History of the studies on the flora and vegetation in the Czech Republic

Historie výzkumu flóry a vegetace v České republice

Dedicated to the centenary of the Czech Botanical Society (1912–2012)

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A brief history of the botanical research on the flora and vegetation in the Czech Republic is presented. This is done in the context of the progress in botany in neighbouring countries as well as the development of the society, especially the establishment of scientific institutions in the different countries. Important botanists who worked in other countries, but spent part of their life in what is now the Czech Republic, are also listed.

Key words: botanical research, Czech Republic, flora, history, vegetation, universities

Historical framework

The present Czech Republic was for several centuries a part of Austrian (from 1867 Austro-Hungarian) Empire and as a consequence was closely connected with other parts of that big country. The Czech Republic consists of three historical parts, Bohemia, Moravia and Silesia. Most of Silesia was ceded to Prussia in 1742 and only a small part, named Austrian Silesia, remained in the Austrian Empire. Most of Silesia that was incorporated into Prussia, later on Germany, became after the WW II the German part of Silesia incorporated into Poland. Bohemia has a natural centre in Praha (Prag in German, Prague in English) and Moravia had two centres Olomouc (Ollmütz) and Brno (Brünn), the latter being more important. With respect to the centre of education, it was more connected with Wien (Vienna) than Prague. Silesia had at that time one important centre, Breslau (Vratislav in Czech, at present Wrocław in Poland). Centre of local importance was Opava (Troppau). Southern border of Silesia with Moravia and Bohemia are formed by the Sudetes mountain range. This mountain chain attracted not only botanists from Silesia but also from both Austria and Prussia and for that reason it became one of the best known regions at that time. After the WW I, a series of new states appeared in central Europe, many of them with new borders. The same occurred after the WW II, when the borders of many countries changed. Process of splitting of some countries occurred again after 1990. So, during the course of one century many regions were located in several different countries. This caused difficulties as the botanical literature was written in different languages and many topographical names changed, which is something botanists in countries with stable borders do not experience.

Similar changes occurred in the Botanical Society and its journals. It was founded in 1912 as the Czech Botanical Society. After the WW I it became the Czechoslovak Botanical

Society (1919), during the WW II (1939–1945) Czech Botanical Society and after the war the Czechoslovak Botanical Society again (1945–1992), which from the 1960s existed in parallel with the Slovak Botanical Society (see Novák 1962 and Holub 1982 for reviews of its history). Splitting of Czechoslovakia at the beginning of 1993 was followed by another change in the name back to the original Czech Botanical Society (from 1993).

Important institutes for science are universities. Within the present Czech Republic the oldest university is Universitas Carolina (Univerzita Karlova in Czech, Karls Universität in German) founded by Charles IV in 1348. During the anti-reformation its name was changed to Karl-Ferdinands Universität, and used up to the end of the WW I. In 1882, it was split into a German and Czech University. At the beginning of the war in 1939 the Nazis closed all Czech universities, after the war the German University was closed and most Germans had to leave Czechoslovakia. Organizational incorporation within the university and the heads of botany up to the end of WW II are given in Table 1.

Second oldest university in the Czech Republic was founded at Olomouc in 1573. During its history this university was closed and opened several times and opened most recently in 1946. The third university was founded after the WW I in Brno and from 1920 it had an Institute of Botany led by Josef Podpěra until he died in 1954. A detailed history of botany at this university is described in Vacek & Bureš (2001).

Each region had institutions for educating primary and secondary school teachers. After 1990, most of them were combined with other schools and changed into universities. The exception was in southern Bohemia, where the new University of South Bohemia was founded based on institutes of the Academy of Sciences and several local faculties. There was a polytechnic school in Prague, which during the 19th century became the Technical University. There were also positions there for botanists, who specialized in agriculture and forestry. In 1920, the Agriculture Faculty was formed and in 1952 an independent Agriculture University (Vysoká škola zemědělská, now Česká zemědělská universita, Czech University of Life Sciences). Similar changes also occurred at Brno, where an independent Agriculture University (Vysoká škola zemědělská, now Mendel's University) was founded in 1919.

Also important for the development of science are scientific societies. Similar to the Royal Society, Královská česká společnost nauk (Königlich böhmische Gesellschaft für Wissenschaften) was established in Prague in 1790 by transforming a previously private academy founded at the end of 1760 (Böhmische Gesellschaft für Wissenschaften). It published the journal Abhandlungen and later was officially recognized by the Emperor. It also organized scientific expeditions, for example, that to the Krkonoše Mts in which T. Haenke participated as a botanist. In 1864, an important committee was founded: Komitét pro přírodnické vyzkoumání Čech, which started to publish Archiv pro přírodnické vyskoumání Čech. It published many important volumes, such as Čelakovský's Prodromus (Čelakovský 1867–1881) and others. The Natural History Club (Přírodovědecký klub v Praze) was established in 1869 (see Viniklář 1931). Similarly in Moravia, important groups and journals appeared in the 1860s, but the first Czech clubs were not established until the end of 19th century (1898 in Prostějov). The Natural History Club (Přírodovědecký klub) was established in Brno in 1904. For Silesia, such groups and journals were published in Breslau, which was then not part of the Austro-Hungarian Empire, but did publish floristic novelties recorded in the whole of Silesia.

