi magnam portam, in loco aprico.	*Oenothera biennis* L. (s.l.)	Hryniewiecki (1954) does not mention the species *Oenothera biennis*. We have adopted the name *Oenothera biennis* sensu lato (in a broader sense)	Bielany: Kobendza 1929, Sudnik-Wójcikowska 1982, 1987, Solińska-Górnicka et al. 1997; surroundings: Szubert 1824, Karo 1867, Kobendza 1930, Sudnik-Wójcikowska 1987 (often)
23	OPULUS *Tournef*. *p* 607, Sambucus Aquatica flore simpl. *C*.B.P. *p*. 564. Sambucus palustris *Dodon*. *Pempt*. 846	In sylvis humidioribus, Bielanensi praecipue, floret Junio.	*Viburnum opulus* L.	Hryniewiecki (1954) mentioned this species	Bielany: Kobendza 1929, Sudnik-Wójcikowska 1982 (quite often), 1987, Solińska-Górnicka et al. 1997; surroundings: Szubert 1824, Błoński 1892 (among others Młociny, Babice, Opalin), Kobendza 1930, Sudnik-Wójcikowska 1987 (quite often)
24	OPHRYS, Ophris R*iv*. Ophris Bifolia *C*.B.P. 87. Pseudo-Orchis, Bifolium *Dodon*. *Pempt*. 242	In Saltu Bielanensi flor. Julio.	*Listera ovata* (L.) R. Br.	Hryniewiecki (1954) mentioned this species	Bielany: species later not reported; surroundings: Szubert 1824, Karo 1867 (Zacisze), Rostafiński 1872 (near Kampinos), Kobendza 1930 (Sieraków, Karolinów), Sudnik-Wójcikowska 1987 (rarely, three locations, among others Młociny), Głowacki, Ferchmin 2003 (three locations, scattered, single specimens)
25	OREOSELINUM R*iv*. & *Offic*. Apium montanum Nigrum C.B.P. Apium montanum *Dalechampii*. Oreoselinum sive Veelgutta *Dodon*. *Pempt*. 696. Polon. *Pietruszka pogurna*. (…) quod icone sua optime expressit Rivinus, prae *Dodonaeo* & *Lobel*.	Copiose crescit in Bielan. saltu	*Peucedanum oreoselinum* (L.) Moench.	Hryniewiecki (1954) mentioned this species	Bielany: Sudnik-Wójcikowska 1987 (surroundings of Bielany); surroundings: Kobendza 1930 (commonly), Sudnik-Wójcikowska 1987 (often)

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26	PARIS, vulgo Herba Paridis *Offic*. Solanum Quadrifolium bacciferum C.B.P. 167. Herba Paris *Dodon*. *Pempt*. 444	*Floret* Junio in saltu Bielan.	*Paris quadrifolia* L.	Hryniewiecki (1954) mentioned this species	Bielany: Błoński 1892, Kobendza 1929, Sudnik-Wójcikowska 1982 (rarely), 1987, Solińska-Górnicka et al. 1997; surroundings: Szubert 1824, Karo 1867 (Zacisze), Błoński 1892 (Babice, Młociny, Natolin), Kobendza 1930 (not often)
27	POLYGONATUM latifolium flore majore C.B.P. *l*. *a*. Polygonatum latifolium II. *Clusii in Hist. Rar*. 276. Poloni appellant *Kokorżyczka, Krovvka.*	In saltu Bielanensi frequ. *floret* Majo & Jun.	*Polygonatum odoratum* (Mill.) Durce	Erndtel lists two taxa: the first is: 'POLYGONATUM latifolium Vulgare C.B.P. *p.* 303. Polygonatum vulgo Sigillum Salomonis J.B. III, 529. *& Officinarum.*' – no localisation, the second is the one mentioned here from Bielany – 'POLYGONATUM latifolium flore majore…'. The first species is *Polygonatum multiflorum*. Hryniewiecki (1954) cites only this one species and omits *Polygonatum odoratum*, which seems to be an oversight	Bielany: Błoński 1892, Kobendza 1929, Sudnik-Wójcikowska 1982 (rarely), 1987, Solińska-Górnicka et al. 1997; surroundings: Szubert 1824, Rostafiński 1872 (Kaskada), Błoński 1892 (Babice), Kobendza 1930 (often), Sudnik-Wójcikowska 1987 (quite often, 38)
28	POLYGONUM COCCIFERUM, Polygonum Polonicum Cocciferum J.B. Polygonum minus I.C.B. P*in*. *p*. 281. Polygonum Cocciferum *Camer*. *Ep*. (…) De hoc meminit *Bernitius in Catalogo Piant,, Warsav. p,* 74. (…) Vid, etiam J*oh, Loeselii Flora Prussica a Gottsched edita*, *p.* 203	Crescit copiose in arenosis agris, a P.P. Jesuitarum Villa ad Vistulam usque & saltum Bielanensem extensis.	*Scleranthus perennis* L.	In Erndtel (1730), the citation should read: J.B. III (Volume III). Although the taxon is described under the now incorrect name Polygonum, and the description pertains to a plant from the Caryophyllaceae family, the species was also mentioned by Hryniewiecki (1954)	Bielany: Kobendza 1929, Sudnik-Wójcikowska 1987 (surroundings of Bielany); surroundings: Szubert 1824, Kobendza 1930 (often), Sudnik-Wójcikowska 1987 (often)
29	POLYPODIUM Vulgare C.B.P. 359. Polypodium majus *Dodon*. P*empt*. 464. Polon. *Paprotka*.	Ad arborum truncos provenit passim in saltu Bielanensi	*Polypodium vulgare* L.	Hryniewiecki (1954) does not include *Polypodium vulgare* in his list. The omission of this species is likely an oversight	Bielany: Majewski 1876, Łapczyński 1884, Kamieński 1885, Rostafiński 1886; surroundings: Szubert 1824 (near Warsaw), Błoński 1892 (Natolin), Kobendza 1930 (rare, two locations: Pociecha, Przęsławice), Sudnik-Wójcikowska 1987 (occasionally, one location, Las Kabacki), Głowacki, Ferchmin 2003 (15 locations, not threatened, in expansion)

