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Critical review of studies of Carboniferous and Lower Permian plant reproductive organs in Poland with complete list of so far published taxa

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ABSTRACT. Reproductive organs of Carboniferous and Lower Permian plants are poorly known in Poland. There are very few monographs on this topic and in them older determinations often require revision. In addition many specimens, including some nomenclaturatal types, have been lost or damaged. The end of the 19th and early 20th century was a period of intense activity in Silesia by eminent geologists and palaeobotanists from Germany, in particular Goeppert, Štúr, Roemer, Potonié and Gothan. However, many papers from this period are now difficult to access, even though some have gained high reputation and are highly cited in the literature. The materials collected in this period are gathered in many German museums and are still used for the taxonomic revisions and descriptions of new taxa. In the 1930s, two papers written by Bocheński on lycopod cones remain to this day highly cited in the literature. The innovative research techniques used by Bocheński and the excellent photographic documentation of specimens provided placed them among the classic articles on the topic. Studies of Carboniferous flora in the period after World War II were mainly aimed at biostratigraphy. The published papers are generally reviews of the flora of separate horizons or boreholes. Reproductive organs were typically determined only up to the level of genus, and the articles lacked accurate descriptions and rarely were they documented with photographs of specimens. In this paper all published records of Polish Carboniferous and Lower Permian plant reproductive organs are collated and critically reviewed. At least 13 genera and 30 species of lycopsid cones and sporophylls, 10 genera and 50 species of sphenopsid cones, 18 genera and 37 species of pteropsid fertile pinna, 1 genus and species of noeggerathialean cone, 30 genera and 65 species of pteridosperm ovules and pollen organs, 3 genera and 4 species of cycadalean seeds and macrosporophylls, 7 genera and 30 species of cordaitalean strobili and seeds, 3 genera and species of conifer reproductive organs have been recorded so far. Only about half of these accounts have been adequately documented with good illustrations. It is apparent from this summary, that it is necessary to review and, as far as possible, fully describe Carboniferous and Lower Permian plant reproductive organs from Poland to determine an accurate record of their composition and diversity.

KEYWORDS: plant reproductive organs, coal flora, Carboniferous, Permian, history of Palaeobotany, Poland

INTRODUCTION

Reproductive organs of Carboniferous and Lower Permian plants are poorly known in Poland. There are a number of reasons for this including an overall lack of detailed monographs on the topic and the dated nature of these monographic treatments from which older determinations often require revisions. Where reviews have occurred they were typically conducted by foreign authors without access to the original materials and are not included in the Polish literature (e.g. Chaloner & Boureau 1967, Leisman & Phillips 1979). In addition, many specimens have been lost since their publication. In recent years, intensive reviews of old Carboniferous collections have been conducted in the Czech Republic, in particular relating to materials from the Czech area of the Upper and Lower Silesian Basins (e.g. Bek & Strakova

1996, Bek & Opluštil 1998, Šimůnek 2000, Šimůnek & Bek 2003, Bek & Opluštil 2004, Šimůnek & Libertín, 2006). Review of specimens from the Polish parts of these basins and stored in Polish museums has also commenced (e.g. Pacyna & Zdebska 2010).

This survey article includes discussion on those papers where taxa of reproductive organ were described and illustrated, since only in this case can we be sure that the determinations are correct. Papers which list taxa, giving only the location and age determination without description or illustration have been included in tables (Tables 1–8) and the most important of them are described briefly. The purpose of this paper is to determine the taxa of reproductive organs from the Carboniferous and Lower Permian of Poland to provide an accurate record of the species and generic composition of the source floras, and to serve as a record of fact relating to summarising the diversity reported in historical documents in an accessible format.

RESEARCH HISTORY AND CRITICAL DISCUSSION OF THE SELECTED PAPERS

In the late 19th and early 20th century, following the extensive mining of black coal, Carboniferous palaeobotany bloomed throughout Western Europe, Poland's difficult political and economic situation was not conducive to the development of science. Silesia, split between Prussia, the Austro-Hungarian Empire and Russia was troubled, and the conflicts were not conducive to the development of extractive industries or, even more, scientific research. German geologists and palaeobotanists used the area as a source of valuable and interesting material, but their studies were for the large part random and non-systematic. The first Polish palaeobotanic papers on the Carboniferous, by Tondera (1888, 1889, 1890a, b), are not equal to them, either in appearance or in insight into the topic. Comparability to the European level of palaeobotanic papers was finally achieved by Rydzewski (in particular, Rydzewski 1919). During this period, the father of Polish palaeobotany M. Raciborski issued most of his papers, but these mainly concern Mesozoic floras. From the Palaeozoic, he described only the flora of the Karniowice Travertine (Raciborski 1890, 1891), which comes from the lowest Permian period (Lipiarski 1971).

World War I did not change this situation, and papers issued in the interwar period are mainly biostratigraphical reports by Bocheński and Stopa. In the 1930s, Bocheński prepared his PhD and his Habilitation on the cones of lycopods from the Upper Silesian Basin (Kwiecińska 2003). The two papers issued on this basis (Bocheński, 1936, 1939) in English and German are so marvellous and incisive on the topic, and came with such excellent photographic documentation that they became part of the established Carboniferous literature worldwide. Since his work, no monograph on the subject has appeared in Poland.

After World War II, almost the entire territory of Silesia was in Poland. The coal industry developed very rapidly. Unfortunately, studies of Carboniferous flora in the post-war era were almost solely biostratigraphic in nature. When reviewing drilling cores and open pits, attention was mainly focused on the indicator species, the most commonly found and stratigraphically important. Fertile taxa, relatively seldom found and thus insignificant biostratigraphically, and furthermore the most difficult to classify, were ignored, or assigned only to a genus. The species determinations from many different ages and distant areas that repeat the same species are somewhat un-insightful and in many cases probably wrong.

After the change of regime in 1989, there were harsh times for the Polish coal industries, dismissals and liquidation of mines. The outcrops of productive Carboniferous strata were devastated (Jureczka 2001). The coal spoil tips, a big problem, became the main location for finding Carboniferous plant fossils (Pacyna 2002a, b, 2003, 2004, 2007a, b, c, 2008a, b, Pacyna & Wojciechowski 2004, Pacyna & Zdebska 2001, 2002, 2005, 2010).

In the history of research on Carboniferous and Lower Permian plant reproductive organs in Poland, therefore, we can distinguish two conventional periods: the 19th and early 20th centuries (until the end of Word War II) and the post-war period until the end of the 80s.

I PERIOD – 19TH AND EARLY 20TH CENTURIES (1820–1945)

The first illustrations and descriptions of Carboniferous plants originating in Silesia were made by Volkmann (1720). He described

and illustrated some seeds from Wałbrzych area and lycopsid sporophylls and cones from Kamienna Góra among others. The first scientific descriptions of Carboniferous plants originating in current Polish territory (Wałbrzych, Nowa Ruda) may be in Sternberg's fundamental palaeobotanic works (1820–1838) which include, as well as the numerous sterile specimens, descriptions and illustrations of the specimens of plant reproductive organs.

The end of the 19th and early 20th century was a period of intense activity in Silesia by eminent palaeobotanists and geologists from Germany, in particular H.R. Goeppert, D. Štúr, H. Potonié, F. Roemer, and W. Gothan. The materials collected in this period have either disappeared or been taken out of Poland and are gathered in many German museums (e.g. in the Museum für Naturkunde in Berlin); they are still used for taxonomic reviews and descriptions of new taxa (e.g. Remy & Remy 1955a, b, Thomas & Brack-Hanes 1991, Thomas & Taylor 1993, Opluštil et al. 2010). Many papers from this period are now difficult to access, even though some gained high reputation and are cited in the literature around the world (e.g. Solms-Laubach 1895, Gothan 1913). The list of parts (only cryptogamous plants) of the taxa confirmed then, along with their brief descriptions, can be found in the multi-tome Traité de Paleobotaniqué edited by Boureau (1964, 1967, 1970, 1975).

The important works of Goeppert (1852, 1859, 1864–1865) also contains descriptions of Carboniferous and Permian plants from Lower and Upper Silesia. It was there that the genus *Calathiops* was established. Goeppert (1864–1865) said that they are reproductive organs compounded of small clusters scale-like appendages located on the ends of the bare, dichotomously divided axes, without clearly saying whether they are ovules in cupules or microsporangia. Benson (1935) emended the genus *Calathiops* and included only ovules within it. The genus *Calathiops* is sometimes linked with the leaves of *Mariopteris* and *Karinopteris*, but specimens showing an organic connection of these genera have not previously been described (Taylor & Taylor 1993).

Papers by Štúr (1875, 1877, 1885, 1887) are extremely important for the Carboniferous flora of Silesia – detailed, in-depth, and richly illustrated. A series of new taxa were established in them, endemic in Silesia or recorded later in other European basins (Tables 1–5). To this day, it is the best compendium of the Carboniferous flora of Lower Silesia. Štúr devoted yet another paper to Upper Silesia, a short paper (1878) of a review and stratigraphic nature. Some Štúr's specimens are stored now in Polish Geological Institute in Warsaw.

In 1895, Solms-Laubach described a new species of sphenophyll cone – *Bowmanites roemeri* (original entry name for the species as *Römeri*) on the basis of the material with tissue structure preserved coming from Orzesze beds (Westphalian B) in the Niedzieliska mine near Jaworzno. This species is sometimes cited as two other combinations with other genera names: *Sphenophyllostachys roemeri* (Boureau 1964) or *Sphenophyllum roemeri* (Brzyski 1969a, b). This is, as far as the author is aware, the sole example of a Carboniferous reproductive organ from Poland described on the basis of a specimen with fully preserved anatomy.

In 1913, Gothan published a monograph on leaves of ferns and seed ferns from Upper Silesia (Gothan 1913). This is an extensive, exhaustive work and is still cited in the world literature. It includes a description of several genera of reproductive organs belonging to these groups. He described a new genus and species of fertile fern leaf of the family Marattiaceae *Tetrameridium caducum.* This was morphologically a sphenopterid leaf, and thereby Gothan proved that some leaves included in the morphological genus *Sphenopteris* did belong to this family (Boureau 1970). In 1950, Gothan described a new genus and species – *Waldenburgia corynopteroides* – a fertile fern leaf with an unclear systematic position (Filicophyta *incertae sedis*) on the basis of a well-preserved specimen from the Wałbrzych Carboniferous (Gothan 1950).

In 1928, on the basis of materials from Westphalian C Orzesze in Upper Silesia, Bode (1928) described a new genus of lycopod cone – *Sporangiostrobus*, with two species: *S. orzechensis* and *S. rugosus*. Bode's specimens, now located in the Museum für Naturkunde in Berlin, were last revised by Opluštil, Bek and Schultka (Opluštil et al. 2010). They claimed that the species *S. rugosus* was a synonym of *S. orzeschensis*, since in their opinion the differences in the morphology of spores and organ morphology are located within the variation of one species. They also assigned the species *S. orzeschensis* to the genus *Omphalophloios* as *Omphalophloios orzeschensis* (Table 1).

Zimmermann and Gothan (1932) described numerous and well preserved specimens of several species of the genus *Sphenopteris*. These were often accompanied by reproductive organs, both ovules and pollen organs, in some specimens remaining organically linked to with leaves. Both scholars counted the fertile organs accompanying the leaves, and not necessarily connected to them, to those species of leaf because of their repeated common distribution and limited themselves to giving only approximate generic names, to which the organs could be classified if they were found isolated. Except the relatively easily recognisable ovules – classified as *Lagenospermum* (probably a new species), the material contained star-shaped structures, which were deemed by them to be cupules of *Diplotheca stellata* from which the seeds had dropped. Although in 1923 Gothan (Gothan 1923b) described these cupules under the name *Telangium* (*Calymmotheca*), he did not identify clearly whether they were pollen organs or divided seed cupules. The name *Telangium* (*Calymmotheca*) refers to the microsporangia (Taylor & Taylor 1993). Zimmermann (1932) described seeds constantly associated with the foliage of *Cardiopteridium waldenburgense*.

In 1898, based on specimens from the Segen-Gottes mine in Wałbrzych, Potonié (1897–1899) described a new species of lycopod sporophyll, namely *Lepidophyllum waldenburgense.* Thomas and Brack-Hanes (1991) referred this material to their emended genus *Cantheliophorus* and selected a holotype for the type species *C. waldenburgensis* from this material. Specimens that may be included in this species can also be found in Polish collections (e.g. in the Museum of Palaeobotany, Institute of Botany of the Jagiellonian University).