Last of the important institutions for the development of botany are museums. The oldest one was established at Opava, in Silesia, in 1814. It still exists and plays an important role in the exploration of nature in that region. The most important museum (Vaterländisches Museum) was founded in Prague (formally in 1818, de facto 1822), mainly as a result of C. (K.) M. Sternberg's initiative. It currently houses the biggest herbarium in the Czech Republic and among the curators of it were many important personalities: K. B. Presl, A. J. Corda, E. Purkyně (son of J. E. Purkyně), L. Čelakovský (see Table 2 for all the heads of the botany department there). Charles University also has a herbarium the curators of which were also curators of the herbarium at the Museum, such as K. B. Presl and L. Čelakovský, who used duplicates from rich collections to form collections at both institutions.

Many botanists born in the Czech Republic who worked in other countries and many born in other countries made substantial contributions to the studies of nature in the Czech Republic. Early botanical publications were written mainly in Latin, later mostly in German, which was the official language in the country until WW I. In the first half of the 19th century scientific papers were rarely written in Czech for which the botanical terminology was poorly developed. At that time some people started to use Czech and so a dualism in the research was gradually developing. This tendency later increased due to the splitting of Prague University into German and Czech parts in 1882. They became more and more duplicated in the two parts of the University, which only ended during the WW II.

Research on flora

Research on the flora (and vegetation) is successful provided that two conditions are fulfilled: (i) there is literature (or experts) for identifying the plants and (ii) there are a large number of people doing field research. Both processes can be connected, especially at the beginning of the research, when people collect plants and botanists identify them and write floras. Publication of a good flora is usually followed by an increase in interest in the topic and in knowledge, especially on distribution, which leads to the publication of more advanced results. It is a positive feedback, which increases the extent of our knowledge. The following text is mostly devoted to people involved in plant identification. All those who worked in data collection cannot be included in this brief contribution. This does not mean they were or are less important. These people were previously listed many times, for example, by Klášterský et al. (1982) and Sofron & Nesvadbová (2009). Useful and detailed information is given in the list of botanists who worked in Slovakia (Vozárová et al. 2010).

Second half of the 18th century

Most advanced research on plants was carried out in Silesia, which has a long tradition of such studies, e.g. at the end of 16th century Schwenckenfeld published a local flora covering also the Krkonoše Mts (1600, cf. also Hendrych 2001). Mattuschka (1776–1777) and Krocker (1787–1823) published the first floras of Silesia at the time when the first data on plants in Bohemia and Moravia were collected (by Haenke, Mikan, F. W. Schmidt). Especially, the contribution by Haenke (1791) to the flora of Krkonoše, with descriptions of several species (e.g. *Poa laxa*), was one of the most important. In the last decade of the

18th century, F. W. Schmidt published the first Flora of Bohemia (1793, 1794). However, it was not a critical review of the information and includes many mistakes. In Moravia, the knowledge was even more fragmentary.

First half of 19th century

Silesia

The research on the plants in Silesia continued and is summarized in several floras (Wimmer & Grabowski 1827–1829, Wimmer 1832, 1844–1845). All of them stimulated further research and for that reason there was a more complete knowledge of the flora of Silesia. The flora of the border mountains, the Sudetes, became better known than that of Moravia and Bohemia. There were two centres of research in Silesia, both in Breslau. The first was the University and the second, a society (Schlesische Gesellschaft für Vaterländische Kultur) that published Jahresberichte, in which many floristic papers were published. It was a stimulating environment, which resulted in an increase in knowledge and advances in taxonomy, well illustrated by the floras published.

Bohemia

In Prague, the research on plants was carried out mainly at the University. There was a regular position for botanist there from the mid 18th century and this strongly influenced botanical research in Bohemia. Table 1 gives the list of professors of botany at the end of 18th and during the 19th and first half of the 20th centuries.

The second attempt to write a flora of Bohemia was that by J. E. Pohl (1809–1814), which was not finished because Pohl became a member of an expedition to Brazil on which he changed his interests (see last chapter). V. Kosteletzky who was for a long time a professor of botany, published his Clavis analytica (Kosteletzky (1824). Some other botanists were connected with private gardens; the most important was I. F. Tausch. He was an extremely precise botanist, especially compared to others in Prague; he described many species, some of them from the Krkonoše Mts, such as *Festuca versicolor*, *Arabis sudetica*, *Carex vaginata*, *Sorbus sudetica*, *Taraxacum alpestre* and many *Hieracium* species. He also described many species collected in other countries.

An important person was Kaspar Maria von Sternberg. He was an organizer and financed many expeditions. He worked initially in Regensburg (Germany) and in 1810 (continued 1822, 1831) he published a monograph on *Saxifraga*. Later on, he returned to Bohemia and started his extremely important work on fossil plants. His book (Sternberg 1820–1838) was selected as a starting point for the names of fossil plants (Kvaček & Kvaček 1992). His influence on the development of botany in Bohemia was extraordinary due to another activity: he established the Museum of the Czech Kingdom, later the National Museum, where the collections of books and plant material were stored and where there was a position for a professional botanist. Most important people who worked in the National Museum are given in Table 2. Some of the names will be mentioned later, A. J. Corda, however, is especially noteworthy because of his microscopic studies and drawings of plants and especially of fungi and liverworts. Inspired by Sternberg, he also studied the anatomy of fossil plants. His work was highly valued and his name was used for many taxa, e.g. *Cordaitophyta*.