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30	PSYLLIUM Vulgare. Psyllium majus erectum C.B.P. 191. & J.B. Pulicaris Herba *Lobelii. Icon*. 437. Polon. *Pleszć, Pleszne Ziełe.* (…) *In Val, Cordi*, accuratissimi alias Botanici, *Histor, de Plant. L.* II. *p*.174, pro vera Psyllii, falsa invenitur Conyzae sylvestris figura. Miror etiam hanc plantam in *Loeselii Flora Prussica* & augmentis ejus Helwingianis penitus non inveniri : *Volckamerus in Flora Norimb*, Hortensibus an numeravit, uti & *Ruppius in Jenensi*: Solus J.C. *Buxbaum. in Enum. Piant, Halensium* in agris glareosis bey Schrappelau inveniri, observavit.	Copiose provenit & floret *Julio* mense in agris arenosis sub Pultosk P.P. Jesuitar. Villa, qui Bielanum versus ad Vistulae littus extenduntur.	*Plantago arenaria* Waldst. & Kit.	Erndtel lists five taxa under the genus *Plantago* and one under the name *Psyllium*, referring to *Plantago arenaria*. In contrast, Hryniewiecki (1954) identifies three species within the genus *Plantago*, but does not mention *Plantago arenaria* among them. In addition, he incorrectly includes *Pulicaria vulgaris*, which belongs to the family Asteraceae (Compositae)	Bielany: Sudnik-Wójcikowska 1987 (surroundings of Bielany); surroundings: Szubert 1824, Karo 1867 (Gocławek), Rostafiński 1872 (Leszno), Błoński 1892 (among others Marymont, Babice, Węglowa Wólka), Cybulski 1894 (Praga), Kobendza 1929 (Piaski), 1930 (often), Sudnik-Wójcikowska 1987 (quite often)
31	PULMONARIA latifolia, Symphytum maculosum sive Pulmonaria latifolia C.B. P*in.* 259. Symphytum maculosum *Dodon*. *Pempt*. 135. Pulmonaria maculosa *Lobel. Icon*. *p*. 586. (…) *Miodunki,* Polon.	In saltu Bielanensi frequentissima floret Majo.	*Pulmonaria obscura* Dumort.	Erndtel lists two taxa in the genus Pulmonaria. The first is: ‘PULMONARIA anguftifolia flore coerul. sive Pulmonaria angustifolia coerulea C.B.P.’ and the second is ‘PULMONARIA latifolia…’ listed here from Bielany. The first of these species is *Pulmonaria angustifolia* Hryniewiecki (1954) also identifies two additional species: *Pulmonaria officinalis* and *Pulmonaria obscura*, both referring to the second taxon. Later authors have reported either one species or the other from Bielany. Based on current understanding of their distributions, we have concluded that only *Pulmonaria obscura* is found in the Bielany Forest	Bielany: Kobendza 1929, Sudnik-Wójcikowska 1982, 1987, Solińska-Górnicka et al. 1997 (we wszystkich pracach *Pulmonaria obscura*); surroundings: Szubert 1824 (only as *Pulmonaria officinalis*), Karo 1867 (*Pulmonaria officinalis*, Gocławek), Kobendza 1930 (*Pulmonaria obscura*; many in Zamczysko, occasionally on grondy), Sudnik-Wójcikowska 1987 (*Pulmonaria obscura*, rarely); if *Pulmonaria officinalis* is given in older literature, it is probably sensu lato

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32	RAPUNCULUS Corniculatus, spica breviori R*iv.* Rapunculus, folio oblongo, spica orbiculari C.B. P*in*. 92.	Florent Majo & Junio in saltu Bielanensi.	*Phyteuma orbiculare* L.	Hryniewiecki (1954) mentioned this species	Bielany and surroundings: species later not reported
33	RHAMNUS SOLUTIVUS *Officin*. Rhamnus Catharticus C.B.P. 478. Rhamnus Solutivus *Dodon. Pempt*. 756. Cervi spina Val. Cordi *Rivini ap. Heucherum*, Polon. *Szakłak*.	Nascitur in Dumetis saltus Bielanensis frequentissime.	*Rhamnus cathartica* L.	Hryniewiecki (1954) mentioned this species	Bielany: Sudnik-Wójcikowska 1982 (quite often), 1987, Solińska-Górnicka et al. 1997; surroundings: Szubert 1824, Kobendza 1930, Sudnik-Wójcikowska 1987 (quite often)
34	SANICULA *Rivini & Offic.* C.B. *Pin*. 319. Sanicula mas Fuchsii, sive Diapensia J.B. III. 639. Sanicula *Dodon. Pempt*. 140. (…) Polon, *Zankel*, sec. *Syren*. Refertur a *Rivino*	In sylvestribus locis, v. g. in Bielanensi nemore floret *Junio*.	*Sanicula europaea* L.	Hryniewiecki (1954) mentioned this species	Bielany: Kobendza 1929; surroundings: Szubert 1824, Błoński 1892, Kobendza 1930, Sudnik-Wójcikowska 1987 (rarely, Las Kabacki), Głowacki, Ferchmin 2003 (one location, few)
35	SCUTELLARIA latifolia flore minore. *Riv*.	in saltu Bielanensi frequens	*Scutellaria, S. galericulata* L., *S. hastifolia* L. (?)	Erndtel lists two taxa under the name 'Scutellaria'. The first taxon is described as follows: 'SCUTELLARIA Riv. Lysimachia coerulea, galericulata, vel Gratiola coerulea C.B.P. 246'. This description is quite extensive and likely covers two species: *Scutellaria galericulata* and *Scutellaria hastifolia*. The second taxon provided by Erndtel, 'SCUTELLARIA latifolia flore minore, Riv.', probably refers to *Scutellaria galericulata*. Hryniewiecki (1954) identifies both species as well	*Scutellaria galericulata*: Bielany: species later not reported; surroundings: Szubert 1824, Kobendza 1930 (commonly), Sudnik-Wójcikowska 1987 (quite often); *Scutellaria hastifolia*: Bielany: species not reported; Cybulski 1895b (near Bielany); surroundings: Szubert 1824, Karo 1867 (Gocławek), Sudnik-Wójcikowska 1987 (rarely, three locations)
36	SESELI pratense *Rivini*. Seseli pratense, Silaus forte Plinii C.B.P. 162. Siler alterum pratense *Dodon. Pempt*. 310. a *Tournefort. Instit. p*. 313. appellatur Angelica pratensis Apii folio. (…) *Bernitius* quid sibi velit cum Seseli palustri lactescente non liquet	In pratis prope Bielanum floret aestate.	*Silaum silaus* (L.) Schintz & Thell.	The species is mentioned by Hryniewiecki (1954). Although the observation pertains to a species whose location in Mazovia is well outside its typical range, the species designation and name identification are likely accurate	Bielany: species later not reported; surroundings: Rostafiński 1872 (Domaniew)