It is from the end of the 19th century that the first Polish palaeobotanic papers on the Carboniferous also originate. In 1888 the first ever Polish palaeobotanic paper appeared, by Tondera (1888), on the Carboniferous flora of Upper Silesia. There are no reproductive organs described therein. In another, much more extensive work on the flora of the Upper Silesia from 1889, Tondera (1889) established several new species, including two new species of reproductive organ. The species *Palaeostachya abbreviata* Tondera 1889 is not cited in any subsequent papers. On the basis of the description and table of figures (Tondera 1889, Tab. XII, fig. 1), it appears that the illustrated specimens probably belong to the genus *Macrostachya*. Similarly, a new species of lycopod cone *Lepidostrobus minor* Tondera 1889 has not entered the world literature. The same species name was later used another twice to describe completely different lycopod cones of the genus *Lepidostrobus*. Arber in 1922 (see Crookall 1966) described a new species of lycopod cone *Lepidostrobus* (*Ortholepidostrobus*) *minor* from the United Kingdom Carboniferous. Crookall (1966) included the species established by Arber in synonyms of *Lepidostrobus goodei* Jongmans 1931, emphasising that this was not the species established by Tondera. Leisman and Rivers (1974) described microspore lycopod cones preserved in coal balls from North America as a new species *Lepidostrobus minor*. They link this material with the species *Lepidodendron* (now *Hizemodendron*) *serratum*. *Lepidostrobus minor* Leisman & Rivers 1974 is quoted and illustrated in a number of important papers (e.g., Phillips 1979). Meanwhile, Tondera's two new species have been published validly, giving the diagnosis in Latin and sufficiently illustrated. In order to confirm the validity of Tondera's species, or judge whether they are synonyms of previously described species, or because of their state of preservation they may only be considered as *nomina dubia*, a review of the original materials is necessary. Only then it will be possible to settle the matter of the priority of the naming of *Lepidostrobus minor* Tondera 1889 and renaming subsequent homonyms. This will require a more extensive taxonomic review.

Other papers, written by Rydzewski on the Polish Carboniferous only appeared 20 years later. He amassed a number of new materials and reviewed Tondera's specimens. In 1913 he published a stratigraphical paper, in which he compared the flora in the eastern part of the Upper Silesian Coal Basin to other European basins (Rydzewski 1913). There, he enumerated several species of reproductive organ, but the paper does not contain illustrations and descriptions of these species. A more extensive paper from 1915 (Rydzewski 1915) refers to the flora of the Dąbrowa region and contains a description of the flora with illustrations and biostratigraphic comparisons with other basins in Europe. Finally, Rydzewski (1919) began development of a monographic report on

Polish Carboniferous flora, but only published a paper on the genus *Lepidodendron*.

The end of the 1930s is the period when two of the great papers, still cited in the international literature (e.g. Bateman et al. 1992), by Bocheński were published (1936, 1939). Bocheński examined the cones of several lycopod species from the Upper Silesian Basin. In addition to the standard maceration in the Schulze mixture, he also gradually prepared the flattened compressions that preserved all the tissues. In this way he described a number of previously unknown details and clarified earlier researchers' doubts about the anatomy of the species *Lepidostrobus major* (now *Lepidocarpon major*), *Sigillariostrobus rhombibractiatus*, and *S. ciliatus* (now a synonym of *S. rhombibractiatus*). Bocheński (1936) described two new species – *Sigillariostrobus czarnockii* and *Lepidostrobus bohdanowiczii*. The species *Lepidostrobus bohdanowiczii* was then transferred by Chaloner and Boureau (1967) to the genus *Lepidocarpon*, and Leisman and Phillips (1979) listed it among the genus *Achlamydocarpon*.

These researchers did not, however, use Bocheński's) original materials, which had been destroyed (Prof. I. Lipiarski, pers. comm.). Bocheński (1936, 1939) succeeded in isolating spores from the sporangia of all the species investigated, illustrated their variability and associated them with dispersed species.

Bocheński (1936) did not designated holotypes for the new species *Sigillariostrobus czarnockii* and *Lepidostrobus bohdanowiczii* he described, and therefore all the specimens he illustrated are syntypes of these species. Since the specimens were destroyed, it is not possible to designate lectotypes. Of the two species described by Bocheński, only *Sigillariostrobus czarnockii* was then given by Kotasowa (1979) from the Libiąż beds (Westphalian D) in Upper Silesia, and Migier from Westphalian B from the Lublin Coal Basin (Migier 1988, Kotasowa & Migier 2001, pl. CCXLI, fig 2b). These determinations are based exclusively on the morphology of the specimens; the authors did not analyse the materials for spore content. From Kotasowa's Upper Silesian specimens, after confirming the spores described for this species by Bocheński, it will be possible to designate a neotype for *Sigillariostrobus czarnockii*. This is necessary for the future as the species has been validly established and is cited in the international literature (Boureau 1967, Amerom & Gaipl 1995).

II PERIOD – POST WAR (1945–1989)

Polish post-war publications about Carboniferous and Lower Permian macroflora are usually descriptions of flora from separate beds or from boreholes. With a few exceptions, they contain only the determinations of reproductive organs to the genus level, with no more accurate description and rarely documented with photos of specimens. The most frequently appearing designations in them are *Lepidostrobus* sp., *Sigillariostrobus* sp., *Lepidostrobophyllum* sp. (Tab. 1), as well as several species of the genera *Palaeostachya* and *Calamostachys* (Tab. 2).

The border changes after World War II meant that almost the entire territory of Silesia was in Poland. In Lower Silesia, of the German researchers Franz Zimmermann remained and was still active, however, several years after the war he was forced to leave Poland for political reasons. His published papers add a great deal of relevant data to the understanding of the Carboniferous flora of Lower Silesia (Zimmerman 1958). He described the sporophylls and lycopod cones from the Wałbrzych Culm (Zimmermann 1956). He gathered (Zimmermann 1960) information on the reproductive organs of seed ferns described by other German researchers in Lower Silesia and presented new data on the species: *Sphenopteris adiantoides* (seeds), *S. divaricata-linki* (seeds and pollen organs), and *S. bermudensiformis* (seeds and pollen organs). He prepared (Zimmermann 1962) a "Guide for the classification of the most important Carboniferous plants in Lower Silesia". This comprehensive and richly illustrated work was meant to appear as the 170th Bulletin of the Institute of Geology; however, for political reasons, it was never released. It is only available as a printed manuscript. This guide is a very useful reference for the determinations of Carboniferous plants. It is also an invaluable source of knowledge on the occurrence of reproductive organs of Carboniferous plants in Lower Silesia; Zimmermann included not only his years of observations, but also collated data from many currently inaccessible papers by German authors on the Carboniferous flora of Lower Silesia. The numerous determinations of fertile taxa provided by him in this paper are given in Tables 1–7.

Zimmerman's work in Lower Silesia was continued by E. Sagan. On the basis of the

rich palaeobotanic materials from the Lower Silesian Carboniferous he had collected in the District Museum in Wałbrzych, he published two atlases (Sagan 1981, 1983), in which he illustrated many specimens of sphenopsid and lycopsid reproductive organs. However, he unfortunately did not provide detailed descriptions. He devoted an extensive paper to the seed fern *Sphenopteris bermudensiformis* (Sagan 1965). On the basis of rich materials from the Namurian A Wałbrzych beds, he gave new details on the morphological construction of the leaf, and described and illustrated the construction of triply branched axis. He stated that the middle branch of the leaf axis was fertile and had cupules located on it, which, had they been found separately, would have been described as *Diplotheca stellata*.

Sagan (1980) also described the rich material of the genus *Eleutherophyllum* from the Namurian A of Lower Silesia. In the species *E. mirabile* he confirmed the first occurrence of sporangia and spores. In *E. drepanophyciforme* and *E. waldenburgense*, he described the location on the shoots, and the development and construction of sporangia.

After the war, W. Remy and his wife R. Remy reported on a range of materials collected by German palaeobotanists in the late 19th and early 20th century in the area of Lower Silesia. These materials are deposited in various collections in Germany. Numerous papers were prepared on the basis of these materials devoted exclusively to taxa from Poland, or added these materials to broader papers, together with materials derived from German and French basins. A number of taxa of Carboniferous plant reproductive organs in Poland they described function in the international literature with German position names and with very generally stated stratigraphic positions and locations (Remy, 1953, 1955, Remy & Remy 1955a, b, 1957, 1960).

In 1955, based on a specimen collected by H. Potonié in the Rudolf mine in Lower Silesia (Namurian A), Remy and Remy (1955b) described a new genus and species of seed fern microsynangium – *Simplotheca silesiaca*. On a rock with a large fragment of a leaf of *Sphenopteris dicksonioides*, they identified a very small cluster of sporangia (2.0–2.2 mm in length) located next to the major axis of the leaf (and therefore not in any way in an organic relationship). What Remy and Remy (1955b) considered as cluster of sporangia, Millay and Taylor (1979) interpret as a simple synangium, generally similar to *Aulacotheca*. On the basis of the preservation of the specimens, how the organ opened, and whether it was empty in the middle, cannot be settled. The microspores isolated from sporangium by Remy and Remy (1955b) are saccate and seem to be similar to the morphological genus of isolated spores *Schulzospora*.

Wolf, Sagan and Daber (1977) described the leaves of *Sphenopteris* (*Lyginopteris*) *völkeli* and the pollen organs linked with it from the Namurian A age of Lower Silesia beds.

Storch (1980) reviewed and described new material of the genus *Sphenophyllum* from three Central European limnic basins: two German, Zawickau (Westphalian D) and Saar-Nahe (Westphalian C – Stephanian C) and the Polish area of the Intra Sudetic Depression (Namurian, Westphalian A). The specimens he reviewed from the collections of Zimmerman (Institute of Geological Sciences, Wrocław University) and Sagan (District Museum in Wałbrzych) considerably increased knowledge of the species: *Sphenophyllum cuneifolium*, *Sphenophyllum* aff. *cuneifolium* (=*Sphenophyllum* n. sp. Zimmermann, 1958), *S. cuneifolium* form *amplum*, and *S. tenerrimum.* In this material, there are also well preserved specimens of cones attached to sterile shoots.

From the Lower Carboniferous (Visean) of the Góry Bardzkie Mountains, Górecka (1958) documents *Lepidostrobus* sp. and *Calathiops* sp.

Bocheński and Bolewski (1958) provided information on their discovery of lycopsid cone and fern sporangium with preserved anatomical structure and with spores preserved within sporangia. These materials come from "Tonstein" type refractory shales from Łaziska beds in the Siersza, Jaworzno and Tenczynek mines and boreholes (Upper Silesia). Bocheński, however, was not able to report on these materials in detail, and the specimens have been dispersed or lost (Brzyski 1969a, b).

From the Ruda and Orzesze Beds (Westphalian A) in Dąbrowa Górnicza area of Upper Silesia, the species *Calamostachys paniculata* (Kotas 1965) is well-known. *Calamostachys* sp. is known from the Poruba Beds (Namurian A) in the Katowice and Chorzów areas. Cones of *Calamostachys* sp. were found in the profile that contains the calamite "forest" composed of the standing trunks of *Calamites*

(*Stylocalamites*) *suckowii* in the outcrop at the brickworks at Brynów, in the southern part of Katowice (uppermost Westphalian A). A single cone of *Calamostachys* in this outcrop was found in conjunction with abundant accumulations of *Asterophyllites grandis* twigs with leaves (Brzyski et al. 1976).

From the Karniowice Travertine, the species *Calamostachys tuberculata* was given, which is a cone from a calamite with leaves known as *Annularia stellata*. *A. stellata* occurs commonly in sediments from the Upper Westphalian to the Lower Permian in Poland together with this cone, and its occurrence has been confirmed, as well as in the Travertine, in the Libiąż beds (Lipiarski 1971, Lipiarski & Sarnecka 2001).

Lepidostrobus cones, although unclassified as to species, are given from the Polish Carboniferous, mainly Upper Silesia, relatively frequently (Table 1) They are, with few exceptions, records without description and rarely documented by photos of specimens appearing with reviews of flora from separate beds or the drill holes. Even more commonly given in Poland are isolated sporophylls from the cones *Lepidostrobus* called *Lepidostrobophyllum*. Migier (1973) gives *Lepidostrobus* sp. from the Poruba beds (Namurian A) from the Katowice and Chorzów areas. The organ species of the sporophylls *Lepidostrobophyllum lanceolatum* is known from the entire Upper Carboniferous in Upper Silesia. It is mentioned by Migier (1973) while giving other species of flora from the Poruba Beds in the Katowice and Chorzów areas, Kotasowa (1975) also mentions well preserved specimens from the Upper Visean of Upper Silesia. *Lepidostrobophyllum* sp. is given by Kotasowa (1979) from the Libiąż beds (Westphalian D) of Upper Silesian Coal Basin, and Migier (1979) from the north-eastern part of the Lublin Coal Basin from the Upper Visean and Namurian A. From the Karniowice Travertine (Autunian), Lipiarski (1971) described a new species of the genus *Lepidostrobus* – *Lepidostrobus stopae*. Cones of *Sigillaria*, some determined as the species *Sigillariostrobus czarnockii* mostly disintegrated and poorly preserved, are given by Kotasowa (1979) from the Libiąż beds (Westphalian D) of Upper Silesia. From these same beds, Kotasowa (1979) described and illustrated *Lepidocarpon major*.

Papers on the Upper Silesian Basin are cited and summarised in Migier (1972a, b) and Kotasowa and Migier (1995).

Information on lycopod cones from the Lublin Basin is few, and were most frequently determined only as to genus; and the data was gathered by Migier in her paper (1988).

Cones from lycopods and horsetails have also been found in boreholes from Pomerania and Central Poland. Data on these may be in the papers of Kuchciński (1986) and Kmiecik and Migier (1979), who found beautifully preserved and diverse specimens of *Lepidostrobus* cones in Westphalian B drill holes near Warsaw.