Table 1. – Organization of botany within Prague University (Karl-Ferdinands Universität, Universita Karlova, Deutsche Universität) up to 1945, with the professors and their assistants (up to the beginning of the 20th century after Maiwald 1904: 71)

Faculty	Period	Professor	Assistant
Faculty of Medicine: pharmaceutical botany	1749–1762	Scotti de Campostella	
	1763–1768	J. Bohadsch (J. Boháč)	J. Zauschner
	1775–1811	Johann G. Mikan	J. Chr. Mikan (1798)
	1812–1826	Johann Chr. Mikan	V. Kosteletzky (1824)
	1826–1849	Vinzenz Kosteletzky	F. R. Kolenati (1842), J. Poech (1844), F. Keil (1848)
Faculty of Medicine: natural history	1752–1768	J. Bohadsch (J. Boháč)	
	1775–1800	J. Zauschner	
	1800–1812	Josef Mayer	
	1814–1819	Fr. X. Berger	
	1820–1849	Joh. Sw. Presl	
Faculty of Philosophy: natural history	1784–1787	Josef Mayer	
	1788–1790	Josef Schönbauer	
	1790–1800	V. v. Blaha with the extraordinary teachers F. W. Schmidt and J. Chr. Mikan	
	1801–1812	Johann Chr. Mikan	
	1812–1828	Em. Kirschbaum, Fr. Mühlwenzel	J. Sw. Presl
	1833–1849	Karl B. Presl	
Faculty of Philosophy	1849–1872	V. Kosteletzky (botany)	E. Soyka (1852), J. Taraba (1858–1861), T. Hlavin (1861–62), O. Nickerl (1864–1865), J. Muhr (1870–1871), K. Renger (1871–1873)
	1849–1852	Karl B. Presl (zoology)	
	1872–1873	A. Kerner (appointed, but did not come)	
	1873–1882	Moriz Heinrich Willkomm	K. Knaf (1874–1878), P. Hora (1878–1882), Ladislav J. Čelakovský (1880–1882)
German University: Faculty of philosophy	1882–1892	Moriz Heinrich Willkomm	P. Hora (1882–1884),V. Schiffner (1884–1892)
	1892–1899	Richard v. Wettstein, Victor Schiffner (extraordinary Prof. 1896–1902)	V. Schiffner (1892–1896), V. Folgner (1896–1899)
	1899–1921	Günther Beck v. Managetta	V. Folgner (1899–1905), A. Pascher (1905–1914), Karl Rudolph (1914–1919)
Faculty of Natural Science (founded 1922)	1922–1923	Karl Cori (Head of the Institute of Zoology, Nobel Prize winner in 1947)	
	1924–1935	Fritz Knoll	Franz Pohl (1919–1941), Franz Firbas (1926–28)
Deutsche Universität in Prag: Abteilung für pharmazeutische Botanik und Kryptogamenkunde	1935–1945	Adolf Pascher	Erich Daumann (1930–36), Karl Preis (1936–1942)

Faculty	Period	Professor	Assistant
Czech University (founded 1882), Faculty of Philosophy, Faculty of Natural Science, Institute of Botany (since 1920)	1882–1902	Ladislav Čelakovský	J. Velenovský (1883–?), B.Němec (1895–1901)
	1902–1928	Josef Velenovský	K. Domin (1904–1919)
	1919–1924	Karel Domin	F. A. Novák (1919–1934), V. Krajina (1927–1939), J. Dostál (1928–1946)
	1928–1945	Karel Domin	
	1928–1931	Jan Vilhelm (systematics of cryptogams)	
	1934–1964	František A. Novák (pharmaceutical botany)	
	1936–1951	Jindřich Suza	
Institute of Pharmaceutical Botany (1924 divided from Institute of Botany, in 1928 merged back)	1924–1928	Karel Domin	

Table 2. – Heads of the Department of Botany at the National Museum, Prague, up to 1989.

Period	Head
1823–1846	Karel Bořivoj Presl
1857–1860	Emanuel Purkyně
1861–1902	Ladislav Čelakovský
1903–1927	Edwin Bayer
1932	Karel Malkovský
1933–1948	Ivan Klášterský
1948–1965	Albert Pilát
1965–1970	Miloš Deyl
1970–1989	Jiří Soják

The third flora was that published by the brothers K. B. Presl and J. S. Presl, the Flora Čechica (1819). Immediately it was succeeded by a checklist of flora of Bohemia by P. M. Opiz [also F. M. Opic] (1822, 1823). These books stimulated further studies on plants of Bohemia. The whole period of the first half of the 19th century is named "opician" after him. He did not have an academic position but worked in forestry administration. In addition to his botanical activities, he started an institute for the exchange of plant collections, which he administered for a long period of 40 years. This exchange led to a deeper knowledge of Czech flora, even outside the country. A large number of botanists were associated with Opiz who helped with the collection of herbarium material. This material was used for exchange and was a great source of material from throughout Europe, and also good basis for increasing the knowledge of the Bohemian flora. Opiz worked also on taxonomy, many of the species and genera described by him are still recognized. His concept of species was narrow and almost comparable to that of Jordan, and he also had a similar narrow concept of genera. He left a manuscript "Botanische Topographie Böheims", which includes a large data set and is still an important source of information. Skalický (1967) provides a useful interpretation of the geographic names used in Opiz's work.

I have already mentioned the Presl's brothers. Jan Svatopluk Presl was a naturalist not focused only on botany and his main contribution was in establishing Czech terminology in different fields of science. Many of his terms are still used as names of elements, animals and plants. His botanical work was less important. Karel Bořivoj Presl was an excellent scientist. He was a university professor and also a curator of botanical collections in the National Museum. He did not only work in Bohemia, but also in Sicily and his treatment of pteridophytes (Tentamen pteridographiae...; published in 1837) and monographs on *Lobeliaceae* (Presl 1836) and *Hymenophyllaceae* (Presl 1845) are still very highly valued. Both brothers studied the botanical collections of T. Haenke (see the last section). There was also another stimulus for botanists in this region, the journal Flora oder Allgemeine Botanische Zeitung (later only Flora) published in Regensburg, in which many botanical papers were published including those from botanists working in Bohemia.