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37	TRIENTALIS Cordi & Rivini, Pyrola Alsines flore major *C.*B. *Prodr*. cap. 17. p. 100. ubi elegantissima & accurata figura. Alsinanthemum *Thalii Sylv. Harc. & Oelhasii* in Elench. (…) *Ruppium Flor. Jenens. p.* 17	Inveni florentem circa Mariaemontem & in saltu Bielanensi, Julio mense.	*Trientalis europaea* L.	Hryniewiecki (1954) mentioned this species	Bielany: Rostafiński 1872, Kobendza 1929, Solińska-Górnicka et al. 1997; surroundings: Szubert 1824, Karo 1867, Rostafiński 1872, Błoński 1892, Kobendza 1930, Sudnik-Wójcikowska 1987 (quite often)

* – According to Mirek et al. (2020) and Ochyra et al. (2003)

2. Quotes from species descriptions, regarding their occurrence and sometimes associated information about flowering.
3. Modern names. Uncertain taxa are marked with a question mark.
4. Comments and questions that have been raised regarding certain taxa, particularly concerning their original names and corresponding modern names. In addition, gaps and errors have been identified, including those noted in Hryniewiecki's work from 1954. If no comments are provided, it indicates that the taxon was listed by Hryniewiecki in 1954 and that both the species designation and name identification are considered accurate and beyond doubt.
5. The subsequent occurrences in Bielany and its surrounding areas are based on selected key publications. The species found in Bielany during the 19th century are documented in the following works: Karo (1867), Rostafiński (1872), Majewski (1876), Łapczyński (1882), Kamieński (1885), Rostafiński (1886) and Błoński (1892). In the 20th century, the focus primarily shifted to the Bielany Forest, though some references pertained to the whole of Bielany. Relevant publications from this period include Kobendza (1929), Sudnik-Wójcikowska (1982, 1987) and Solińska-Górnicka et al. (1997). The greater Warsaw area and the adjacent Kampinos Forest are considered the 'surroundings'. Some of the publications mentioned above are cited again as they provide information beyond Bielany. These include Karo (1867), which covers locations near Warsaw, such as Gocławek and Zacisze, Rostafiński (1872) and Błoński (1892), which details multiple sites near Bielany, including Babice, Marymont, Młociny, Opalin, Powązki and Węglowa Wólka, among others. In addition, Sudnik-Wójcikowska (1987) discusses areas around Bielany and throughout Warsaw. Other locations were listed from publications of: Szubert (1824) who always put it as: 'near Warsaw'; Cybulski (1894, 1895a, b) who also put it as: 'near Warsaw'; Kobendza (1930) who described the occurrences in various forms covering sites and habitats; and Głowacki, Ferchmin (2003) who presented from Kampinos Forest only protected, rare and endangered (EN) species. For rarer species, selected sites were listed, especially those closer to Bielany. Only more general information about their occurrence was provided for more common species. A separate set of selected works was listed as the only representative of mosses in the table.

Among the species from Bielany identified by Erndtel, several distinct groups can be categorised based on their historical and current presence in the Bielany Forest, as well as in Warsaw and Masovia, along with their current status within the flora of Poland. Initially, it is important to highlight specific representatives of spore-bearing plants. Among the bryophytes discussed in the study, precise location details are provided for only one species. The species referred to as 'MUSCUS PENNATUS MINOR...' did not have a modern designation in Hryniewiecki's monographs (1937, 1954), but more recent research (Drobnik et al. 2016) has identified it as *Abietinella abietina* (authors of taxa Latin names are given in Table 2). This marks the first recorded occurrence of this moss in the Bielany Forest, as well as in Warsaw

and its vicinity. It is a relatively common species found in grasslands. It was later documented from Bielany and the Bielany Forest in five additional publications from the 19th and 20th centuries, alongside numerous other localities in the surrounding area (Ciurzycki 2018).

Among pteridophytes, the location was given only for one fern – listed under the same name as the modern one, 'POLYPODIUM Vulgare', also with the same Polish name as the modern one, 'Paprotka'. In description of the occurrence, attention is drawn to the information about the specific way of growth of this species near tree trunks, 'Ad arborum truncos', and its sporadic occurrence in the Bielański Forest. This is important in the context of interest in this species in later 19th-century publications. In them, one can find a lot of information about its occurrence, as well as its acquisition and transplantation, and the resulting discussion on the naturalness of its site in the Bielański Forest (Majewski 1876; Łapczyński 1882; Kamieński 1885; Rostafiński 1886). According to the information contained in Erndtel (1730), the site can certainly be considered natural. Hryniewiecki (1954) did not mention this species, which, in this case, seems to be an oversight. Contemporary studies have not found the species at the Bielany site. However, in the monograph on the flora of Warsaw (Sudnik-Wójcikowska 1987), one site was given, in the Kabacki Forest, at the city's southern border. From the Kampinos Forest in the interwar period, Kobendza (1930) listed this species as 'rare', finding two sites. In contemporary times, as many as 15 sites were given from the Forest, describing the species as expanding (Głowacki and Ferchmin 2003).