The numerous reproductive organ taxa provided in a valuable summary of studies on the Polish Carboniferous flora by Kotasowa and Migier (2001) have significantly enriched Poland's Carboniferous flora (see Tables 1–7). Unfortunately, in many cases the basin of origin of the specimens is not specified, and the age is very generally given as Carboniferous, with no descriptions or illustrations. A number of very interesting taxa, in particular of seed fern reproductive organs, are not even mentioned, never mind illustrated, in any prior published paper by these authors. Only a few taxa have been described and illustrated in earlier published papers by these authors. In many cases, it is not specified whether the occurrence given is based on data in the literature which are not the author's work or the authors themselves found these specimens. Some of these taxa are known from the Ostrava section of the Upper Silesian Basin. Therefore, the occurrence of all the taxa listed by the authors without illustration, description, exact location, and precise description of stratigraphic position should be considered questionable.

All three Polish coal basins extend beyond the borders. The Lower and Upper Silesian Basins have their continuation on the Czech side. The Lublin Basin extends into Ukraine. The flora of the Czech part of the Lower and Upper Silesian Basins has been researched from the beginning of the 19th century (Sternberg 1820–1838) and is very well understood (Purkyňová 1970). Many of the reproductive organ taxa of Carboniferous plants that have been described there in detail have never been given from the (much larger) Polish areas of these basins (e.g.: Bek & Opluštil 1998, Šimůnek & Libertín 2006). The flora in the Ukrainian area of the Lublin Basin is currently being reported (Kotasowa et al. 2003). The author has seen photographs of some specimens made available by late A. Kotas.

They are poorly preserved materials in thin drill cores, and in the fertile specimens a few *Lepidostrobus* cones and isolated *Lepidostrobophyllum* sporophylls.

COMMENTS TO TABLES

It was unsuccessful to establish the current Polish names of some localities, because for example there were several localities about the same German name, in the region from which probably come described specimens (Rospond 1951), coal mines names and mining areas were frequently changed. In tables some comments are also provided about taxa nomenclatural status, and status of specimens described from Poland. Species names in current usage and recommended by present author are selected as the first cited name. Synonym lists are also provided, complete synonym lists are provided for taxa that have been described as new for science based on specimens from Polish territory.

Original published names of localities, boreholes, horizons and age determinations were given, for authoritative discussion and strata correlation see Wójcik and Grzybowski (1909), Czarnocki (1937), Stopa (1954, 1957a), Zdanowski and Żakowa (1995) and Table 9. Kraków Coal Basin is a historical name which was used for eastern part of Upper Silesian Coal Basin (mainly Dąbrowa Górnicza area) during the 19th and early 20th Century.

Explanation of symbols and abbreviations used in the tables

* – papers with an illustration of a given taxon
^ – papers in which a given taxon has been described as new for science based on specimens from Polish territory
USCB – Upper Silesian Coal Basin
LSCB – Lower Silesian Coal Basin
LCB – Lublin Coal Basin

Dictionary of localities names before 1945 (after Rospond 1951, Zimmermann 1958)

Polish – German

Lower Silesia

Biały Kamień (part of Wałbrzych) – Weisstein
Boguszów – Gottesberg
Chełmiec – Hochwald
Chwalibóg mine (Wałbrzych) – Segen-Gottes-Grube
Czarny Bór – Schwarzwaldau
Czerwieńczyce – Rothwaltersdorf
Daleszów (part of Kamienna Góra) – Leppersdorf
Dzikowiec Kłodzki – Ebersdorf bei Neurode (also misspelt as Eckersdorf, Ebendorf)
Dzikowiec Kłodzki, Fortuna mine – Ebersdorf bei Neurode, Fortuna Grube
Glinno – Heinrichhau
Głęboki Wąwóz (near Wałbrzych) – Tiefer Grund bei Waldenburg
Jabłonów – Gaablau
Jedlina Dworzec/Zdrój – (Bad) Charlottenbrunn
Jugów – Hausdorf (bei Neurode)
Kamienna Góra – Landeshut
Kamionki – Steinkunzendorf
Kłodzko – Glatz
Konradów (part of Wałbrzych) – Conradsthal
Krakus shaft (Wałbrzych) – Schuckmannsschacht
Lubawka – Liebau in Schlesien
Marciszów – Merzdorf
Modlęcin – Friedersdorf
Niedamirów – Kunzendorf
Nowa Ruda – Neurode
Piast mine (Nowa Ruda) – Rubengrube
Poniatów (part of Wałbrzych) – Seitendorf
Poniatów, antitank dich – Seitendorf, Kampfwagen-Abwehrgraben
Ptasia Góra – Vogelkoppe
Radogoszcz near Lubań – Wünschendorf bei Lauban
Sobięcin (part of Wałbrzych) – Hermsdorf bei Waldenburg
Sokolec – Falkenberg
Sokolec Kłodzki – Glätzisch Falkenberg
Stare Bogaczowice – Altreichenau
Stara Warta – Alt-Warthau
Stary Zdrój (part of Wałbrzych) – Altwasser (see Wałbrzych, Dworzec Miasto)
Szczawno Zdrój – Bad Salzbrunn
Szczepanów – Tschöpsdorf
Thorez/Biały Kamień/Julia mine (Wałbrzych) – Fuchsgrube/Juliusschaft
Wałbrzych – Waldenburg
Wałbrzych, Dworzec Miasto (older Wałbrzych Miasto, Stary Zdrój) – Waldenberg, Bahnhof Altwasser
Wambierzyce – Albendorf
Wolbromów – Klein Neudorf
Wolibórz – Volperdorf

Upper Silesia

Belk – Belk
Bytom – Beuthen
Chorzów-Królewska Huta – Königshütte
Gierałtowice – Gieraltowitz also as Geroldsdorf
Katowice – Kattowitz
Katowice-Janów – Janow
Katowice-Rozdzień – Rosdzin
Katowice-Załęże – Zalenze
Leszczyny-Dabieńsko – Dubensko
Łaziska Górne – Ober Lazisk
Mikołów – Nikolai
Mysłowice – Myslowitz
Mysłowice-Brzezkowice – Brzen(s)kowitz
Mysłowice-Janów – Janow
Orzesze – Orzesche
Rybnik-Chwałowice – Chwallowitz
Rybnik-Niedobczyce – Niedobschutz
Rybnik-Paruszowiec – Parusschowitz
Siemianowice-Huta Laura – Laurahütte
Tychy-Wyry – Wyrow
Wodzisław Śląski-Pszów – Pschow

German – Polish

Lower Silesia

Albendorf – Wambierzyce
Altreichenau – Stare Bogaczowice
Alt-Warthau – Stara Warta
Altwasser (see Wałbrzych, Dworzec Miasto) – Stary Zdrój (part of Wałbrzych)
(Bad) Charlottenbrunn – Jedlina Dworzec/Zdrój
Bad Salzbrunn – Szczawno Zdrój
Conradsthal – Konradów (part of Wałbrzych)
Ebersdorf bei Neurode (also misspelt as Eckersdorf, Ebendorf) – Dzikowiec Kłodzki
Ebersdorf bei Neurode, Fortuna Grube – Dzikowiec Kłodzki, Fortuna mine
Falkenberg – Sokolec
Friedersdorf – Modlęcin
Fuchsgrube/Juliusschaft – Thorez/Biały Kamień/Julia mine (Wałbrzych)
Gaablau – Jabłonów
Glatz – Kłodzko
Glätzisch Falkenberg – Sokolec Kłodzki
Gottesberg – Boguszów
Hausdorf (bei Neurode) – Jugów
Heinrichhau – Glinno
Hermsdorf bei Waldenburg – Sobięcin (part of Wałbrzych)
Hochwald – Chełmiec
Kunzendorf – Niedamirów
Landeshut – Kamienna Góra
Leppersdorf – Daleszów (part of Kamienna Góra)
Liebau in Schlesien – Lubawka
Merzdorf – Marciszów
Neurode – Nowa Ruda
Rothwaltersdorf – Czerwieńczyce
Rubengrube – Piast mine (Nowa Ruda)
Schuckmannsschacht – Krakus shaft (Wałbrzych)
Schwarzwaldau – Czarny Bór
Segen-Gottes-Grube – Chwalibóg mine (Wałbrzych)
Seitendorf – Poniatów (part of Wałbrzych)
Seitendorf, Kampfwagen-Abwehrgraben – Poniatów, antitank dich
Steinkunzendorf – Kamionki
Tiefer Grund bei Waldenburg – Głęboki Wąwóz (near Wałbrzych)
Tschöpsdorf – Szczepanów
Wolbromów – Klein Neudorf
Waldenburg – Wałbrzych
Waldenberg, Bahnhof Altwasser – Wałbrzych, Dworzec Miasto (older Wałbrzych Miasto, Stary Zdrój)
Weisstein – Biały Kamień (part of Wałbrzych)
Wünschendorf bei Lauban – Radogoszcz near Lubań
Vogelkoppe – Ptasia Góra
Volperdorf – Wolibórz

Upper Silesia

Belk – Belk
Beuthen – Bytom
Brzen(s)kowitz – Mysłowice-Brzezkowice
Chwallowitz – Rybnik-Chwałowice
Dubensko – Leszczyny-Dabieńsko
Gieraltowitz also as Geroldsdorf – Gierałtowice
Janow – Katowice-Janów
Janow – Mysłowice-Janów
Kattowitz – Katowice
Königshütte – Chorzów-Królewska Huta
Laurahütte – Siemianowice-Huta Laura
Myslowitz – Mysłowice
Niedobschutz – Rybnik-Niedobczyce
Nikolai – Mikołów
Ober Lazisk – Łaziska Górne
Orzesche – Orzesze
Parusschowitz – Rybnik-Paruszowiec
Pschow – Wodzisław Śląski-Pszów
Rosdzin – Katowice-Rozdzień
Wyrow – Tychy-Wyry
Zalenze – Katowice-Załęże

Table 1. Carboniferous and Lower Permian lycopsid cones and sporophylls described so far from Poland territory

Taxon	Location	Horizon, age	References, comments
Achlamydocarpon bohdanowiczii (Bocheński 1936) Leisman & Philips 1979 (= *Lepidostrobus bohdanowiczii* Bocheński 1936) (= *Lepidocarpon bohdanowiczii* (Bocheński 1936) Chaloner & Boureau 1967)	USCB, Brzeszcze mine	Orzesze Beds, roof of coal seam no. XIII Westphalian B	Bocheński 1936^* (Bocheński's type specimens lost), Chaloner & Boureau 1967, Migier 1972a, b, Kotasowa & Migier 2001
Achlamydocarpon lanceolatum (Lindley & Hutton 1831–1833) Leisman & Phillips 1979) (=*Lepidostrobophyllum lanceolatum* (Lindley & Hutton 1831–1833) Chaloner & Boureau 1967) (=*Lepidophyllum lanceolatum* Lindley & Hutton 1831–1833) (=*Lepidocarpon lanceolatum* (Lindley & Hutton 1831–1833) Chaloner & Boureau 1967) (=*Lepidocarpopsis lanceolatum* (Lindley & Hutton 1831–1833) Abbott 1963) (=*Lepidostrobus lanceolatus* (Lindley & Hutton 1831–1833) Goeppert in Bronn, 1848)	LSCB, Intra-Sudetic Depression, Kamienna Góra, Stary Zdrój, Czerwieńczyce, Głęboki Wąwóz	Szczawno and Wałbrzych formations; Upper Visean, Namurian A	Gothan 1932, Zimmermann 1956, 1958, 1962*, Migier 1972b, Kotasowa & Migier 1995, 2001
	USCB, Dąbrowa Górnicza area, Sosnowiec IG 1 borehole, Katowice area, Chorzów area, Kraków Coal Basin, Silesia mine	Lower Malinowice, Zabrze, Poruba, Ruda, Załęże and Orzesze beds; Upper Visean, Namurian A – Westphalian D	Rydzewski 1913, Kotasowa 1968, 1975*, Migier 1972a*, b, 1973
	LCB	Dęblin and Lublin formations; Namurian B – Westphalian C	Migier 1988
Bothrostrobus (Nathorst 1894) Zalessky 1904 *Bothrostrobus* sp.	USCB	Carboniferous	Kotasowa & Migier 2001 (Occurrence in Polish Carboniferous doubtful)
Cantheliophorus waldenburgensis (Potonié 1898) Bassler 1919 emend. Thomas & Brack-Hanes 1991 (= *Lepidophyllum waldenburgense* Potonié 1898) (= *Lepidocarpon waldenburgense* (Potonié 1898) Schopf 1941)	LSCB, Intra-Sudetic Depression, Wałbrzych, Thorez, Chwalibóg, Krakus, Julia shafts	Wałbrzych, Biały Kamień, Žacleř formations; Namurian A – Westphalian B	Potonié 1898, Bassler 1919, Zimmermann 1958, 1962*, Chaloner & Boureau 1967, Sagan 1981*, Kotasowa & Migier 1995, Thomas & Brack-Hanes 1991* (Lectotype designation, type species of genus *Cantheliophorus*)
	USCB	Namurian A – Westphalian D	Kotasowa & Migier 2001
Eleutherophyllum drepanophyciforme Remy & Remy 1960	LSCB, Intra-Sudetic Depression, Wałbrzych, Thorez mine	Wałbrzych Formation; Namurian A	Remy & Remy 1960^* Sagan 1980*, 1981*
Eleutherophyllum mirabile (Sternberg 1833) Štúr 1877	LSCB, Intra-Sudetic Depression, Wałbrzych, Chwalibóg and Thorez mines, Krakus shaft	Wałbrzych Formation; Namurian A	Zimmermann 1958, Sagan 1980*, 1981*
Eleutherophyllum waldenburgense (Štúr 1877) Zimmermann 1930	LSCB, Intra-Sudetic Depression, Wałbrzych, Chwalibóg and Thorez mines, Krakus shaft	Wałbrzych Formation; Namurian A	Zimmermann 1958, 1962*, Sagan 1980*, 1981*
Flemingites (Carruthers 1865) Brack-Hanes & Thomas 1983 or *Lepidostrobus* Brongniart 1828	LSCB, Góry Bardzkie Mts.	Srebrna Góra Formation; Visean	Muszer & Haydukiewicz 2006*
Lepidocarpon major (Brongniart 1828) Hemingway 1941 (=*Lepidostrobus major*(*us*) (Brongniart 1828) Arber 1922) (=*Lepidophyllum majus* Brongniart 1828) (=*Lepidostrobophyllum majus* (Brongniart 1828) Hirmer 1927)	LSCB, Wałbrzych area, Nowa Ruda area, Wałbrzych, Victoria mine	Biały Kamień and Žacleř formations; Westphalian A and B	Zimmermann 1962,Sagan 1981*, Kotasowa & Migier 1995
	USCB, Dąbrowa Górnicza area; Janina mine; Georgsgrube near Niwka	Załęże, Orzesze and Libiąż beds; Westphalian A, B and D	Feistmantel 1874, Bocheński 1936*, Chaloner & Boureau 1967*, Migier 1972a, b, Kotasowa 1968*, 1979, Kotasowa & Migier 2001
	LCB, northern and western parts	Dęblin and Lublin formations; Namurian B – Westphalian C	Migier 1988
Lepidocarpon Scott 1900 *Lepidocarpon* sp.	USCB, Janina mine	Libiąż Beds; Westphalian D	Kotasowa 1979*