Moravia

Less botanical research was done in Moravia than in Bohemia and especially Silesia. There was no professional basis for studies on botany and the research was done by several societies. The publications of these societies were in German; one of them published the journal Mitteilungen des Mährisch-schlesischen Gesellschaft für Ackerbau, which regularly allotted space for Botanische Notizen. In the first period, the most important botanist was M. C. F. von Hochstetter, who published data from northern Moravia and the vicinity of Brno. The first attempt at a flora for Moravia was that of Rohrer & Mayer (1835), which remained unfinished because Rohrer died.

Regions bordering on Silesia were extensively studied by Silesian botanists, but because the flora there seemed to be poor those bordering on Bohemia remained almost unstudied for several decades. The most extensively studied was the area in the vicinity of Brno, later on also areas in southern Moravia. The floristic research in this region was done by hobby botanists and mainly based on studies of relatively small areas.

Botanical research in the second half of the 19th and beginning of the 20th century

Silesia

In this period, the progress in research in Silesia became more evident. The better knowledge of the Silesian flora resulted in publication of E. Fiek's flora (Fiek 1881), which is still one of the best floras in central Europe. The work was based on an extensive herbarium, and floristic records documented by herbarium vouchers were consistently indicated in this flora; this was an extremely modern approach. The deep knowledge of the flora resulted in a thorough understanding of regional variability of plants. This was followed by T. Schube's study of the distribution of species in the whole of Silesia (Schube 1903–1904) and a new flora (Schube 1904).

The stimulating scientific atmosphere at that time lead to taxonomic progress: many groups of critical taxa were revised by botanists such as Rudolf v. Uechtritz and Julius Milde who raised the taxonomic knowledge to the highest level. Another student of botany from Breslau, Ferdinand Pax (later professor of zoology in Breslau) started his research

career in Silesia where it borders with Bohemia, but later on he did most of his work in the Carpathians and Poland.

B o h e m i a

In 1849, the famous physiologist Jan Evangelista Purkyně returned to Prague. Although mainly a physiologist he did some work on plants. He had a marked influence on Czech society. He founded the biological journal Živa, to which he contributed many papers, and educated three students who became excellent botanists: Ladislav Čelakovský (see below), Julius Sachs (who is considered to be the founder of plant physiology) and Emanuel Purkyně, his son. The main media for publication of research were in other countries, Flora in Regensburg, Österreichische Botanische Wochenblatt (later Zeitschrift) and Verhandlungen der zoologisch-botanischen Gesellschaft in Vienna (last two were the most important, especially for botanists in Moravia); journal Lotos started publishing papers on botany in Prague in 1851. For large books it was Archiv pro přírodovědný průzkum Čech (a German version also existed, Archiv für naturwissenschaftliche Landesdurchforschung von Boehmen).

Ladislav Čelakovský was the leading person of the botanical life in Bohemia for several decades. He was a good morphologist and very critical taxonomist. In the 1860s he started to publish a new, critical flora in two parallel editions, German (Prodromus der Flora von Böhmen; Čelakovský 1867–1881) and Czech (Prodromus květeny české; Čelakovský 1868–1883). He critically revised earlier records. The whole flora was presented in three volumes; this work stimulated botanical research in Bohemia and immediately the fourth volume with additions was published. Prodromus was followed by a series of additions to his flora (Resultate der botanischen Durchforschung..., Čelakovský 1882–1894), where new findings were published. A lot of people cooperated with Čelakovský and many of them continued working in this field. One of them was Josef Rohlena, who coordinated floristic research in the 1920s–1930s. The knowledge of the flora substantially increased under the influence of Čelakovský, in particular with respect to taxonomy and distribution of species. Although the level of understanding was not as high as in Silesia it was comparable in terms of quality. Later, Čelakovský (1887, 1897) published a determination key for the whole area of the present Czech Republic.

Čelakovský became professor of botany in 1880, and after the University was split into a German and Czech part in 1882 he joined the Czech University. He succeeded as a university teacher, founding a school and educating many successors who continued in the research on the flora, not only in this country, but also abroad. The most famous was Josef Velenovský, especially notable for his study of Mesozoic floras, bryology and flora of Bulgaria (see below). In the last period of his long life he studied fungi. Foundation of the Department of Botany at the Czech University strongly influenced future development of this science in Bohemia and later on in Czechoslovakia. On the other hand, it was also the start of parallel development of botany in the German and Czech Universities, which became more and more isolated. Over time, new positions for botanists were established, for example in the Czech Technical University and a number of secondary schools teaching agriculture.

Moravia

During the 1850s the situation in Moravia remained unchanged with many local but uncoordinated botanists. The knowledge of the flora in southern Moravia was influenced by Neilreich's Flora of Austria (1859, 1866). At the beginning of the 1860s, the society Naturforschender Verein was founded in Brno. It got some support and started to publish Verhandlungen, which became an important publication. (In volume 5 of this journal is the famous article by Mendel on his genetic laws.) With respect to botanical research, the foundation of the herbarium of the Naturforschender Verein was extremely important. It grew quickly, and also received donations of important collections (G. Niessl, A. Zawadzki, J. F. Freyn and others). In 1863, A. Makowsky published a flora for the Brno district, which contains data for the best known part of Moravia. A number of local contributions were published in Verhandlungen or other journals. As A. Oborny grew up in this environment he published a number of contributions on the local flora and several taxonomically difficult genera. He compiled the information on the flora of Moravia and Austrian Silesia and in a short time produced a voluminous and critical flora (Oborny 1883–1886). In the environment of the German-speaking society concentrated in Brno, H. Laus and J. Hruby started their professional careers. Laus was probably the first to do systematic research on particular habitats, such as sand dunes, halophytic and also ruderal habitats. On the other hand, Johann Hruby studied the plants of particular geographic regions.