For the remaining species, specifically the seed plants, a comprehensive list was published that now serves as a reference for historical data (Sudnik-Wójcikowska 1982). This list can be further enriched with information from subsequent studies (Solińska-Górnicka and Symonides 1991). Erndtel's list encompasses a group of 14 species that, according to this data, were also present in the Bielański Forest at the end of the 20th century, that is, *Artemisia campestris*, *Euonymus verrucosus*, *Frangula alnus*, *Hypericum montanum*, *Impatiens noli-tangere*, *Oenothera biennis*, *Ononis arvensis*, *Paris quadrifolia*, *Polygonatum odoratum*, *Pulmonaria obscura*, *Rhamnus cathartica*. These are almost exclusively common species. Only *Hypericum montanum* can be classified as rarer. This species was reported by Kobendza (1929) from Bielany. Later, it was not reported from the Bielany Forest and Warsaw, and it was recorded as sporadic in the Wawerski Forests (Sudnik-Wójcikowska 1982, 1987). Then, in subsequent studies, it was found again in the Bielany Forest (Solińska-Górnicka and Symonides 1991). In the vicinity, it was reported in the 19th century by several authors from different locations. In the Kampinos Forest, it occurs in small numbers and is strongly endangered (Głowacki and Ferchmin 2003). As stated in Table 1, the species was incorrectly identified in Hryniewiecki's study (1954). Erndtel listed two taxa under the name *Hypericum*, with the first one described as 'HYPERICUM Vulgare *C.B.P.* 279. Hypericum Vulgare, sive Perforata, caule rotundo, folias glabris J.B. III. 381. Polon. *Panni – Mariey Dzwonki, Świętego Jana Ziele*' and which was listed by Hryniewiecki together with its Polish names as *Hypericum perforatum*, which raises no doubts.

However, the second species given by Hryniewiecki is *Hypericum maculatum* (as *Hypericum quadrangulum*). The description of this species by Erndnel allows us to consider only *Hypericum montanum* or *Hypericum pulchrum*. The second of these species can be definitely excluded here due to its western range (Łapczyński 1892). The species currently has only five historical localities in southwestern Poland (Zając and Zając 2001). In turn, the historical descriptive name, as given by Erndnel, was given as a synonym for *Hypericum montanum* in the flora of the Munich area at the beginning of the 19th century (Schrank and Mayrhoffer 1818).

The remaining species from Erndnel's list tend to be rarer in Warsaw and the Mazovia region (Zając and Zając 2001). Among these, six species were subsequently recorded in the Bielański Forest during the 19th and early 20th centuries. However, data from the late 20th century, specifically from the monograph on the flora of Warsaw (Sudnik-Wójcikowska 1987), indicates that they were only found in other locations within the current city limits. These species include *Actaea spicata, Aristolochia clematitis, Calla palustris, Lilium martagon, Sanicula europaea* and, specifically in the Kampinos Forest, *Daphne mezereum*. In addition, seven species were noted in areas of Warsaw at the end of the 20th century but were not recorded in the Bielański Forest: *Hepatica nobilis, Listera ovata, Peucedanum oreoselinum, Plantago arenaria, Salsola kali* subsp. *ruthenica,*

Scutellaria galericulata and *Verbascum blattaria* (Sudnik-Wójcikowska 1987).

All the species mentioned above merit further discussion for various reasons. The orchid *Listera ovata*, which currently enjoys partial protection, is not particularly rare in Poland. It has even been documented in nearby Młociny (Sudnik-Wójcikowska 1987); however, it has neither been reported in Bielany since then nor cited in subsequent studies after Erndtel. Thus, information regarding its previous presence in the Bielany Forest represents new insights into the historical flora of this area. Similarly, *Hepatica nobilis* presents a comparable situation. While the species is generally quite common and was not classified as rare in the Kampinos Forest (Głowacki and Ferchmin 2003), it is considerably rarer in Warsaw. It has also not been reported in Bielany after Erndtel's observations. Likewise, the otherwise ubiquitous species *Peucedanum oreoselinum* shares this pattern, as it has not been documented in the Bielański Forest, making Erndtel's account the sole reference for this location.

Lilium martagon was later reported from Bielany by Rostafiński (1872), and at the end of the 20th century, it was relatively common both in Warsaw and the Kampinos Forest (Sudnik-Wójcikowska 1987; Głowacki and Ferchmin 2003). Other species rare in Warsaw and its vicinity, reported by Endtel and various subsequent authors from Bielany include: *Actaea spicata*, *Aristolochia clematitis*, *Calla palustris* and *Sanicula europaea* (Rostafiński 1872; Błoński 1892; Kobendza 1929).

Among these species, *Aristolochia clematitis* warrants further elaboration. It is a relatively rare anthropophyte, with its most notable occurrences in the Polish lowlands found along the Vistula Valley (Zając and Zając 2001). In Erndtel's description of the species, there is no mention of its presence in Bielany. However, he does refer to its occurrence 'among the willows on the banks of the Vistula' in his account of another, unidentified species termed 'Lapathum'. Later, Rostafiński reported *Aristolochia clematitis* from Bielany in 1872. Subsequently, Kobendza (1929) also referenced it, but not in the context of the Forest itself. Instead, he included it in a separate section titled 'The influence of the Vistula on the vegetation of Bielany', which discusses plants restricted to the flood terrace. The author describes a locality in the southern vicinity of Bielany, stating: 'found it between Marymont and the citadel of prof. Hryniewiecki', while noting that this is not the same locality identified by Rostafiński. Although Erndtel provided a habitat description along with a locality, it was vague: 'by the road leading to Bielany', leaving the exact proximity to Bielany unclear. It can only be assumed that it occurs nearby. While the species designation and identification are undisputed, the inclusion of this species within the flora of the Bielany Forest, or even Bielany in a broader context, remains somewhat uncertain.

In a manner similar to Kobendza's (1929) study of Bielany, we can also explore the botanical thread related to the plants along the Vistula River. Erndtel identified several species from the banks of the Vistula, which during that period, adhered to the Bielany Forest. One such species is the anthropophyte *Salsola kali* subsp. *ruthenica*, which did not grow within the Forest itself but thrived along the Vistula banks, particularly along the road from Bielany to Pułtusk. Today, this species is quite common in Warsaw, including areas around Bielany, within the Vistula Valley, and in ruderal zones (Sudnik-Wójcikowska 1987). In the Kampinos Forest, Kobendza (1930) noted its presence, stating: 'It grows throughout sandy areas, although it is most frequently found along the Vistula'.