Table 1. Continued

Taxon	Location	Horizon, age	References, comments
Lepidophyllum ?n. sp. [=?*Lepidostrobophyllum fimbriatum* (Kidston 1883) Allen 1961]	LSCB, Intra-Sudetic Depression, Wałbrzych, Chwalibóg mine	Szczawno Formation; Upper Visean	Gothan 1932, Zimmermann 1956^*,1958 (revision of original specimens need)
Lepidostrobophyllum "grande" Gothan ex Zimmermann 1962 (non *Cantheliophorus grandis* Bassler 1919) (non *Lepidocarpon grande* (Bassler 1919) Schopf 1941)	LSCB, Wałbrzych area, Nowa Ruda area	Žacleř Formation; Westphalian A and B	Zimmermann 1962^* (Undescribed formally species of *Lepidocarpon*)
Lepidostrobophyllum Hirmer, 1927 *Lepidostrobophyllum* sp.	USCB, Libiąż mine	Libiąż Beds, Westphalian D	Kotasowa 1979
	LCB	Terebin Formation; Namurian A	Migier 1979, Kotasowa & Migier 1995
Lepidostrobus (?) *attenuatus* Goeppert 1864	LSCB, Lubań	Ludwikowice Formation; Rothliegenden, Stephanian –Lower Permian	Weiss 1879
Lepidostrobus brongniartii Goeppert in Berger 1848	USCB (?)	Carboniferous	Berger 1848^*, Chaloner & Boureau 1967
Lepidostrobus fastigiatus Goeppert 1864	LSCB, Wałbrzych	Jüngere Steinkohlen-Formation; Upper Carboniferous	Goeppert 1864*
Lepidostrobus cf. *major* (Brongniart 1828) Arber 1922	LCB, northern and western parts	Lublin Formation; Westphalian A–B	Migier 1988
Lepidostrobus minor Tondera 1889	USCB, Siersza	Izabella seam; Upper Carboniferous	Tondera 1889^*
Lepidostrobus silesiacus Susta 1929	USCB	Orzesze Beds; Westphalian B	Migier 1972a, b
	LCB	Lower Kumów Beds; Namurian B – Westphalian B	Migier 1980, 1988
	Middle Poland	Lublin and Maguszew formations; Westphalian C	Kotasowa & Migier 1995
Lepidostrobus cf. *silesiacus*	LCB, Maguszew borehole	Mudstone Series; Westphalian A–C	Migier 1966
Lepidostrobus stopae Lipiarski 1971	USCB, Karniowice	Karnowice Travertine; Lower Autunian, Lower Permian	Roemer 1870, Raciborski 1890, 1891*, Lipiarski 1971*^, Lipiarski & Sarnecka 2001*
Lepidostrobus variabilis Lindley & Hutton 1831–1833	LSCB, Wałbrzych area, Nowa Ruda area	Biały Kamień and Žacleř formations; Westphalian A–B	Zimmermann 1962, Kotasowa & Migier 1995
	USCB, Dąbrowa Górnicza area, Kraków Coal Basin, Brzeszcze, Jaworzno, Siersza and Silesia mines; Georgsgrube near Niwka; Ignacy shaft, Mortimer mine near Zagórze	Nadredenowe, Poruba, Załęże and Orzesze beds; Namurian A, Westphalian A–B	Feistmantel 1874, Rydzewski 1913,1915, Kotasowa 1968*, Migier 1972a, b, Kotasowa & Migier 1983
	LCB, northern and western parts	Lower Kumów Beds; Namurian B –Westphalian B	Migier 1980, 1988
Lepidostrobus Brongniart 1828 *Lepidostrobus* sp.	LSCB, Intra-Sudetic Depression, Kamienna Góra, Stary Zdrój, Poniatów, Czerwieńczyce Sudety Mts., Góry Bardzkie Mts., Paprotnia, Czerwieńczyce, Mokrzeszów, Lubiechów	Mergelinge Schichten, Paprotnia Beds, Szczawno Formation; Upper Devonian, Upper Visean – Upper Carboniferous	Gothan & Zimmermann 1937*, Górecka 1958, Zimmermann 1956*, 1958, 1962
	USCB, Wieczorek borehole, Wełnowiec IG 1 borehole, Katowice area, Chorzów area; Orzesze, Leopold mine; Tychy, Heinrichgluck mine; Sosnowiec, Porąbka-Klimontów mine	Pietřkovice, Hrušov, Poruba and Załęże beds; Namurian A, Westphalian A	Štúr 1878, Migier 1971*, 1972a*, b, 1973, Krawczyński et al. 1997*
	LCB	Terebin Formation; Namurian A	Kotasowa & Migier 1995
	Western Pomerania	Carboniferous	Kotasowa & Migier 1995
	Middle Poland, Warszawa area, Mszczonów IG 2, Nadarzyn IG 1 boreholes	Lublin Formation; Westphalian B	Kmiecik & Migier 1979*, Kotasowa & Migier 1995

Table 1. Continued

Taxon	Location	Horizon, age	References, comments
Lepidostrobus connected with *Lepidodendron acuminatum* Goeppert 1847	LSCB, Intra-Sudetic Depression, Wałbrzych	Szczawno Formation; Upper Visean	Zimmermann 1956
Lepidostrobus connected with *Lepidodendron veltheimii* Sternberg 1825 (=*Lepidostrobus veltheimianus* Feistmantel 1873)	LSCB, Wałbrzych, Stary Zdrój, Czerwieńczyce	Wałbrzych Beds; Culm, Kohlenkalk; Lower Carboniferous	Feistmantel, 1873*, Štúr 1877*
Sigillariaestrobophyllum Kotasowa & Migier 2001 *nomen nudum*	USCB	Carboniferous	Kotasowa & Migier 2001
Sigillariostrobus czarnockii Bocheński 1936	USCB, Libiąż mine	Orzesze and Libiąż beds; Westphalian B and D	Bocheński 1936^* (Type specimens lost), 1939*, Chaloner & Boureau 1967, Migier 1972a, b, Kotasowa 1979, Kotasowa & Migier 2001*
	LCB, northern and western parts	Lublin Formation; Westphalian A–B	Migier 1988 Kotasowa & Migier 2001*
Sigillariostrobus nobilis Zeiller 1884	Poland	Upper Carboniferous	Chaloner & Boureau 1967
Sigillariostrobus cf. *nobilis*	USCB, eastern part, Silesia mine	Upper Carboniferous	Rydzewski 1913
Sigillariostrobus rhombibractiatus Kidston 1897 (=*Sigillariostrobus ciliatus* Kidston 1897)	USCB	Załęże beds; Westphalian A	Bocheński 1939* (Bocheński's specimens lost), Migier 1972a*, b
Sigillariostrobus Schimper 1870 *Sigillariostrobus* sp.	LSCB, Wałbrzych area, Nowa Ruda area, Wałbrzych, Chrobry mine	Žacleř Formation; Westphalian A and B	Zimmermann 1962, Sagan 1981
	USCB, Dąbrowa Górnicza area, Wieczorek borehole; Belk mine; Orzesze, Leopold mine; Tychy, Heinrichgluck mine	Załęże beds; Westphalian A	Štúr 1878, Kotasowa1968*, Migier 1972a*, b; Ćwirzewicz & Kietlińska-Michalik 1998*
	LCB, borehole Żyrzyn	Mudstone Series; Westphalian A–B	Migier 1966
Spencerites membranaceus Kubart 1909	USCB	Carboniferous	Kotasowa & Migier 2001 (occurrence in Polish Carboniferous doubtful)
Sporangiostrobus orzeschensis Bode 1928	USCB, Orzesze	Middle Westphalian	Bode 1928^*, Chaloner & Boureau 1967, Opluštil et al. 2010 (Referred to genus *Omphalophloios* as *Omphalophloios orzeschensis*)
Sporangiostrobus rugosus Bode 1928	USCB, Orzesze	Middle Westphalian	Bode 1928^*, Chaloner & Boureau 1967, Opluštil et al. 2010 (Synonym of *Omphalophloios orzeschensis*)
Ulostrobus Renier & Stockamans 1938 *Ulostrobus* sp.	USCB, Sosnowiec 558 borehole	Grodziec Beds; Namurian A	Kotasowa 1968*, Migier 1972b, Kotasowa & Migier 2001

Table 2. Carboniferous and Lower Permian sphenopsid cones described so far from Poland territory

Taxon	Location	Horizon, age	References, comments
Bowmanites germanicus Weiss 1884	LSCB, Czarny Bór, Gustav mine	Upper Carboniferous	Weiss 1884*^, Migier 1972b
Bowmanites roemeri Solms-Laubach 1895 (=*Sphenophyllostachys roemeri* (Solms-Laubach 1895) Seward 1898) (=*Disphenophyllum roemeri* (Solms-Laubach 1895) Lotsy 1909)	USCB, Niedzieliska mine near Jaworzno	Orzesze Beds; Westphalian B	Solms-Laubach 1895^*(The original spelling *Bowmanites Römeri*), Boreau 1964*, Brzyski 1969a and b (Cited as *Sphenophyllum* (*Bowmanites*) *roemeri*), Kotasowa & Migier 2001
Calamostachys binneyana (Carruthers 1867) Schimper 1869	LSCB, Rudolphgrube, Wolibórz near Nowa Ruda;	Wałbrzych Beds, seam no. 13; Upper Carboniferous	Weiss 1884*, Migier 1972b
Calamostachys cf. *calathifera* (Weiss 1876) Weiss 1884 (=*Stachannularia calathifera* Weiss 1876)	USCB, Orzesze	Upper Carboniferous	Weiss 1884 (With *Annularia sphenophylloides*)
Calamostachys charaeformis Jongmans 1911 connected with *Asterophyllites charaeformis* (Sternberg 1825) Goeppert 1844	LSCB	Žacleř Beds; Carboniferous	Štúr 1887*
Calamostachys germanica Weiss 1876	USCB, Dzikowiec Kłodzki near Nowa Ruda	Upper Carboniferous	Weiss 1876*^, Migier 1972b, Kotasowa & Migier 2001
	LCB, northern part	Magnuszew Formation; Westphalian A–C	Migier 1988*, Kotasowa & Migier 2001*
Calamostachys longifolia Weiss 1876	LSCB, Boguszów, Sobięcin near Wałbrzych	Hängendster Theil der Saarbrücker Schichten; Upper Carboniferous	Weiss 1876, 1884*, Migier 1972b
	USCB, Katowice Łaziska	Upper Carboniferous	Weiss 1884*
Calamostachys ludwigi (Carruthers 1866) Weiss 1876	USCB, Siersza	Izabella seam; Upper Carboniferous	Weiss 1884, Tondera 1889*, Migier 1972b
	LCB, northern part	Lublin Formation; Westphalian B	Migier 1988
Calamostachys (*?*) *nana* Weiss 1884	USCB, Chorzów	Upper Carboniferous	Weiss 1884*^, Migier 1972b
Calamostachys paniculata Weiss 1876	LSCB, Biały Kamień, Wałbrzych, Sobięcin near Wałbrzych	Szczawno and Wałbrzych formations; Upper Visean, Namurian A, Saarbrücker Schichten	Weiss 1876*^, 1884*, Boureau 1964, Migier 1972b, Kotasowa & Migier 1995
	USCB, Dąbrowa Górnicza area	Załęże Beds; Westphalian A, Gerhardflötz	Štúr 1878, Weiss 1884, Kotas 1965, Kotasowa 1968*, Migier 1972a, b, Kotasowa & Migier 1983
	LCB, northern and western parts	Lublin Formation; Westphalian B	Migier 1988
Calamostachys ramosa Weiss 1876	LSCB, Wałbrzych area, Nowa Ruda area,	Biały Kamień and Žacleř formations; Westphalian A and B	Zimmermann 1962, Kotasowa & Migier 1995
	USCB	Załęże and Orzesze beds; Westphalian A and B	Migier 1972a, b
	LCB	Lublin Formation; Westphalian B	Migier 1988
Calamostachys sahni Stockmans & Williere 1953	LCB, northern part	Lublin Formation; Westphalian B	Migier 1988
Calamostachys solmsi (Weiss 1876) Weiss 1884	LSCB, Wałbrzych	Biały Kamień and Žacleř formations; Wesphalian A and B	Weiss 1884, Boureau 1964, Kotasowa & Migier 1995
Calamostachys tuberculata (Sternberg 1825) Weiss 1884	LSCB	Biały Kamień and Žacleř formations; Wesphalian A and B	Kotasowa & Migier 1995
	USCB: Filipowiece, Karniowice	Karnowice Travertine; Lower Autunian	Raciborski 1890, 1891*, Lipiarski 1971*, Lipiarski & Sarnecka 2001*