The botanists in Brno mainly came from the German-speaking part of the community. Some years later, Eduard Formánek, a secondary school teacher in Brno, published his flora of Moravia, the first flora of Moravia written in Czech (Formánek in 1887–1897). It was based on Oborny's Flora, but Formánek supplemented it with a large amount of new data, collected by him and other botanists.

Olomouc became a centre of a Czech-speaking group some years later. At the beginning of the 20th century, František Polívka, a secondary school teacher, published a flora for all three parts of the Czech Kingdom, Bohemia, Moravia and Austrian Silesia (Polívka 1900–1904). It was the largest flora for almost a century. Later on, he published a key for the same geographic area (Polívka 1912). In 1903, Josef Podpěra moved to Olomouc and immediately started to organize Czech botanical life in natural history clubs and regional museum societies in central Moravia. In 1908 Podpěra became professor at a secondary school in Brno and again started to organize botanical life there. During the WW I Podpěra was conscripted into the army and early on became a prisoner of war in Russia. In fact, this was to his advantage as Russian botanists knew of his work and he was allowed to work in the herbarium in Ufa, south of the Ural Mts, and, later on was appointed as a professor in Tomsk.

At the beginning of the 20th century, taxonomy in the whole of central Europe was strongly influenced by two multivolume books, published in Germany: Ascherson's & Graebner's (1896–1939) Synopsis der mitteleuropäischen Flora and Hegi's (1906–1931) Illustrierte Flora von Mitteleuropa. In 1912, Czech botanical life was invigorated by the establishment on 17 June of the Czech Botanical Society. Josef Velenovský was elected president, Karel Domin vicepresident and Gustav Daněk treasurer. Members of the committee were: Eduard Baudyš, Augustin Bayer, Otto Gintl, Karel Kavina, František Smotlacha and Jan Vilhelm. In 1914, the Botanical Society started to publish the journal Preslia.

Czechoslovakia 1918–1939

The creation of a new state provided a big stimulus and also some new barriers to botanical research. The former cosmopolitan space was broken up into a number of national states and although it was still possible to travel it was no longer easy to move and be employed in other countries. New states established a number of new positions, a second university was founded in Brno and Josef Podpěra was appointed professor of botany. Relatively small museums and secondary schools in different parts of the country were supported and employed a lot of teachers of biology. In technical universities in Prague and Brno new departments (and positions) were established for teaching agriculture, forestry and phytopathology. So, botany became more structured. There were two universities with botany departments in Prague (Table 1), the Czech and German. For a short period (1924–1928), there were two botany departments within the Czech University, evidently a consequence of the complicated relationship between Josef Velenovský and Karel Domin. The development in both Universities was independent. In the Czech University professor Josef Velenovský was replaced as a head by Karel Domin, who was the leading authority for more than 20 years. Karel Domin and Josef Podpěra founded the journal Acta Botanica Bohemica in 1922, in which several big contributions to the Czech flora were published, such as Podpěra's monograph of the Pavlovské vrchy hills (Podpěra 1928) and Domin's flora of the Mšeno region (Domin 1942).

Josef Rohlena organized the research on the flora and drew on his experience of working with Čelakovský. He started with a series of additions to the flora of Bohemia (Příspěvky k floristickému výzkumu Čech) in 1922 (Rohlena 1922). The first two contributions were based only on his findings, the third was a joint publication with J. Rozum. He continued publishing up to 1938, the last two were joint publications with Josef Dostál (e.g. Rohlena 1937-1938).

Many brief accounts of interesting plants collected in Bohemia were also published in Věda přírodní (edited by Karel Domin) and Časopis národního musea. Domin was sometimes criticized for publishing a lot of small contributions of local importance. But, thanks to this these records are published and not hidden in personal notebooks or herbaria.

Increasingly important were the studies carried out in the National Museum. Edwin Bayer was the curator of the Museum for a long period (1902–1927) and after him, Albert Pilát and Ivan Klášterský were the most prominent of those taking this position (Table 2). Miloš Deyl was also employed by the National Museum, remained there until 1976 and for many years was the curator. Most of the effort went into building up the herbarium and publishing a journal (Časopis národního musea, where e.g. Rohlena's contributions were published). Main botanical field activities were in Slovakia and Transcarpathian Ukraine, which were parts of Czechoslovakia between the wars.

There were many local botanists in Moravia who regularly published their observations in Sborník klubu přírodovědeckého v Brně. Josef Podběra started to publish his flora of Moravia (1926–1930) in this journal, but did not finish it. The most important people that worked on the flora were J. Gogela, A. Wildt, G. Říčan, F. Zavřel, R. Dvořák, H. Zavřel and F. B. Teuber, and, later on representatives of a younger generation such as J. Ambrož, J. Suza, S. Staněk and others.