Another species noted by Erndtel in the Bielany region along the banks of the Vistula is the native *Plantago arenaria*. In his monograph on Bielany, Kobendza (1929) documented its presence in exposed, wind-blown sands in the area. Furthermore, this species is quite common in sandy and ruderal habitats throughout Warsaw and its surroundings (Kobendza 1930; Sudnik-Wójcikowska 1987). Erndtel provided a comprehensive description of this species, including its Polish names, 'Plesze' and 'Pleszne Ziełe', which continue to be used today (often referred to as psyllium due to its medicinal applications). While the identification and designation of this name are generally easy, Hryniewiecki (1954) did not mention the species. Instead, he referenced a species from the Asteraceae family, *Pulicaria vulgaris*, which shares a similar Polish name, common psyllium. Hryniewiecki's attribution of this species as 'PSYLLIUM Vulgare' points to the historical Polish designation 'Płeszne ziele' associated with it. Thus, he made an error in this instance; however, this species might still have occurred in the

area. Currently, *Pulicaria vulgaris* is not very common in Mazovia and is considered generally rare in Poland, approaching an EN status – as near threatened (NT) (Zając and Zając 2001; Kaźmierczakowa et al. 2016). In Warsaw, it is exceedingly rare, found on sandy alluvia of the Vistula, with records from a single site located at the city's southern edge (Sudnik-Wójcikowska 1987). The species is typically found along periodically flooded water banks. However, Erndtel's observations indicate its presence not only along the banks of the Vistula near Bielany, but also in the sandy fields around Pułtusk. In addition, Erndtel provides a detailed morphological description of the taxon, aligning with that of *Plantago arenaria*. This includes notable features such as the four petals of the corolla and the distinctively bursting seeds, which serve as the herbal raw material for the plant.

Another plant associated with the Vistula River is *Verbascum blattaria*. While it is a native species in Poland, its occurrences are primarily limited to the southern regions. In central and northern Poland, particularly along the Vistula Valley, it is regarded as synanthropic and is considered very rare (Zając and Zając 2001). This species is included on the red list and has an undetermined threat status of data deficient (DD) due to insufficient data (Kaźmierczakowa et al. 2016). It has been documented by several authors, with early reports noting its presence 'near Warsaw' by Szubert (1824) and from Zakroczym and Młociny (Rostafiński 1872; Kobendza 1930). More recently, it was observed at a single locality in the Vistula Valley, specifically in the southern part of the city, within the Wilanów region (Sudnik-Wójcikowska 1987). Although there may be minor doubts regarding the species designation and name identification, the classification is considered highly probable and referenced by Hryniewiecki (1954). Doubts may be raised by Erndtel's description of the frequency of occurrence 'in Bielanensi saltu frequens', that is, 'in the Bielański Forest frequent'. However, the species being recorded on the Vistula several times over the next two centuries allows us to assess the observation as probable and consider only the frequency of occurrence as overstated in the description.

The last species from the discussed group is *Scutellaria galericulata*, also with the description 'in Bielanensi saltu frequens'. Erndtel described this species in two entries of the list (Table 1) – firstly in the description with the site from Bielany, briefly in one sentence, and in the second case, without the site from Bielany, in a longer text, he included a description of two taxa of *Scutellaria*: the common *Scutellaria galericulata* and the much rarer *Scutellaria hastifolia*. Both species were also mentioned by Hryniewiecki (1954). Both species could have grown in the Bielański Forest, although the analysis of later records is somewhat surprising. The common species *Scutellaria galericulata* was reported and described later as quite frequent or common in Warsaw and its surroundings (Kobendza 1930; Sudnik-Wójcikowska 1987). However, it has never been reported from the Bielański Forest itself, nor from Bielany in general, although it has habitats corresponding to it there. However, the rare species *Scutellaria hastifolia*, not reported at all from the Kampinos Forest (Kobendza 1930) and reported only from three sites (Sudnik-Wójcikowska 1987) from Warsaw at the end of the 20th century, was reported at the end of the 19th century from the close vicinity of Bielany (Cybulski 1895b). The last cited author, searching for rare and previously unnoted species in Warsaw and its vicinity, examined in 1894 one of the Vistula islands near Bielany. The following year, in a publication, he wrote about *Scutellaria hastifolia*: 'I found this rather rare species in the country in the coastal thickets, clumps near Bielany and on the right bank of the Vistula behind Saska Kępa'. Erndtel also indeed observed this species. In the first part of the description covering both taxa, he gives a detailed description of the occurrence: 'Ad fluviorum & in specie Vistulae ripas, item in Salicetis & Alnetis frequens floret Julio & Augusto', so he writes about the banks of the Vistula and willows and alders. Only in the second description does he give the locality from Bielany. It seems very likely that he observed both species in the Bielański Forest and on the banks of the Vistula near Bielany.

Daphne mezereum is a rare species found in Mazovia and central Poland, characterised by a distinctive appearance that makes identification straightforward (Zając and Zając 2001). Erndtnel unequivocally reported the species from the Bielański Forest. Subsequently, it was noted in Bielany, likely from the Forest as well, by Rostafiński in 1872. However, it has not recently been documented in the wider Warsaw area (Sudnik-Wójcikowska 1987). In the Kampinos Forest, it was initially recorded from a single location and described

as 'very rare for the Warsaw area' (Kobendza 1930). More recently, it has been reported as more prevalent, with scattered localities and some areas showing it to be relatively abundant and expanding (Głowacki and Ferchmin 2003).

One of the rarest and most fascinating species described by Erndtnel is *Cypripedium calceolus*. This distinctive orchid is notable for its recognition and identification and its origins, particularly noted from the Bielański Forest, where it was described as 'Floret Junio in saltu Bielanensi'. This species has a well-documented history: it was reported a century later as being 'near Warsaw' by Szubert in 1824, and subsequently in the second half of the 19th century by Rostafiński in 1872 from locations near Bielany Babice and in Kampinos after Berdau. However, at present, this species is not found in the vicinity of Warsaw and is very rare in central Poland (Zając and Zając 2001; Wnuk 2012; Kucharczyk et al. 2014). It is classified as vulnerable (VU) on the national red list (Kaźmierczakowa et al. 2016). The first and only information regarding the historical occurrence of this rare and unique orchid in the Bielański Forest is particularly valuable in this context.