Table 2. Continued

Taxon	Location	Horizon, age	References, comments
Calamostachys thuringica (Weiss 1876) Zimmermann 1908	LCB, northern part	Lublin Formation; Westphalian C	Migier 1988
Calamostachys Schimper 1869 *Calamostachys* sp.	LSCB, Sobięcin near Wałbrzych, Dzikowiec Kłodzki	Upper Carboniferous	Weiss 1876* (As *Calamostachys* et *Asterophyllites* sp.)
	USCB, Wieczorek borehole, Brynów, Katowice area, Chorzów area	Poruba and Załęże beds; Namurian A, Westphalian A	Migier 1972a*, 1973, Brzyski et al. 1976
	LCB, Lublin 24 borehole	Lublin Formation; Westphalian B	Migier 1988*
	Middle Poland	Upper Carboniferous	Kotasowa & Migier 1995
Calamostachys connected with *Mesocalamites ramifer* Štúr 1877	LSCB, Intra-Sudetic Depression, Wałbrzych, Thorez mine, Chwalibóg, Krakus shaft	Wałbrzych Formation; Namurian A	Zimmermann 1958, 1962, Sagan 1983
Cingularia typica Weiss 1870	LSCB, Czarny Bór mine	Biały Kamień and Žacleř formations; Westphalian A	Štúr 1885, Sagan 1983*, Migier 1972b, Kotasowa & Migier 1995
Cingularia connected with *Annualaria radiata* (Brongniart 1822) Sternberg 1825	LSCB	Žacleř Beds; Carboniferous	Štúr 1887
Huttonia spicata Sternberg 1837	LSCB, Dzikowiec Kłodzki	Upper Carboniferous	Weiss 1876*
Koinostachys (*Sphenophyllum*) *beinerti* Remy 1955 (=*Sphenophyllostachys beinerti* (Remy 1955) Boureau 1964)	LSCB, Dzikowiec Kłodzki, Frischauf mine	Wałbrzych and Žacleř formations; Namurian A, Westphalian A	Remy 1955^*, Boreau 1964, Kotasowa & Migier 1995
Koinostachys (*Sphenophyllum*) *waldenburgensis* Remy 1955 (=*Sphenophyllostachys waldenburgensis* (Remy 1955) Boureau 1964)	LSCB, Wałbrzych	Wałbrzych and Žacleř formations; Namurian A, Westphalian A or B	Remy 1955^*, Boreau 1964, Kotasowa & Migier 1995
Lilpopia polonica Lipiarski 1971	USCB, Karniowice	Karniowice Travertine; Lower Autunian, Lower Permian	Lipiarski 1971*^, 1972b*, Lipiarski & Sarnecka 2001*
Lilpopia raciborskii (Lilpop 1937) Conert & Schaarschmidt 1970	USCB, Karniowice	Karniowice Travertine; Lower Autunian, Lower Permian	Roemer 1870, Raciborski 1891, Lilpop 1937*^, Conert & Schaarschmidt 1970, Lipiarski 1971*, 1972a*, 2001, Kerp 1984, Lipiarski & Sarnecka 2001*
Macrostachya caudata Weiss 1876 (=*Anastachys* (*Sphenophyllum*) *caudata* Remy 1955) (=*Sphenophyllostachys caudata* (Weiss 1876) Boureau 1964)	LSCB, Beste Grube, Sobięcin near Wałbrzych	Wałbrzych Formation; Namurian A	Weiss 1876*^, Kotasowa & Migier 1995, Kotasowa & Migier 2001 (Taxonomic confusion, probably two different genera confused under *caudata* species name)
Macrostachya carinata var. *approximata* Weiss 1884	USCB, Orzesze	Upper Carboniferous	Weiss 1884*^
Macrostachya hauchecornei Weiss 1884 (=*Sphenophyllum hauchecornei* (Weiss 1884) Remy 1955) (=*Sphenophyllostachys hauchecornei* (Weiss 1884) Boureau 1964)	LSCB	Žacleř Formation; Westphalian B	Weiss 1884, Štúr 1885, Boreau 1964*, Migier 1972b, Kotasowa & Migier 1995
	USCB, Orzesze	Untere Nicolaier Schichten, Lower Westphalian B; Saarbrücker Stufe	Weiss 1884*^, Remy 1955*
	LCB, south part	Lublin Formation; Westphalian B	Migier 1988
Macrostachya infundibuliformis (Brongniart 1828) Schimper 1869	Silesia	Upper Carboniferous	Weiss 1884, Boureau 1964*
Macrostachya Schimper 1869 *Macrostachya* sp.	USCB, borehole Janina 89	Libiąż Beds; Westphalian D	Kotasowa 1979*
Palaeostachya abbreviata Tondera 1889	USCB, Siersza	Izabella seam; Upper Carboniferous	Tondera 1889^*
Palaeostachya distachya (Sternberg 1825) Jongmans 1911	USCB	Załęże Beds; Westphalian A	Kotasowa & Migier 1983

Table 2. Continued

Taxon	Location	Horizon, age	References, comments
Palaeostachya elongata (Presl 1838) Weiss 1876	LSCB	Biały Kamień and Žacleř formations; Wesphalian A and B	Weiss 1876, Migier 1972b, Kotasowa & Migier 1995, Kotasowa & Migier 2001
	USCB, Dąbrowa Górnicza area, Katowice, Mysłowice, Orzesze	Załęże, Orzesze and Łaziska beds; Namurian B, Westphalian A–C	Weiss 1884; Boureau 1964*, Kotasowa 1968, Migier 1972a, b, Kotasowa & Migier 1983, 2001
	LCB, western and northern parts	Lublin Beds; Westphalian A–C	Migier 1988*, Kotasowa & Migier 2001*
Palaeostachya (*?*) *gracillima* Weiss 1884	LSCB, Nowa Ruda, Piast mine	Upper Carboniferous	Weiss 1884*^
Palaeostachya pedunculata Williamson in Weiss 1884	LSCB, Wałbrzych area, Nowa Ruda area, Wałbrzych, Amalia shaft, Boguszów	Biały Kamień and Žacleř formations; Westphalian A and B	Weiss 1884*, Zimmermann 1962, Boureau 1964, Kotasowa & Migier 1995 Sagan 1983*
	USCB, Dąbrowa Górnicza area, Kraków Coal Basin, Brzeszcze and Siersza mines, Orzesze, Wesoła near Mysłowice	Załęże Beds; Westphalian A	Weiss 1884, Rydzewski 1913, Kotas 1965, Migier 1972a, b, Kotasowa & Migier 1983
	LCB, northern and western parts	Lublin Formation; Westphalian B	Migier 1988
Palaeostachya tenera (Weiss 1876) (=*Volkmannia tenera* Weiss 1876)	LSCB, Sobięcin near Wałbrzych	Upper Carboniferous	Weiss 1876*^ (As *Volkmannia tenera*, Weiss 1876), Migier 1972b
	USCB, Radzionka mine	Upper Carboniferous	Weiss 1884
Palaeostachya Weiss 1876 *Palaeostachya* sp.	LCB	Lublin Formation; Westphalian B	Migier 1988*
Paracalamostachys minor Weiss 1884	USCB, Chorzów	Unterster Theil der Saarbrücker Stufe; Upper Carboniferous	Weiss 1884^*, Boureau 1964, Migier 1972b
Paracalamostachys polystachya (Sternberg 1825) Weiss 1884 (=*Volkmannia polystachya* Sternberg 1825) (=*Bruckamannia polystachya* (Sternberg 1825) Štúr 1887 (=*Calamostachys polystachya* (Sternberg 1825) Stockmans & Williere 1953)	LSCB, Wałbrzych, Nowa Ruda, Biały Kamień, Julius shaft, Dzikowiec Kłodzki	Wałbrzych Formation, Žacleř Beds; Namurian A	Sternberg, 1825^* (Syntypes of Sternberg from Wałbrzych in collection of National Museum in Prague), Weiss 1884*, Štúr 1887* (some described specimens connected with leafy shoots *Asterophyllites polystachyus* Štúr 1887), Weiss 1876*, 1884, Boureau 1964, Migier 1972b, Kotasowa & Migier 1995
Paracalamostachys rigida Weiss 1884 (=*Calamostachys rigida* Weiss 1876)	LSCB, Dzikowiec Kłodzki near Nowa Ruda, Wałbrzych	Wałbrzych Formation; Namurian A	Weiss 1876^*, 1884*, Boureau 1964, Migier 1972b, Kotasowa & Migier 1995
Paracalamostachys striata Weiss 1884 (=*Calamostachys striata* (Weiss 1884) Hirmer 1927	LSCB	Upper Carboniferous	Štúr 1885, Migier 1972b
	USCB, Orzesze mine	Upper Carboniferous	Weiss 1884^*(Described with connected leafy twigs *Asterophyllites striatus* n. sp.), Migier 1972b, Boureau 1964*
Pothocites cf. *minor* Hartung 1938	LSCB, Wałbrzych, Thorez mine	Wałbrzych Formation; Namurian A	Sagan 1983*, Kotasowa & Migier 1995
Pothocites Peterson 1841 *Pothocites* sp. connected with *Asterocalamites scrobiculatus* (Schlotheim 1820) Zeiller 1879	LSCB, Intra-Sudetic Depression, Wałbrzych, Thorez mine, Czerwieńczyce, Kamienna Góra	Szczawno and Wałbrzych formations; Upper Visean, Namurian A	Goeppert 1859, Feistmantel 1873*, Zimmermann 1956*, 1958, Sagan 1983*
	USCB	Lower Carboniferous – Namurian A	Kotasowa & Migier 1995
Sphenophyllostachys cuneifolius (Sternberg 1823) Boureau 1964 (=*Sphenophyllum cuneifolium* (Sternberg 1823) Zeiller 1893) (=*Bowmanites cuneifolius* (Sternberg 1823) Hoskins & Cross 1943)	LSCB, Wałbrzych area, Nowa Ruda area	Žacleř Formation; Westphalian A and B	Zimmermann 1962, Storch 1980*
	LCB, northern part	Lublin Formation; Westphalian A–B	Migier 1988

Table 2. Continued

Taxon	Location	Horizon, age	References, comments
Sphenophyllostachys majus (Bronn in Bischoff 1828) Boureau 1964 (=*Sphenophyllum majus* (Bronn in Bischoff 1828) Hemingway 1931) (=*Bowmanites major* (Bronn in Bischoff 1828) Hoskins & Cross 1943)	LSCB, Wałbrzych area, Nowa Ruda area	Žacleř Formation; Uppermost Westphalian B	Zimmermann 1962
Sphenophyllostachys tenerrimus (Ettingshausen 1854) Stockmans & Williere 1953 (=*Sphenophyllum tenerrimum* (Ettingshausen 1854) Helmhacker 1874) (=*Bowmanites tenerrimus* (Ettingshausen 1854) Hoskins & Cross 1943)	LSCB, Intra-Sudetic Depression, Wałbrzych, Nowa Ruda, Teresa mine, Thorez, Chwalibóg, Krakus, Julia shafts	Wałbrzych Formation; Namurian A	Zimmermann 1958, 1962, Boureau 1964, Storch 1980*, Sagan 1983
	USCB, Witkowice	Ostrava Beds; Culm, Lower Carboniferous	Štúr 1877*
Sphenophyllostachys trichomatosus (Štúr 1887) Boureau 1964 (=*Asterophyllites trichomatosus* Štúr 1887)	LSCB	Žacleř Beds; Carboniferous	Štúr 1887*, Boureau, 1964 (Sterile leafy shoots with cones attached)
Sphenophyllostachys (as *Volkmannia*) connected with *Sphenophyllum costatulum* Štúr 1887	LSCB, Wałbrzych, Nowa Ruda	Žacleř Beds; Carboniferous	Štúr 1887* (sterile leafy shoots with cones attached)
Sphenophyllum emarginatum (Brongniart 1822) Koenig 1825	LSCB, Wałbrzych area	Žacleř Formation; Uppermost Westphalian B	Zimmermann 1962 (Sterile leafy shoots with cones attached)
Sphenophyllum Koenig 1825	LSCB, Okrzeszyn	Radwanice Beds; Lowermost Stephanian	Zimmermann 1962 (Sterile leafy shoots with cones attached)
Calamostachys Schimper 1869 and *Palaeostachya* Weiss 1876 (as *Bruckmannia* Sternberg 1825 or *Volkmannia* Sternberg 1825) connected with *Calamites schulzi* Štúr 1887 *Calamites schumanni* Štúr 1887 *Calamites ramosus* Artis 1825 *Calamites suckowii* Brongniart 1828 *Calamites sachsei* Štúr 1878	LSCB	Žacleř Beds; Carboniferous	Štúr 1887*