In the new state, Silesia was at the periphery both in terms of its geographical location and the centres of excellence. Josef Otruba published extensively on plants. Most of the

studies on botany were carried out in Opava, the former historical centre of this region, where the Slezské Museum is located. A new centre was established in Ostrava, the most important industrial town in the region. However, the research activity was not as great as in the past or as good as that being done in Moravia.

Great stimulus for botanists was the change in the geographical delimitation of the state: Slovakia and Transcarpathian Ukraine (Podkarpatská Rus) attracted many botanists, who did research there. In 1928, Karel Domin and Josef Podpěra published an updated version of Polívka's determination key, enlarged to include the whole of Czechoslovakia. It became an important guide for the next 20 years. Domin (1935) published Enumeratio Plantarum, which for many years was a source of nomenclature. There was also a big increase in the number of publications as many new journals appeared, which regularly published floristic data, large papers and monographs. Many authors still published their more important scientific papers in German journals, namely Beihefte zum Botanischen Zentralblatt. In Moravia and Silesia, new journals were published in Brno and Ostrava at the beginning of the century. In addition, there were many other possibilities and for that reason the botanical knowledge of the new state increased rapidly.

The development in the German University in Prague was different. For many years it was guided by F. Knoll, who is one of the founders of modern flower biology. In the Department of Botany, a new area of study was developed under the direction of Prof. Karl Rudolph. He introduced pollen analysis to Czechoslovakia and his studies were respected throughout Europe. Adolf Pascher started as a plant taxonomist (he published a monograph on *Gagea*), but later switched to working on algae and his studies and concepts became world-known. Floristic research in those areas with mostly German inhabitants was published mainly in the journal Natur und Heimat.

An integral part of botanical life were museums: the National Museum in Prague, Moravské zemské muzeum in Brno and the museum in Olomouc, where the leading authority was J. Otruba. There were large herbaria in all these museums as well as in all three universities (German and Czech in Prague, and in Brno). Of less importance was the research being done at that time by the staff of the National Museum. There were three good botanists there, A. Pilát who studied mainly fungi, I. Klášterský and later M. Deyl who mainly explored the flora of Slovakia, Transcarpathian Ukraine and Balkans. Botanical research was also stimulated by the publication of herbarium collections for exchange (exsiccata). Most important were those published by K. Domin in Prague (Flora Čechoslovenica exsiccata), second, that by J. Podpěra in Brno (Flora exsiccata Reipublicae Bohemicae Slovenicae) and third that by F. Petrak in Hranice na Moravě (Mährische Weisskirchen – Flora Bohemica et Moravica exsiccata). In fact, F. Petrak was mainly a mycologist and his collection of fungi was one of the biggest in the world.

Botanical research was done also at technical universities in Prague and Brno, mainly in their agriculture and forestry departments. Karel Kavina, a leading authority in Prague, worked in many fields, such as plant anatomy and bryology, and had a great influence on nature protection. In Brno, K. Vandas needs to be mentioned who worked mainly in other countries, especially Yugoslavia. He was a good scientist but poor teacher and did not establish a school of study. There were several others, the most notable being E. Baudyš, who started his career as a botanist, but later specialized on phytopathology, in particular plant galls formed by different invertebrates and fungi.

Immediately after the WW I (in 1919), the Czech Botanical Society changed its name to Czechoslovak Botanical Society and spread its activities to Slovakia. The activities of the Botanical Society mainly involved the universities in Prague and Brno. In 1937, several young botanists established a formal group (Kruh mladých československých botaniků) and started to publish a new journal, Studia Botanica Čechoslovaca, and a series of books, Opera Botanica Čechica. They published several important contributions to the Czech flora, such as Zlatník's (1938) treatment of the *Hieracium alpinum* group.

Period 1939–1945

During this period research was strongly influenced by developments in central Europe and in particular the WW II. At the beginning of autumn 1938 large areas of the country were ceded to Germany and in spring 1939 the rest of the country was occupied by Germany while Slovakia became an independent state. In autumn 1939 all Czech Universities were closed. This resulted in a big change in activity. In Prague, Karel Domin founded a research institute for medicinal plants (Komise pro sběr léčivých rostlin), where he hid most of the botanists from the former Department of Botany of the Czech University. Within this institute he started to organize the production of a new flora for the country. Members of this institute compiled excerpts from most of the older literature and created a big data base that is still extremely useful. Similarly, in Brno J. Podpěra tried to establish an institute for studying beneficial plants, but was not so successful and he was prevented from continuing his studies shortly before he retired. Botanical studies were not encouraged during the occupation, for example, the herbaria of the National Museum and the University in Brno were rehoused in bad conditions, and publishing and especially society life, such as meetings and lectures, were suppressed. People had to be extremely careful and some botanists lost their life in concentration camps (e.g. V. Krist and A. Bayer from Brno). Some others became involved in anti-Nazi activities: Vladimír Krajina was one of the leaders and spent several years in prison, while some others remained free, such as Miloš Deyl.

During the war, some useful contributions were published. Josef Rohlena published Prodromus Florae Montenegrinae (see below) in a special volume of Preslia (Rohlena 1942). Karel Domin succeeded in publishing a local flora for the Mšeno region (Prodromus Květeny Mšenské; Domin 1942), the scope of which was unfortunately limited by new border between Germany and the Protectorate (Protektorat für Böhmen und Mähren), which divided that region. There were many local activities, like that in eastern Bohemia (Kobrle 1965), where Jan and Emil Hadač in Pardubice and another group in Hradec Králové organized clubs, whose members worked on the flora, which resulted in the publication of several big contributions, such as that of Buřil et al. (1941).