Erndtnel's list also includes species that are even rarer, namely those that have not been reported later from Bielany or other Warsaw areas and Mazovia. These are: *Aruncus sylvestris*, *Bupleurum longifolium*, *Digitalis ferruginea*, *Phyteuma orbiculare* and *Silaum silaus*. Due to their rarity, they constitute the most valuable data on the list discussed.

The first of the above-mentioned, *Aruncus sylvestris*, is a common species in the Carpathians, Sudetes and uplands. In the lowlands and in central Poland, it is scarce and recorded only on the outskirts of Mazovia (Zając and Zając 2001; Krzemińska-Freda 2012). This species was never reported from Warsaw and its surroundings. Only Rostafiński (1872) reported a locality from Bielany after Erndtel (1730). It is worth noting that this is quite exceptional because, in other cases, Rostafiński sporadically quoted this author. However, Sudnik-Wójcikowska (1987) reports from Warsaw only after Rostafiński (1873), and only with the general description 'forests', without the information that this is a locality from Bielany, and that it was reported after Erndtel. The species is, therefore, rarer here than *Cypripedium calceolus* discussed above, although it is not even listed on the national red list due to its abundant occurrence in southern Poland (Kaźmierczakowa et al. 2016).

The next species, *Bupleurum longifolium*, is considerably rarer than the previously mentioned nationally and within the Masovia region. It holds an EN status, as Kaźmierczakowa et al. (2016) noted. Currently, it is found only in a limited number of locations in the mountains, uplands and northern areas, with only one known site in central Poland along the border of Masovia and Podlasie (Zając and Zając 2001). Hryniewiecki (1954) does not reference this species, having misidentified the one described by Erndtel as *Bupleurum rotundifolium*, which is deemed incorrect here. *Bupleurum rotundifolium* possesses a distinctly characteristic morphology, and Erndtel's description does not align with it. Furthermore, the description of its habitat featuring the term 'in dumetis', indicating forests and thickets, is not appropriate. *Bupleurum rotundifolium* is a southern European species that appears in Poland as an archaeophyte. It is primarily found in the country's southern regions, particularly in the highlands, where it has become increasingly rare as a field weed. Most of the old localities are historical and are currently unconfirmed, so this species is recognised as EN (Bomanowska 2012; Węgrzynek 2014; Kaźmierczakowa et al. 2016). There are no reported localities in Mazovia, not even historical ones (Zając and Zając 2001). However, it is worth noting that it could occur here and was stated twice in the 19th century. The first time it was by Szubert (1824) – 'near Warsaw' – and then at the end of the century by Cybulski (1895a), who noted: 'The plant has so far been found only in the southern parts of the country. I found several specimens on the Teresp. railway trackway'.

The species *Digitalis ferruginea* is classified as an ephemerophyte in Poland. It has not been reported from Bielany or Warsaw in more recent studies (Sudnik-Wójcikowska 1982, 1987). Erndtel identifies three taxa under the name *Digitalis*: 'DIGITALIS Rivini, Digitalis purpurea J.B. II. 812', 'DIGITALIS lutea Tabern. 567', and a third species mentioned above, recorded from Bielany. The first species, *Digitalis purpurea,* is a contemporary invasive kenophyte; the second, *Digitalis lutea,* is classified as an ephemerophyte; and the third, as noted here, is *Digitalis ferruginea*, also an ephemerophyte. Hryniewiecki (1954) does not include *Digitalis ferruginea* in his listings. He only mentions two species: *Digitalis purpurea* (without specifying its loca-

tion) and *Digitalis grandiflora* (referred to as *Digitalis ambigua*), likely about *Digitalis lutea* but inaccurately, as Erndtel does not mention this species. Currently, *Digitalis purpurea* is both cultivated and found in the wild, although it is noted to be quite rare in Mazovia and Warsaw (Zając and Zając 2001). No reports of *Digitalis ferruginea* or other species have emerged from Bielany. However, Szubert (1824) previously documented *Digitalis purpurea* (from Europe), *Digitalis lutea* and *Digitalis ferruginea* (both noted from Włochy near Warsaw), along with the native *Digitalis grandiflora*, which he described as being 'near Warsaw'. Karo (1867) also mentioned *Digitalis grandiflora* (at Gocławek), and Rostafiński (1872) noted two species: *Digitalis purpurea* (from Kłodno near Warsaw) and *Digitalis grandiflora* (from Jabłonna). In 1930, Kobendza only referred to *Digitalis grandiflora* (as rare and scattered, in four locations), while Sudnik-Wójcikowska (1987) listed *Digitalis purpurea* (noted sporadically, in one location), *Digitalis lutea* (historical location) and *Digitalis grandiflora* (sporadically, in two locations).

The rarest species, especially in the lowlands, listed by Erndtel is *Phyteuma orbiculare*. The species has relatively few localities in Poland, scattered in the mountains, uplands, Lower Silesia and the Lublin region. In the northern part of the country, five historical localities are known. The species has never been listed in central Poland and in Mazovia (Zając and Zając 2001). Erndtel lists two taxa under the name 'Rapunculus'; the first is 'RAPUNCULUS spicatus, Rapunculus Corniculatus Rivini, Rapunculus spicatus C.B. Pin. p. 92' without specifying localities. This is *Phyteuma spicatum*. The second one listed from Bielany and a forest ('in saltu Bielanensi') is *Phyteuma orbiculare*. Hryniewiecki (1954) listed only the first and omitted the second. It may be intentional, as the species was deemed questionable due to its observation in Mazovia, an area far from other known locations. However, it concerns a very characteristic species that is easy to recognise without similar species and the general range does not rule out the area around Warsaw. The lower Vistula valley has known historical sites (Zając and Zając 2001). For this reason, the designation of the species and its identification is highly likely, and information regarding its historical presence not only in the Bielański Forest but also throughout Mazovia and central Poland is highly significant. The second species of this genus, *Phyteuma spicatum*, has been referenced multiple times in Bielany – first by Karo (1867) and Rostafiński (1872) in the 19th century and later by Kobendza (1929). By the end of the 20th century, it had not been reported in the Bielański Forest (Sudnik-Wójcikowska 1982), although it was noted sporadically at two locations in Warsaw (Natolin, Powsin; Sudnik-Wójcikowska 1987). Subsequently, it was rediscovered in the Bielański Forest (Solińska-Górnicka and Symonides 1991). In the vicinity of Warsaw, it was noted by Szubert (1824). Historically, it was rare in the Kampinos Forest (Kobendza 1930) and remains uncommon there today (noted at one locality, in small numbers; Głowacki and Ferchmin 2003).