Table 3. Carboniferous and Lower Permian pteropsid fertlile pinna described so far from Poland territory

Taxon	Location	Horizon, age	References, comments
Asterocarpus cf. *pinnatifidus* (Gutbier) Weiss 1869	LSCB, North Sudetic Depression, Radogoszcz, Zgorzelec area	Świerzawa Formation; Rothliegenden, Lower Permian	Weiss 1879, Mastalerz 1990, Lipiarski & Sarnecka 2001
Asterocarpus Goeppert 1836 *Asterocarpus* sp.	LSCB, North Sudetic Depression, Radogoszcz, Zgorzelec area	Świerzawa Formation; Rothliegenden, Lower Permian	Weiss 1879*, Mastalerz 1990, Lipiarski & Sarnecka 2001
Corynepteris coralloides (Gutbier 1835–1836) Zeiller 1888	LSCB, Wałbrzych area, Nowa Ruda area	Žacleř Formation; Westaphalian A–B	Zimmermann 1962*
Corynepteris sternbergi (Ettinghausen 1854) Kidston 1923	LSCB, Wałbrzych area, Nowa Ruda area	Žacleř Formation; Westphalian A–B	Zimmermann 1962*
	USCB, Wujek mine	Lower Załęże Beds; Westphalian A	Stopa 1957*
Corynepteris quercifolia (Goeppert 1836) Zimmermann 1958	LSCB, Intra-Sudetic Depression, Wałbrzych	Wałbrzych Formation; Namurian	Zimmermann 1958
Corynepteris silesiaca Remy & Remy 1955	LSCB, Chełmiec (Hochwald)	Weißsteiner Schichten; Westphalian A	Remy & Remy 1955a^*, 1957*
Crossotheca schatzlarensis Štúr 1883	LSCB	Biały Kamień and Žacleř formations; Westphalian A and B	Kotasowa & Migier 1995

Table 3. Continued

Taxon	Location	Horizon, age	References, comments
Discopteris karwinensis Štúr 1883	LSCB, Wałbrzych area, Nowa Ruda area	Žacleř Formation; Westphalian A–B	Zimmermann 1962*, Boureau 1970
	USCB, Katowice mine	Lower Załęże Beds; Westphalian A	Stopa 1957
Discopteris schumanni Štúr 1883	LSCB, Wałbrzych area, Nowa Ruda area, Klaraschacht near Gorce	Žacleř Formation; Westphalian A–B	Remy & Remy 1957*, Zimmermann 1962*
Discopteris (*Eudiscopteris*) *vullersi* Štúr 1885	LSCB, Wałbrzych area, Nowa Ruda area	Žacleř Formation; Westphalian A–B	Zimmermann 1962*
	USCB, Ruda, Chwallowitz borehole	Muldengruppe; Middle Westphalian	Gothan 1913*
Boweria schatzlarensis (Štúr 1885) Kidston, 1911 (=*Hapalopteris schatzlarensis* Štúr 1885)	LSCB, Nowa Ruda	Žacleř Formation; Namurian	Štúr 1885*
Hawlea schaumburg-lippeana Štúr 1885	USCB, Belk	Paralic Series; Namurian	Štúr 1885* (Probably synonym of *Pecopteris saraefolia* Bertrand 1928 (Boureau 1975))
Hymenophyllites schimperianus Goeppert 1859	LSCB, Czerwieńczyce, Stary Zdrój	Kohlenkalk; Lower Carboniferous	Feistmantel 1873*
Oligocarpia (*?*) *stipulataeformis* Štúr 1885	USCB, Katowice	Paralic Series; Namurian	Štúr 1885*
Pecopteris aspera Brongniart 1828	LSCB, Czerwieńczyce, Stary Zdrój	Biały Kamień Beds; Visean, Namurian B–C, Westphalian A	Zimmermann 1962*
Pecopteris (*Cyathocarpus*) cf. *arborescens* (Schlotheim 1820) Weiss 1869	LSCB, North Sudetic Depression, Radogoszcz, Zgorzelec area	Świerzawa Formation; Rothliegenden, Lower Permian	Weiss 1879, Mastalerz 1990, Lipiarski & Sarnecka 2001
Pecopteris bredowi Germar 1844	USCB, Karniowice, Filipowice, Dulowa	Karniowice Travertirne; Autunian, Lower Permian	Lipiarski 1971*, Lipiarski & Sarnecka 2001 (Probably conspecific with *Myriotheca permica* Remy 1954)
Pecopteris (*Asterotheca*) *miltoni* (Artis 1825) Brongniart 1828 (=*Hawlea miltoni* (Artis 1825) Štúr 1877)	LSCB, Wałbrzych area, Nowa Ruda area, Wałbrzych, Nowa Ruda	Žacleř Formation; Upper Carboniferous, Westphalian A–B	Štúr 1885*, Zimmermann 1962*
	USCB, Dąbrowa, Katowice, Orzesze	Paralic Series; Namurian	Štúr 1885*
Pecopteris (*Senftenbergia*) *namuriana* Zimmermann 1958	LSCB, Intra-Sudetic Depression, Thorez mine, Krakus shaft	Wałbrzych Formation; Namurian	Zimmermann 1958^
Pecopteris (*Senftenbergia*) *pennaeformis* Brongniart 1822	LSCB, Wałbrzych area, Nowa Ruda area	Žacleř Formation; Westphalian A–B	Zimmermann 1962*
	USCB, Jankowice mine near Rybnik	Załęże Beds; Westphalian A	Lipiarski 1965*
Pecopteris (Brongniart 1822) Sternberg 1825 *Pecopteris* sp.	USCB, Orzesze borehole	Muldengruppe, Middle Westphalian	Gothan 1913*
Pyriformis marschachtii Thomas & Taylor 1993	Poland, Kladno, Mar-Schacht	Westphalian C	Thomas & Taylor 1993^* (According to Pšenička et al. (2005) specimen comes from Kladno locality (Kladno-Rakovnik Basin, Czech Republic) and the specimen is *Corynepteris angustissima*-type fern fertile pinna)
Rhodea (*Zeilleria*) *subpetiolata* (Potonié 1890) Gothan 1912	USCB, Wujek mine	Lower Załęże Beds; Westphalian A	Stopa 1957*
Rhodea tenuis Gothan 1913	LSCB, Intra-Sudetic Depression, Thorez mine	Wałbrzych Formation; Namurian	Zimmermann 1958
Senftenbergia acuta (Brongniart 1828) Štúr 1883	USCB, Orzesze	Paralic Series; Namurian	Štúr 1885*
Senftenbergia crenata (Lindley & Hutton) Štúr 1885	LSCB, Wałbrzych, Nowa Ruda	Žacleř Formation; Upper Carboniferous	Štúr 1885*
Senftenbergia ophiodermatica (Goeppert) Štúr 1883	USCB, Janów	Paralic Series; Namurian	Štúr 1885*

Table 3. Continued

Taxon	Location	Horizon, age	References, comments
Senftenbergia plumosa (Artis 1825) Štúr 1877	LSCB, Wałbrzych area, Nowa Ruda area	Žacleř Formation; Westphalian A–B	Zimmermann 1962*
	USCB, Brzeszcze mine	Lower Załęże Beds; Westphalian A	Stopa 1957*
Senftenbergia schwerini Štúr 1883	LSCB, Nowa Ruda	Žacleř Formation; Upper Carboniferous	Štúr 1885*
	USCB, Janów	Paralic Series; Namurian	Štúr 1885*
Sphenopteris (*Discopteris?*) *papillosa* Gothan 1913	USCB, Paruschowitz and Gieraltowitz IV boreholes	Muldengruppe; Middle Westphalian	Gothan 1913^*
Sphenopteris (*Renaultia*) *schwerini* (Štúr 1885) Zeiller 1899	LSCB, Wałbrzych area	Žacleř Formation; Westphalian A	Zimmermann 1962*
Sphyropteris schumanni Štúr 1885	LSCB, Nowa Ruda	Žacleř Formation; Upper Carboniferous	Štúr 1885*
Tetrameridium (*Sphenopteris*) *caducum* Gothan 1913	USCB, Mokra (Mokrau), Brade mine	Obere Muldengruppe; Middle Westphalian	Gothan 1913*^, Boureau 1970, Migier 1972b
Waldenburgia corynepteroides Gothan 1950	LSCB, Wałbrzych, Biały Kamień, Julius mine; Gustaw mine, Czarny Bór	Wałbrzych and Žacleř beds; Namurian A or Westphalian	Gothan 1950^*, Remy 1953*, Remy & Remy 1957*, Boureau 1970*
Weissites pinnatifidus (Gutbier 1843) Remy 1954	USCB, Filipowice	Karnowice Travertine; Lower Autunian, Lower Permian	Lipiarski 1971*, Lipiarski & Sarnecka 2001*
Zeilleria avoldensis (Štúr 1885) Kidston 1884	USCB, Siersza, Kostuchna	Muldengruppe; Middle Westphalian	Gothan 1913*
Zeilleria frenzli Štúr 1883	LSCB, Wałbrzych area, Nowa Ruda area	Žacleř Formation; Westphalian A and B	Zimmermann 1962
	USCB, Smilowitz borehole	Obere Muldengruppe; Middle Westphalian	Gothan 1913*

Table 4. Carboniferous noeggerathialean (progymnosperms?) cones described so far from Poland territory

Taxon	Location	Horizon, age	References, comments
Noeggerathiostrobus bohemicus Nemejc 1928	USCB, Robert mine, Jaworzno	Libiąż Beds; Westphalian D; Łaziska Beds; Upper Westphalian B	Remy & Remy 1957* (Description and illustration of microspores isolated from cone), Boureau 1964*, Kotasowa & Migier 2001, Šimůnek & Bek 2003

Table 5. Carboniferous and Lower Permian pteridosperm (lyginopteridalean, medullosalean and callistophytalean) ovules and pollen organs described so far from Poland territory

Taxon	Location	Horizon, age	References, comments
Aphlebiocarpus schutzei Štúr 1877	LSCB, Intra-Sudetic Depression, Wałbrzych, Stary Zdrój, Thorez mine, Chwalibóg, Krakus shaft	Wałbrzych Formation; Namurian	Štúr 1877^*,1885*, Zimmermann 1958, Migier 1972b
Alcicornopteris convoluta Kidston 1887	LSCB, Intra-Sudetic Depression, Wałbrzych	Szczawno Formation; Upper Visean	Zimmermann 1958; Kotasowa & Migier 1995, 2001
Alcicornopteris zeilleri Vaffier 1901	LSCB, Intra-Sudetic Depression, Wałbrzych	Szczawno Formation; Upper Visean	Zimmermann 1958, Kotasowa & Migier 1995
Aulacotheca Halle 1933 *Aulacotheca* sp.	USCB, Sosnowiec, Mortimer-Porąbka mine	Załęże Beds; Westphalian A	Kotasowa 1968*, Kotasowa & Migier 2001 (Record without description, only illustration)
Aulacotheca campbellii (White 1900) Halle 1933	LSCB, Wałbrzych area, spoil heap of Chrobry mine	Žacleř Formation; Duckmantian (Westphalian B)	Pacyna 2007a, b, Pacyna & Zdebska 2010
Boulayatheca fertilis (Kidston 1914) Taylor & Kurmann 1985	LSCB: Wałbrzych, spoil heap of Chrobry mine	Žacleř Formation; Duckmantian (Westphalian B)	Pacyna 2007a, b, Pacyna & Zdebska 2010