Czechoslovakia, 1945–1992

The end of the WW II was also the end of the German society in this country. Most of the German inhabitants were expelled to Germany and Austria, the German University in Prague was closed. Some of its professors died at the end of the war, such as A. Pascher and others went to Germany or Austria. Other unfortunate events also affected the botani-

cal community. For example, Širjaev (emigrant from USSR) went to West Germany and later to USA. Karel Domin was impeached for cooperating with Nazi government and imprisoned. In spite of the law court subsequent ruling that he should be released he was not allowed to continue his botanical studies, and he along with V. Krajina and M. Pulchart were expelled from the Botanical Society. The loss of botanists continued, Vladimír Krajina and others emigrated in 1948 immediately after the communist putsch. Another wave of emigrations was after 1968. Many experts were not allowed to teach. On the other hand, new possibilities were created. The Academy of Science was formed as a network of laboratories and institutes. Geobotanical laboratories were founded in Prague and Brno at the beginning of the 1950s and employed many active botanists. Many of them were not allowed to teach, but were allowed to do research. In 1962, the geobotanical laboratories became Institute of Botany and leading centres of research. The creation of organizations responsible for nature protection and of regional museums presented new possibilities for botanists.

In 1948–1950, Josef Dostál with the help of many other botanists published Flora of Czechoslovakia in two volumes (Dostál 1948–1950). In subsequent years, he published two editions of a Key based on that Flora (Dostál 1954, 1958). This flora was based on material collected during the WW II by K. Domin. These books became popular and were used for many years. In 1948, a new botanical journal was established, Československé botanické listy. Unfortunately, after five years it had to cease publication because of a shortage of paper. Preslia, published by the Botanical Society, was the main botanical publication. In 1966, two other journals started: Folia Geobotanica et Phytotaxonomica Bohemoslovaca published by the Institute of Botany (the name was shortened to Folia Geobotanica et Phytotaxonomica since 1967, and later to Folia Geobotanica, now published by Springer), and Zprávy Československé botanické společnosti (Bulletin of the Czechoslovak Botanical Society) published by the Botanical Society. Folia published specialist papers written in foreign languages (now only in English). Zprávy became an important Czech journal containing information of interest for people doing field research. It published determination keys, distribution maps, information on new species and articles on plants. Many new, but often short-lived journals appeared, but in Opava, Plzeň, Liberec, České Budějovice they survived for longer. Several local floras, covering regions around Pardubice, Rokycany, Plzeň, Horažďovice, Mladá Boleslav, Šluknov and probably the most important the flora of the Krkonoše Mts by J. Šourek (1969) were also published.

In fact, there was a continuing selection against strong personalities, especially in universities. In 1950s, J. Podpěra in Brno and J. Dostál and F. A. Novák were still active. However, J. Podpěra died in 1954 and F. A. Novák in 1963. Josef Dostál retired, but for a decade was employed at the restored University in Olomouc. Miloš Deyl worked in the National Museum. Ivan Klášterský moved to the Geobotanical Laboratory where, after it became the Institute of Botany, a strong Department of Taxonomy under leadership of Josef Holub was formed. This department produced monographs on several critical groups and initiated work on a distribution atlas. Some people published their results, such as M. Kovanda on *Sorbus* and the *Campanula rotundifolia* group, A. Chrtková on *Lotus* and *Vicia*, P. Tomšovic on *Rorippa* and I. Novotná on *Arabis*. Results of many others remained unpublished and partly lost. At the Charles University in Prague, Radovan Hendrych became the leading person and was also politically "acceptable", especially after 1968 (see Hrouda 2005). He published many papers on the taxonomy and distribution of different groups and the systematics of *Trifolium* and *Thesium*, carried out research

on phytogeography of Slovakia, and analysed the Carpathian element in the Czech flora (Hendrych 1985). Of the younger generation, Jindřich Chrtek and B. Křísa were particularly active. J. Chrtek had to leave the University in 1976 and entered the National Museum.

In Brno, Jan Šmarda and later, after his death, J. Vicherek and M. Smejkal were the leading botanists; unfortunately, M. Smejkal was not "politically correct" and for that reason his influence was less than it should have been. M. Dvořáková and F. Dvořák were the other taxonomists there. Outside these centres, J. O. Martinovský did important studies on *Stipa*. At Agriculture Universities, there was a decline in the number of botanists studying wild plants and the flora. V. Zelený (Praha) studied *Leucanthemum*, J. Chmelař and his student J. Koblížek in Brno studied *Salix*.

During the 1970s a new generation started working on different groups, especially apomictic plants: A. Plocek on *Alchemilla*, J. Kirschner and J. Štěpánek on *Taraxacum* and J. Kirschner on *Luzula*. At that time J. Holub started his studies on *Rubus* and later in the 1990s J. Chrtek jun. on *Hieracium*. The history of the period 1948–1978 is covered in a paper by Hejný et al. (1978).

At the end of the 1980s, Dostál published his New Flora of Czechoslovakia (Dostál 1989). This book was only partly based on the edition published at the end of 1940s; the author introduced many new taxa and data on distributions, and, as a whole, this book is considered to be very uncritical. As a lot of new names were used it made the book very difficult to use, because the genus concept was different in other countries. On the other hand, the book was popular among hobby botanists, because it covered the whole flora and was the only book generally available at that time.