According to recent data, the last species mentioned in this group – *Silaum silaus* – is also absent from Mazovia. This species has a number of locations in western Poland, with some areas exhibiting a compact distribution (Zając and Zając 2001). However, it has recently been categorised as NT on the red list (Kaźmierczakowa et al. 2016). The nearest occurrence relative to Warsaw is located in the lower Vistula valley in the Toruń region, approximately 200 km north. Other sites in eastern Poland, such as the Vistula valley near Puławy, have been marked as dubious (Zając and Zając 2001). The species was noted by Hryniewiecki in 1954, and within that context, the identification of the species and its nomenclature were deemed reasonably probable. Despite the potential for former sightings near Warsaw, this species cannot be classified as part of the flora of the Bielański Forest itself; rather, it can only be associated with Bielany more generally, as indicated by its occurrence 'In pratis prope Bielanum', meaning in meadows near Bielany. Nonetheless, considering its significant distance from its established range, observations in this area hold substantial value for the broader region.

Mycological research

Both royal physicians Benhardi and Erndtel were pioneers in the study of fungi, including lichens. Bernhardi (1652) was the first to document three fungi from the Warsaw area, all belonging to the genus *Ustilago*: '*Ustilago seculina, Ustilago avenacea* and *Ustilago hordeacea*'. These fungi are now recognised as causing smut diseases in plants from the Poaceae family. Notably, in the first two parts of the work edited by Bernhardi, he included records of plants from the royal gardens of Warsaw, as documented by Gei at Krakowskie Przedmieście

and by Haik in Ujazdów. Among these records were the aforementioned species *Ustilago avenacea* and *Ustilago hordeacea*. Rostafiński (1928), in his reprint of Bernhardi's work, retained the original names of these species and assigned them numbers 683, 684, 692–694, 1504 and 1505. The sixth chapter interpreted the species sourced from the gardens (numbers 683, 684, 1504 and 1505) as '*Ustilago Carbo Ful'*. Hryniewiecki (1954) later reclassified these species as '*Ustilago Carbo*, *Ustilago Avenae* and *Ustilago Hordei'*. In addition, Majewski (2016) noted that *Ustilago carbo* is an outdated complex term for pollen smuts affecting cereals.

Erndtel can be regarded as the first researcher of macrofungi in the Warsaw area. In the introduction to his short descriptions of various species, he notes on page 45 (Erndtel 1730) that the Vistula River basin boasts a remarkable diversity of fungi, making it nearly impossible to list all species without conducting extensive new studies. He cataloged 28 fungi in the 'Viridarium Warsaviense...' list, all of which began with the noun 'Fungus' (Erndtel 1730). For several mushrooms, he provided Polish common names that are often somewhat distorted, such as 'Denna Bedlka, Muchari biale, Muchari brunatne, Muchari Parchovvate, Szmarży podlugovvati, & Szmarży Okrągle, Kozaky, Kozlarzi, Pębky, Piećarki, Podąbki, Pozary, Prochovvka, Purchatka, Rydzke, Zagievv, Gębka, Hupka'. Though he did not specify locations for any of the taxa, it can be inferred that some of them may have originated from Bielany. Chełchowski (1898), due to limited access to certain cited sources, identified 21 out of the 30 species he believed were included by Erndtel (1730). Hryniewiecki (1954) later repeated this information nearly verbatim, without directly referencing Chełchowski's work in his text.

The first data on lichens in the Warsaw area also come from Bernhardi's work (1652). The author gave the names of two species: 'Muscus arboreus vulg. s. Lichen arboreum' and 'Pulmonaria arborea s. Muscus Pulmonarius', which in Rostafiński's work (1928), under unchanged names, appear under numbers 425 and 522, respectively. Hryniewiecki (1954) interpreted these species as '*Usnea barbata* and *Sticta pulmonaria',* and the first taxon he referred to was under number 426 and not under number 425 as in Rostafiński's work (1928). The second taxon he referred to was under number 522 in Rostafiński's catalog (1928). According to the modern taxonomic division, we can speak of species from the genus *Usnea* and the lungwort *Lobaria pulmonaria* (Fałtynowicz 2003).

According to Hryniewiecki (1954), among the 11 species named 'Muscus...' listed by Bernhardi (1652), some may be lichens, for example, 'Muscus terrestris errectus' according to Hryniewiecki is *Cladonia rangiferina*, and 'Muscus arboreus cappillaceus' is *Bryopogon jubatum* (maybe *jubatus*?) or *Usnea barbata*. The second of the discussed authors, Erndtel (1730), listed 31 species starting with the general name 'Muscus/MUSCUS', among which, according to Hryniewiecki (1954), there are algae, mosses and lichens. Hryniewiecki (1954) designated 'Muscus pyxioides' as *Cladonia pyxidiata*, 'Muscus terrestris erectus' as *Cladonia rangiferina*, 'Muscus terrestris coralloides erectus cornibus ruffescentibus' as *Cladonia rangiformis*, 'Muscus capillaceus' as *Bryopogon jubatum* (now *Bryoria* sp.), 'Muscus arboreus' as *Usnea* sp. and 'Muscus cupressiformis ramosus incanus ramulis fere' as *Stereocaulon paschale* supplemented with question mark.

However, Hryniewiecki's (1954) proposed designations of lichens may raise some doubts. For instance, he identifies 'Muscus terrestris erectus' as *Cladonia rangiferina*. Erndtel (1730) references the works of Thal (1588) and Bauhin (1623) regarding this species, but the descriptions provided by these two authors do not correspond to *Cladonia rangiferina* or align at all with typical lichen descriptions. Instead, they appear to refer to *Huperzia selago*, a member of the Lycopodiaceae family.

Although neither Bernhardi nor Erndtel specified a location for their taxa, it can be inferred, as in the case of fungi, that some specimens could have originated from Bielany. However, lacking definitive evidence of their presence in Bielany, we defer also the determination of their taxonomic affiliation to specialists.