Table 5. Continued

Taxon	Location	Horizon, age	References, comments
Boulayatheca ciliata Pacyna & Zdebska 2010	USCB, Sosnowiec-Zagórze, Porąbka-Klimontów mine	Załęże Beds; Langsettian (Westphalian A)	Pacyna & Wojciechowski, 2004, Pacyna 2007a and b, Pacyna & Zdebska 2010^*
Boulayatheca saganii Pacyna & Zdebska 2010	LSCB, Wałbrzych, Chrobry mine	Žacleř Formation; Westphalian	Pacyna 2007a, b, Pacyna & Zdebska 2010^*
Calathiops beinertiana Goeppert 1865	LSCB, Grunwacke near Czerwieńczyce	Kohlenkalk; Lower Carboniferous	Goeppert 1865^* (Validly published type species of genus *Calathiops* Goeppert 1865)
Calathiops acicularis Goeppert 1865	LSCB, Grunwacke near Czerwieńczyce	Kohlenkalk; Lower Carboniferous	Goeppert 1865^* (Revision of original specimen need)
Calathiops minima Gothan 1937 (=*Psilophyton robustius sensu* Feistmantel 1873)	LSCB, Czerwieńczyce	Kohlenkalk; Kulm, Lower Carboniferous	Feistmantel 1873*, Gothan 1937^*
Calathiops microcarpa Goeppert 1865	LSCB, Grunwacke near Czerwieńczyce	Kohlenkalk; Lower Carboniferous	Goeppert 1865^* (Revision of original specimen need)
Calathiops Goeppert 1865 *Calathiops* sp.	LSCB, Intra-Sudetic Depression, Góry Bardzkie Mountains, Paprotnia, Czerwieńczyce, Mokrzeszów, Lubiechów	Mergelinge Schichten, Paprotnia Beds; Upper Devonian, Visean	Goeppert 1865, Gothan & Zimmermann 1937*, Górecka 1958, Zimmermann 1958, 1962, Migier 1972b (Revision of genus need)
Calymmotheca Štúr 1877	LSCB, Wałbrzych, Stary Zdrój	Wałbrzych Formation; Namurian A	Behrend 1909 (Material in need of revision)
	USCB, Bytom, Heinitz mine, Przeciszów XIX borehole	Muldengruppe; Middle Westphalian	Gothan 1913* (Material in need of revision)
Codonotheca silesiaca Pacyna & Zdebska 2010	USCB, Sosnowiec- Zagórze, Porąbka-Klimontów mine	Załęże Beds; Langsettian (Westphalian A)	Pacyna 2007a, b, Pacyna & Zdebska, 2010^*
Cyclocarpus Braun 1840	LSCB	Žacleř Formation; Westphalian A	Zimmermann 1962, Kotasowa & Migier 2001
Seeds associated with *Cardiopteridium waldenburgense* Zimmermann 1932 leaves	LSCB, Intra-Sudetic Depression	Wałbrzych Beds; Namurian A	Zimmermann 1932^*
Diplotheca stellata Kidston 1903	LSCB, Intra-Sudetic Depression, Kamienna Góra, Wałbrzych	Szczawno and Wałbrzych formations; Upper Visean, Namurian A	Zimmermann & Gothan 1932*, Zimmermann 1956, 1958, 1960*, Sagan 1965*, Kotasowa & Migier 1995, (Revision need)
Dolerotheca migierii Pacyna & Zdebska 2010	USCB, Sosnowiec-Zagórze, Porąbka-Klimontów mine	Załęże Beds; Langsettian (Westphalian A)	Pacyna 2007a, b, Pacyna & Zdebska, 2010^*
Hexagonocarpus Renault 1890	Poland	Carboniferous	Kotasowa & Migier 2001 (Occurrence in Polish Carboniferous doubtful)
Holcospermum ellipsoideum (Goeppert 1852) Walton 1931 (=*Trigonocarpus ellipsoideum* Goeppert 1852)	LSCB, Sudety Mts., Góry Bardzkie Mts., Czerwieńczyce, Wojbórz, Paprotnia	Paprotnia Beds, Biały Kamień and Žacleř formations; Upper Visean, Westphalian A and B	Goeppert 1852, Górecka 1958, Migier 1972b, Kotasowa & Migier 1995
Kotasotheca annaeadamii Pacyna & Zdebska 2010	USCB, Oświęcim, Piast mine	Orzesze or Łaziska Beds; Duckmantian (Westphalian B)	Pacyna 2007a, b, Pacyna & Zdebska, 2010^*
Lagenospermum Nathorst 1914	LSCB, Intra-Sudetic Depression, Thorez mine, Krakus shaft	Wałbrzych Formation; Namurian A	Zimmermann 1958, 1960*
Leptotesta grandeurii Loubiere 1929	USCB, Jaworzno area	Łaziska and Chełm beds; Upper Westphalian B and Westaphalian C	Kotasowa 1978*, Kotasowa & Migier 2001
Pachytesta Brongniart 1874	Poland	Carboniferous	Kotasowa & Migier 2001 (Occurrence in Polish Carboniferous doubtful)
Paracalathiops stachei Remy 1953	LSCB, Wałbrzych or Nowa Ruda area, Krakus shaft; borehole Chełm I	Wałbrzych Formation; Namurian A	Remy 1953^*, Zimmermann 1958, Karczewska 1969*, Kotasowa & Migier 1995

Table 5. Continued

Taxon	Location	Horizon, age	References, comments
Polygonocarpus czarnockii Zalessky 1907	USCB, Dąbrowa Górnicza area	Beds under the Reden coal seam; Upper Carboniferous	Zalesskij 1907^*, Rydzewski 1915, Migier 1972b
Potoniea adiantiformis Zeiller 1899	LSCB, Wałbrzych Depression, Chrobry mine	Biały Kamień and Žacleř formations; Namurian C – Westphalian B	Zimmermann 1962, Kotasowa & Migier 1995 (Also under invalid *Potoniea adiantoides* name)
	USCB, Zabrze, Luise mine	Untere Muldengruppe; Middle Westphalian	Gothan 1913*, Migier 1972b
Ptychotesta Brongniart 1874	Poland	Carboniferous	Kotasowa & Migier 2001 (Occurrence in Polish Carboniferous doubtful)
Rhabdocarpus Goeppert & Berger in Berger 1848	LSCB	Žacleř Formation; Westphalian A and B	Zimmermann 1962, Kotasowa & Migier 2001 (The original spelling of genus name *Rhabdocarpos*)
Rhabdocarpus amygdaliformis Goeppert & Berger in Berger 1848	LSCB, Wałbrzych	Steinkohlen-Formation; Upper Carboniferous	Berger 1848*, Goeppert 1848 (*nomen nudum*), 1864*
Rhabdocarpos Beinertianus Goeppert & Berger in Berger 1848	LSCB, Jedlina Dworzec near Wałbrzych	Carboniferous	Berger 1848*^
Rhabdocarpus conchaeformis Goeppert 1852	LSCB, Jugów	Kohlenkalk; Lower Carboniferous	Goeppert 1852^*, 1859
Rhabdocarpus laevis Goeppert 1864	USCB, Belk, Mikołów area	Steinkohlen-Formation; Upper Carboniferous	Goeppert 1864*
Rhabdocarpus lanceolatus Goeppert 1864	LSCB, Nowa Ruda	Permian	Goeppert 1864*
Rhabdocarpos lineatus Goeppert & Berger in Berger 1848	LSCB, Jedlina Dworzec near Wałbrzych	Upper Carboniferous	Berger 1848*^
Rhabdocarpus obliquus Goeppert 1864	LSCB, Nowa Ruda	Permian	Goeppert 1864*
Rhabdocarpus ocultus Goeppert 1864	LSCB, Nowa Ruda	Permian	Goeppert 1864*
Rhabdocarpus ovoideus Goeppert & Berger in Berger 1848 (=*Carpolithes ovoideus* Goeppert 1845 *nomen nudum*)	USCB, Belk, Mikołów area	Steinkohlen-Formation; Upper Carboniferous	Goeppert 1845, Berger 1848*, Goeppert 1864*
Rhabdocarpus pyriformis Goeppert 1864	LSCB, Nowa Ruda	Permian	Goeppert 1864*
Rhabdocarpus Goeppert & Berger in Berger 1848 *Rhabdocarpus* sp.	LSCB, Czerwieńczyce	Kohlenkalk; Lower Carboniferous	Feistmantel, 1873
Rhabdocarpus spathulatus Goeppert 1864	LSCB, Nowa Ruda	Permian	Goeppert 1864*
Rhabdocarpos Rochschianus Goeppert & Berger in Berger 1848	LSCB, Jedlina Dworzec near Wałbrzych	Upper Carboniferous	Berger 1848*^ (In Table I caption misspelt as R. *Bockschianus*)
Rhabdocarpos truncatus Goeppert & Berger in Berger 1848	LSCB, Jedlina Dworzec near Wałbrzych	Carboniferous	Berger 1848*^
Rhabdocarpos tunicatus Goeppert & Berger in Berger 1848	LSCB, Jedlina Dworzec near Wałbrzych	Carboniferous	Berger 1848*^
Silesiatheca formosa Pacyna & Zdebska 2010	USCB, Sosnowiec-Zagórze, Porąbka-Klimontów mine	Załęże Beds; Langsettian (Westphalian A)	Pacyna 2007a, b, Pacyna & Zdebska 2010^*
Simplotheca silesiaca Remy & Remy 1955	LSCB, Rudolf mine	Wałbrzych Formation; Namurian A	Remy & Remy 1955b^*
Pollen organs associated with *Sphenopteris adiantoides* (Schlotheim 1820) Lindley & Hutton 1834 leaves	LSCB, Wałbrzych	Wałbrzych Formation; Namurian A	Gothan 1923b* Zimmermann 1960* (Revision of original specimens need)

Table 5. Continued

Taxon	Location	Horizon, age	References, comments
Pollen organs associated with *Sphenopteris bermudensiformis* (Schlotheim 1820) Zeiller 1899 leaves	LSCB, Intra-Sudetic Depression, Kamienna Góra, Wałbrzych	Wałbrzych Formation; Upper Visean, Namurian A	Zimmermann & Gothan 1932, Zimmermann 1958, 1960*, Sagan 1965* (Revision of original specimens need)
Pollen organs associated with *Sphenopteris dicksonioides* (Goeppert 1836) Potonié 1903 leaves	LSCB, Dzikowiec, Fortuna mine	Wałbrzych Beds; Namurian A	Gothan 1923b* (Revision of original specimens need)
Pollen organs associated with *Sphenopteris divaricata-linki* Goeppert 1836 leaves	LSCB	Wałbrzych Formation; Namurian A	Zimmermann 1960* (Revision of original specimens need)
Pollen organs connected with *Sphenopteris* (*Lyginopteris*) *völkeli* Behrend 1908 leaves	LSCB	Wałbrzych Formation; Namurian A	Wolf et al. 1977* (Revision of original specimens need)
Schutzia anomala Geinitz 1863	LSCB, North Sudetic Depression, Radogoszcz, Zgorzelec area	Świerzawa Formation; Rothliegenden, Stephanian – Lower Permian	Weiss 1879, Mastalerz 1990, Kotasowa & Migier 2001, Lipiarski & Sarnecka 2001 (The original spelling of genus name *Schützia*)
Telangiopsis bifidum (Lindley & Hutton 1831–1833) Eggert & Taylor 1971 (=*Telangium bifidum* (Lindley & Hutton, 1831–1833) Benson 1904) (=*Rhodea lipoldi* (Štúr 1875) Patteisky 1929)	LSCB, Intra-Sudetic Depression	Szczawno and Wałbrzych formations; Upper Visean, Namurian	Zimmermann 1958 (Revision of original specimens need)
Telangium Benson 1904 (*Calymmotheca* Štúr 1877)	LSCB	Wałbrzych Beds; Namurian A	Gothan 1923b* (Revision of original specimens need)
Telangiopsis sp.1	LSCB, Wałbrzych	Wałbrzych Formation; Lower Namurian	Pacyna 2007a, b
Telangiopsis sp. 2	LSCB, Wałbrzych	Wałbrzych Formation; Lower Namurian	Pacyna 2007a, b
Trigonocarpon Mentzelianum Goeppert & Berger in Berger 1848 (=*Carpolithes Mentzelianus* Goeppert 1845 *nomen nudum*)	USCB, Chorzów-Królewska Huta	Kohlensandstein; Upper Carboniferous	Goeppert 1845, 1848 (*nomen nudum*) Berger 1848*^ (*Trigonocarpon* is original Brongniart (1828) name for *Trigonocarpus*, he adopted new spelling *Trigonocarpus* in 1881)
Trigonocarpus noeggerathi (Sternberg 1826) Brongniart 1828	LSCB, Wałbrzych area, Nowa Ruda area	Biały Kamień and Žacleř formations; Westphalian A and B	Zimmermann 1962, Kotasowa & Migier 1995
	USCB, Kraków Coal Basin, Ornontowice, Janów, Brzeszcze mine, Karniowice, Filipowice	Upper Carboniferous; Karniowice Travertine; Lower Autunian, Lower Permian	Roemer 1863*, Feistmantel 1874 (as *Trigonocarpum Nöggerathi*), Rydzewski 1913, Lipiarski 1971*, Lipiarski & Sarnecka 2001*
Trigonocarpus parkinsoni Brongniart 1828	LSCB, Wałbrzych area, Nowa Ruda area	Biały Kamień and Žacleř formations; Westphalian A and B	Zimmermann 1962, Kotasowa & Migier 1995
Trigonocarpon Schultzianum Goeppert & Berger in Berger 1848	USCB, Mysłowice	Upper Carboniferous	Berger 1848*^ (In Tab. II caption misspelt as *T. Schulzianum* and *T. Scultzianum*)
Trigonocarpus Brongniart, 1828 – *Sphenopteris dicksonioides* (Goeppert 1836) Potoniè 1903	LSCB, Dzikowiec, Fortuna mine	Wałbrzych Beds; Namurian A	Gothan 1923b*

Table 5. Continued

Taxon	Location	Horizon, age	References, comments
Trigonocarpus Brongniart 1828 *Trigonocarpus* sp.	LSCB, Intra-Sudetic Depression, Góry Bardzkie Mts., Wałbrzych, Thorez mine, Krakus shaft, Głęboki Wąwóz, Czerwieńczyce, Wojbórz, Paprotnia, Poniatów, Solec, Stary Zdrój, Konradów	Paprotnia Beds; Upper Visean, Namurian	Zimmermann 1956*, 1958, 1962, Górecka 1958*, Migier 1972b, Kłapciński & Muszer 1987*
	USCB, Katowice area, Chorzów area	Poruba Beds; Namurian A	Migier 1973
	LCB, Milejów IG 1 borehole, Żyrzyn borehole; western part	Mudstone Series; Wesphalian A–C	Migier 1966, 1988, Kotasowa & Migier 2001*
Whittleseya elegans Newberry 1853	LSCB, Wałbrzych, spoil heap of Chrobry mine, Gorce, spoil heap of Klara shaft	Biały Kamień and Žacleř formations; Westphalian A and B	Potonie 1904, Gothan 1923a, Zimmermann 1962, Migier 1972b, Kotasowa & Migier 1995, Pacyna 2007a, b, Pacyna & Zdebska, 2010*
Whittleseya campanulata Pacyna & Zdebska 2010	LSCB, Gorce area, Victoria mine, Witold shaft	Žacleř Beds; Westphalian A–C	Pacyna 2007a, b, Pacyna & Zdebska, 2010^*
Whittleseya silesiaca Pacyna & Zdebska 2010	LSCB, Wałbrzych area, Gorce area near Wałbrzych, spoil heap of Klara shaft	Žacleř Formation; Langsettian (Westphalian A)	Pacyna 2007a, b, Pacyna & Zdebska, 2010^*

Table 6. Lower Permian cycadalean seeds and macrosporophylls described so far from Poland territory

Taxon	Location	Horizon, age	References, comments
Cyclocarpus karniowicensis Raciborski 1891	USCB, Filipowice, Karniowice	Karniowice Travertine; Lower Autunian, Lower Permian	Raciborski 1890, 1891*, Lipiarski 1971*, Lipiarski & Sarnecka 2001*
Fructus Engelhart 1877 *Fructus??*	USCB, Karniowice	Karniowice Travertine; Lower Autunian, Lower Permian	Raciborski 1891
Taeniopteris multinervis Weiss 1869–1872	USCB, Filipowice, Karniowice	Karniowice Travertine; Lower Autunian, Lower Permian	Roemer 1870, Raciborski 1890, 1891*, Lipiarski 1971*, Lipiarski & Sarnecka 2001*
Taeniopteris Brongniart 1832 *Taeniopteris* sp.	USCB, Karniowice	Karniowice Travertine; Lower Autunian, Lower Permian	Lipiarski 1971*, Lipiarski & Sarnecka 2001*

Table 7. Carboniferous and Lower Permian cordaitalean reproductive organs described so far from Poland territory

Taxon	Location	Horizon, age	References, comments
Cardiocarpon Brongniart 1828	USCB, Janów, Susanne mine	Upper Carboniferous	Štúr 1878 (*Cardiocarpon* generic name is a spelling variant of *Cardiocarpus*)
Cardiocarpos acutus Lindley & Hutton 1831–1833	LSCB, Jedlina Dworzec near Wałbrzych	Carboniferous	Goeppert 1845
Cardiocarpon apiculatum Goeppert & Berger in Berger 1848 (=*Carpolithes apiculatus* Goeppert 1845 *nomen nudum*)	LSCB, Wałbrzych, Nowa Ruda, Jedlina Dworzec near Wałbrzych, Lubawka	Obere Steinkohlen-Formation; Upper Carboniferous, Permian	Berger 1848*^, Goeppert 1864* (As *Cardiocarpus apiculatus*)
Cardiocarpus drupaceous Brongniart 1874	LSCB	Žacleř Formation; Westphalian A and B	Zimmermann 1962
Cardiocarpon cicatrisatum Goeppert & Berger in Berger 1848 (=*Carpolithes cordatus* Goeppert 1845 *nomen nudum*)	LSCB, Jedlina Dworzec near Wałbrzych	Upper Carboniferous	Goeppert 1845, Berger 1848*^

Table 7. Continued

Taxon	Location	Horizon, age	References, comments
Cardiocarpon emarginatum Goeppert & Berger in Berger 1848 (=*Carpolithes emarginatus* Goeppert 1845 *nomen nudum*)	LSCB, Jedlina Dworzec near Wałbrzych	Upper Carboniferous	Goeppert 1845, Berger 1848*^
Cardiocarpus orbicularis Brongniart 1881	LSCB, Ottendorf in Silesia, Nowa Ruda, Nawojów Śląski (Schlesisch Haugsdorf) near Lubań	Untere Platten-Dolomiten; Obere Zechstein (?), Permian	Goeppert 1864*
Cardiocarpon operculatum Goeppert & Berger in Berger 1848 (=*Carpolithes operculatus* Goeppert 1845 *nomen nudum*)	LSCB, Jedlina Dworzec near Wałbrzych	Upper Carboniferous	Goeppert 1845, Berger 1848*^
Cardiocarpon punctulatum Goeppert & Berger in Berger 1848	LSCB, Dzikowiec Kłodzki, Jugów near Nowa Ruda	Kohlenkalk; Lower Carboniferous	Berger 1848*^, Goeppert 1852, 1859
Cardiocarpum rostratum Feistmantel 1873	LSCB, Czerwieńczyce	Kohlenkalk; Lower Carboniferous	Feistmantel, 1873* (*Cardiocarpum* generic name is a spelling variant of *Cardiocarpus*)
Cardiocarpus Brongniart 1881 *Cardiocarpus* sp.	LSCB, North Sudetic Depression, Radogoszcz, Zgorzelec	Świerzawa Formation; Rothliegenden, Lower Permian	Weiss 1879*, Mastalerz 1990, Lipiarski & Sarnecka 2001
Carpolithes alatus Lindley & Hutton 1833–1837	LSCB, Jedlina Dworzec near Wałbrzych	Carboniferous	Goeppert 1845
Carpolithes bivalvis Goeppert in Berger 1848	USCB, Dąbrowa Górnicza area	Upper Carboniferous	Goeppert 1845 (*nomen nudum*), 1848 (*nomen nudum*), Berger 1848*^
Carpolithes cotyledoniformis Goeppert 1848	USCB, Dąbrowa Górnicza area	Upper Carboniferous	Goeppert 1848*^, Berger 1848* (In Tab. II caption misspelt as *C. dicotyledoniformis*)
Carpolithes cycadoideus Corda 1841	LSCB, Jedlina Dworzec near Wałbrzych	Carboniferous	Goeppert 1845 (correct Corda spelling *C. cycadinus*)
Carpolithes dictyopteron Goeppert & Berger in Berger 1848	USCB, Mysłowice	Upper Carboniferous	Berger 1848*^ (Genus *Carpolithes* Schlotheim 1820 (=*Carpolithus* Linnaeus 1768) is a repository for seeds and supposed seeds from almost every geological horizon (Andrews 1970), specimens described in Berger 1848 as *Carpolithes* mostly resemble cordaitalean seeds)
Carpolithes fraxiniformis Goeppert & Berger in Berger 1848	LSCB, Jedlina Dworzec near Wałbrzych	Upper Carboniferous	Berger 1848*^
Carpolithes macropterus Corda 1841	LSCB, Jedlina Dworzec near Wałbrzych	Carboniferous	Goeppert 1845
Carpolithes membranaceus Goeppert in Berger 1848	LSCB, USCB	Carboniferous	Berger 1848*^
Carpolithes petiolatus Goeppert in Berger 1848	LSCB, Jedlina Dworzec near Wałbrzych	Upper Carboniferous	Goeppert 1845 (*nomen nudum*), Berger 1848*^
Carpus sp.	USCB, Goczałkowice IG 1 borehole	Lower Malinowice Beds; Upper Visean	Kotasowa 1975* (invalid name)
Cordaitanthus pitcairiniae (Lindley & Hutton, 1833) Feistmantel 1876 (=*Cordaianthus pitcairiniae* (Lindley & Hutton 1833) Renault 1881)	LSCB	Biały Kamień and Žacleř formations; Westphalian A and B	Kotasowa & Migier 1995
	USCB, Dabrowa Górnicza area, Kazimierz-Juliusz 371 borehole, Kryry 5 borehole, Kraków Coal Basin, Brzeszcze mine, Siersza mine	Załęże and Libiąż beds; Namurian A – Westphalian D	Rydzewski 1913, Kotas 1965, Migier 1966, 1972a*, b, Kotasowa 1968*, 1979, Kotasowa & Migier 2001*
	LCB, northern and western parts, Krasnystaw borehole	Mudstone Series; Namurian B – Westphalian C	Migier 1966, 1988, Kotasowa & Migier 2001

Table 7. Continued

Taxon	Location	Horizon, age	References, comments
Cordaianthus Grand'Eury 1877 *Cordaianthus* sp.	LCB, Krasnystaw borehole	Lublin and Maguszew formations; Westphalian A–B	Migier 1966, Kotasowa & Migier 2001 (Proper genus name *Cordaitanthus* Feistmantel 1876)
Cordaicarpus cordai (Geinitz 1855) Zeiller 1886–1888	USCB, Kraków Coal Basin, Siersza mine	Upper Carboniferous	Rydzewski 1913
	LCB, northern and western parts	Lublin Formation; Westphalian A–C	Migier 1988, Kotasowa & Migier 2001*
	Central Poland	Lublin Formation; Westphalian B	Kotasowa & Migier 1995
Cordaicarpus Geinitz 1862 *Cordaicarpus* sp.	USCB, Dąbrowa Górnicza area	Załęże and Libiąż beds; Westphalian A and D	Kotasowa 1968, 1979
	LCB, Krasnystaw, Maguszew boreholes	Lublin and Maguszew formations; Westphalian A–C	Migier 1966, Kotasowa & Migier 2001 (The proper original spelling *Cordaicarpon*)
Jordania moravica Helmhacker 1871	LSCB, North Sudetic Depression, Radogoszcz, Zgorzelec area	Świerzawa Formation; Rothliegenden, Lower Permian	Weiss 1879*, Mastalerz 1990, Lipiarski & Sarnecka 2001
Samaropsis fluitans Weiss 1871 (=*Cordaitanthus pseudofluitans* (Kidston 1922) Florin 1957	LSCB, North Sudetic Depression, Radogoszcz, Zgorzelec area	Świerzawa Formation; Rothliegenden, Lower Permian	Weiss 1879*, Mastalerz 1990, Lipiarski & Sarnecka 2001
Samaropsis lusatica Weiss 1879	LSCB, North Sudetic Depression, Radogoszcz, Zgorzelec area	Świerzawa Formation; Rothliegenden, Lower Permian	Weiss 1879^*, Mastalerz 1990, Lipiarski & Sarnecka 2001
Samaropsis pseudofluitans (Dawson) Davies 1929	LCB, Gostyń IG 10 borehole	Lublin Formation; Westphalian B	Kotasowa & Migier 2001*
Samaropsis Geoppert 1864 *Samaropsis* sp.	USCB, Brzeszcze XXX borehole	Załęże, Libiąż beds; Westphalian A and D	Migier 1972a*, b, Kotasowa 1979
	LSCB, North Sudetic Depression, Radogoszcz, Zgorzelec area	Świerzawa Formation; Rothliegenden, Lower Permian	Weiss 1879*, Mastalerz 1990, Lipiarski & Sarnecka 2001
	LCB, Krasnystaw, Żyrzyn boreholes	Mudstone Series; Westphalian A–C	Migier 1966, 1988, Kotasowa & Migier 2001*

Table 8. Permian conifer reproductive organs described so far from Silesia

Taxon	Location	Horizon, age	References, comments
Ullmannia lanceolata Goeppert 1865	LSCB, Nowa Ruda	Permian	Goeppert 1865*
Walchia piniformis (Schlotheim 1820) Sternberg 1825	LSCB, North Sudetic Depression, Radogoszcz, Zgorzelec area	Świerzawa Formation; Rothliegenden, Lower Permian	Goeppert 1865*, Weiss 1879*, Mastalerz 1990, Lipiarski & Sarnecka 2001
Voltzia hexagona (Bischoff 1828) Geinitz 1862	LSCB, Nowa Ruda	Weissliegenden, Permian	Goeppert 1865*

Table 9. Chart showing global subdivision of Carboniferous System, with approximate equivalency of global subdivisions to regional stage subdivisions in North America and to regional stage and substage subdivisions in western Europe (according to IUGS scheme available at stratigraphy.org, modified)

System	Subsystem	Global series	Global stage (Eastern Europe)	Regional stage (North America)	Regional stage (Western Europe)			Regional substage (Western Europe)
Carboniferous	Pennsylvannian		Gzhelian	Virgilian	Autunian (Lower)			
		Upper			Silesian	Stephanian	C	
			Kasimovian	Missourian			B	
							A	Barruelian
								Cantabrian
		Middle	Moscovian	Desmoisian		Westphalian	D	Asturian
				Atokan			C	Bolsovian
							B	Duckmantian
		Lower	Bashkirian	Morrowan			A	Langsettian
						Namurian	C	Yeadonian
							B	Marsdenian
								Kinderscoutian
							A	Alportian
								Chokierian
	Mississipian	Upper	Serphukovian	Chesterian				Arnsbergian
								Pendleian
		Middle	Visean		Dinantian (=Culm)	Visean		Brigantian
				Meramecian				Asbian
								Holkerian
				Osagean				Arundian
								Chadian
		Lower	Tournaisian			Tournaisian		Ivorian
				Kinderhookian				Hastarian

CONCLUSIONS

As is clear from the facts presented, it is essential to revise and, as far as possible, fully describe the Carboniferous and early Permian plants reproductive organs from Poland. Work to this end has started (Pacyna 2002a, b, 2003, 2004, 2007a, b, c, 2008a, b, Pacyna & Wojciechowski 2004, Pacyna & Zdebska 2001, 2002, 2005). A monograph has already been published on the pollen organs of seed ferns (Pteridospermophyta) from the Lower and Upper Silesia (Pacyna & Zdebska 2010), but knowledge on these plant organs remains in its infancy when compared to other areas of the world including adjacent basins within the Czech Republic.

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