Discussion and conclusions

Bielański Forest is recognised as one of the earliest sites in the region and in the country for conducting botanical research. A thorough analysis of Erndtel's work from 1730, in which he documented the flora of Warsaw and its surroundings, identified 35 species of plants in the Bielany area, comprising one moss, one fern and 33 flowering species. Notably, a contemporary

name was not established for one taxon called 'Lapathum'. Among the identified species, 15 were found in Bielański Forest again at the close of the 20th century (14 flowering plants and one moss), most of which are common taxa. In addition, seven species (six flowering plants and one fern) were documented in the Forest during the 19th and early 20th centuries. Still, they were recorded only at other sites in Warsaw and its vicinity by the end of the 20th century. The remaining 13 species have not been reported from Bielański Forest since then. Some of these are common (e.g., *Peucedanum oreoselinum, Scutellaria galericulata*), while others, particularly those linked to the Vistula River (such as *Plantago arenaria, Salsola kali* subsp. *ruthenica* and *Verbascum blattaria*), were noted during Erndtel's time primarily near the riverbanks rather than within the Forest itself.

However, some species are locally quite rare and very rare. In this group, it is worth mentioning that *Hepatica nobilis and Listera ovata* are currently recorded in a few other locations in Warsaw. One of the most interesting species is *Cypripedium calceolus*, which was last reported from nearby Babice over 150 years ago. However, the most valuable species, whose location in Bielany is isolated in the whole of Mazovia and has never been reported from there later, are *Aruncus sylvestris, Bupleurum longifolium, Phyteuma orbiculare* and *Silaum silaus*, as well as *Digitalis ferruginea*, which has a different character, as it is an ephemerophyte.

Previous studies of the Bielański Forest and the surrounding areas of Warsaw (Kobendza 1929; Hryniewiecki 1954; Sudnik-Wójcikowska 1982, 1987) have not incorporated knowledge about the historical occurrences of the species referenced in Bielany. Furthermore, these species' locations have not been included in nationwide research (Zając and Zając 2001; Kucharczyk et al. 2014). Understanding the distribution of the rarest species is crucial for comprehending the historical flora of the Bielański Forest and grasping the overall ranges of these species across Poland.

The text addresses scarce species designated with various labels on published maps, including historical sites and those considered doubtful. Within the Atlas of Poland grid (abbreviate as ATPOL; Zając and Zając 2001), the Bielański Forest and the entire Bielany area are located entirely within square ED16. Among the rare species mentioned, the following does not occur within this square: *Listera ovata* and *Cypripedium calceolus* (though they can be found in the adjacent ATPOL square covering Babice and in subsequent squares in the Kampinos Forest), along with *Aruncus sylvestris*, *Bupleurum longifolium, Phyteuma orbiculare* and *Silaum silaus*. With the possible exception of *Listera cordata*, all remaining species deserve designation as historical sites (+) or even as doubtful (?) in future studies.

In analysing individual taxa, uncertainties arise that necessitate further clarification – sometimes regarding Erndtel's original work (1730) and often concerning the list compiled by Hryniewiecki (1954). Notably, among the 35 species described, Hryniewiecki either failed to provide or likely misidentified 12 names and omitted certain other species. It is evident that he did not recognise the only moss included. In addition, in some cases, he may not have accurately aligned the modern names with their historical counterparts. This oversight is particularly apparent in cases involving relatively easy-to-identity species, such as *Polypodium vulgare, Frangula alnus* and *Polygonatum odoratum*.

In some instances, he inaccurately identified the modern names (e.g., *Hypericum montanum* and *Plantago arenaria*). A significant shortcoming of his list is the absence of references to the original names provided by Erndtel. Hryniewiecki likely made other errors throughout the list as well. However, it is essential to consider that he created this list over 70 years ago, at a time when the selection and accessibility of source materials from Erndtel's era, as well as modern databases, were considerably more limited and challenging than they are today. It can be inferred that a new, complete, contemporary critical study of Erndtel's work is warranted. This is not only because Hryniewiecki's initial study requires verification, but also due to the observation that within the discussed group of 35 species (which constitute merely a tiny fraction of Erndtel's complete list), 20 species, which account for over half, are no longer present at this site. Among these are several scarce species. Consequently, the species listed here likely do not encompass all the significant historical data within this study.

During the identification process of the species above, the descriptions of related taxa were consulted as necessary. When analysing species from the genera *Ophrys,* and *Orchis*, even rarer taxa than those listed from Bielany were noted in Erndtel's records. These

species, later cataloged by Hryniewiecki, include *Ophrys insectifera* and *Spiranthes spiralis*. Currently, these species are scarce in Poland, and their potential location near Warsaw falls well outside their known range (Fiedor and Bernacki 2014; Kaźmierczakowa and Zarzycki 2014). This raises the possibility that Erndtel's inclusion of them may have been based on an error, either in his identification or in Hryniewiecki's nomenclature. However, an examination of the descriptions in the original sources and those cited within indicates that the identifications are accurate and consistent with the morphology and synonyms of these species. Consequently, regardless of their current distribution, these records can be mainly deemed plausible. It is, therefore, more appropriate to take into account not the contemporary understanding of the ranges of these species, but rather the recognition that the flora of Poland at the beginning of the 18th century was undoubtedly quite different from what we observe today.

Erndtel gathered data for his research nearly 300 years ago. The revelation that rare and currently valuable species once grew in the Bielański Forest provides new insights into the flora of central Mazovia during that period. Therefore, a comprehensive analysis of Erndtel's work could yield additional findings, including even rarer species whose historical presence in Mazovia might seem implausible today. Examining other studies from that time, as referenced here, would be necessary to address such uncertainties.

As highlighted in the introduction, understanding the historical floristic composition of currently studied natural sites is essential for accurately interpreting the changes within their ecosystems (e.g., Bakker et al. 1996; Kapfer et al. 2017; de Bello et al. 2020). Locating information about the past composition of phytocoenoses, such as herbarium collections or critically re-evaluating previously published data, is particularly beneficial in achieving this objective. Rectifying outdated information while reminding especially younger researchers of its significance can enhance the interpretation of modern findings and inspire further exploration into plant cover changes. The Bielański Forest, one of the longest-studied natural areas in both the region and Poland, fully deserves a thorough examination of its botanical history, as it serves as a model site for studying changes in flora.

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