The decision to publish a Flora of the Czech Republic provided a great stimulus for the future development of botany. It started in the early 1980s and in 1988 the first volume was published. At present, there are eight volumes published (Hejný et al. 1988, 1990, 1992, Slavík et al. 1995, 1997, 2000, 2004, Štěpánková et al. 2010) and the last two are in preparation. Most of the people who started the work on this flora already passed away and the current staff is now almost totally different. Unfortunately, because of inter-personal relationships, not all prominent Czech taxonomists were involved as authors in earlier volumes. In spite of this, this Flora is a great achievement. It incorporates the existing knowledge on many aspects, taxonomy, synonyms, distribution and ecology and as in the past, this flora is stimulating further research, especially on distribution. As the Resultaten followed the publication of Čelakovský's Prodromus, a series Additamenta followed the publication of the Flora, starting to flow in 2002 (Hadinec et al. 2002). This year, the 10th volume of this series was published and in all of these volumes there is a lot of new data. A new determination key to the Czech flora was published in 2002 (Kubát et al. 2002).

In parallel with the Flora, a grid Atlas of distributions is being produced. Bohumil Slavík has published three volumes, the fourth was published this year (Slavík 1986, 1990, 1998, Štěpánková 2012). In addition, four atlases of smaller regions were published: Kolbek et al. 1999, Grulich 1997, Vicherek et al. (2000), Jongepier & Pechanec (2006).

Another botanical activity strongly stimulated by floristic research and especially the publication of its results is the compilation of Red Lists of species of vascular plants. The first one (Čeřovský et al. 1979) was followed after two decades by new ones (Čeřovský et al. 1999, Holub 2000, Holub & Procházka 2000, Procházka 2001) for the Czech Republic and several local ones, such as that of Chán (1999) for southern Bohemia, Procházka & Štech (2002) for the Šumava Mts and Štursa et al. (2009) for the Krkonoše Mts. The most

recent version of the Red List covering whole country appears in this issue of Preslia (Grulich 2012).

In the 1960s, the Czechoslovak Botanical Society started a new activity, which greatly improved our knowledge of the flora: Floristic Summer Schools. They were organized by V. Skalický and J. Houfek, lasted for about one week and most of the results were published (Hrouda & Pyšek 2000). From the beginning of the 1990s the Society also organized, together with the Slovak Botanical Society, summer schools once every three years in Slovakia. These schools resulted in a lot of material being collected from many regions, for which the knowledge of the flora was poor. There were also other activities within the Botanical Society, one of which was the organization of regional sections, corresponding to a regional division. This was very attractive for local hobby botanists. These regional sections organized meetings, lectures, excursions and also courses on the local flora. In this period, the activities of the Botanical Society were under a strong influence of Josef Holub for more than 30 years. He served as a scientific secretary for a long time and inspired or led a number of the Society's activities (see Krahulec & Pyšek 1999, Pyšek & Hrouda 2000).

Milestones in lichenological research

Similar to that on vascular plants, the research on lichens was unevenly distributed in the three historical parts of the Czech Republic: in Silesia it was the most advanced along with northern Bohemia close to the German border. The research was strongly influenced by published keys and floras, which stimulated further studies. The important milestones are listed below.

- 1825: V. B. Mann, physician, who participated in Opiz's exchange scheme, published first list of lichens for Bohemia (Mann 1825).
- M. C. F. von Hochstetter published in a paper mainly on vascular plants some data on lichens (von Hochstetter 1825). He also contributed to the exsiccata published by Reichenbach & Schubert.
- In addition to vascular plants, Philipp M. Opiz also studied lichens, and three of his names are accepted by contemporary lichenologists, in 1852 he published a list of the Czech names of lichens and in 1856–1857 reviewed all lichens known from Bohemia (Opiz 1852, 1856–1857).
- J. von Flotow published two papers entitled Lichenes Florae Silesiae, which lists the lichens known for Silesia and the exsiccate series Lichenes exsiccati, in which includes material from the border regions (von Flotow (1850–1851).
- G.W. Körber published two influential works Systema Lichenum Germaniae (Korerber 1855) and Parerga lichenologica (Körber 1859–1865), which includes data from several places in Bohemia and on Körber's types of several species collected in the Krkonoše Mts.
- L. Rabenhorst (1870) published data for northern Bohemia, but mainly influenced lichenology in central Europe.
- B. Stein (1879) published additions to the Silesian lichen flora and some additions to Körber.
- J. Novák (1888, 1893) published the lichen flora in the vicinity of the present Havlíčkův Brod (at that time Deutschbrod) in both Czech and German editions, together with a key to macrolichens and an up-to-date list of lichens known from Bohemia.
- F. Kovář published the first comprehensive lichenofloristic studies for Moravia and produced small monographs on the species of *Peltigera* (Kovář 1909) and *Cladonia* (Kovář 1912) occurring in Moravia.
- In the 1920s, Alfred Hilitzer started studying lichen communities and published many new associations, most importantly epiphytic assemblages (Hilitzer 1925). He researched the lichen flora of many regions in and outside, in the present Transcarpathian Ukraine.
- Josef Anders collected lichens mainly in northern Bohemia and also collected them on one occasion in the Alps. In 1906 he published a key to the macrolichens of northern Bohemia (Anders 1906), and later one for the whole of central Europe (Anders 1928). One year before his death he described the decline in lichens atributable to anthropic influences (though not explicitely stated; Anders 1935).

- V. Kuťák did floristic research in eastern Bohemia and issued Lichenes Bohemiae exsiccata.
- J. Suza, next to A. Vězda the most productive lichenologist in the former Czechoslovakia, studied the distribution and geography of lichens in many regions. He published a paper in which he presented a new synthesis of the distribution of lichens in Moravia within the European context (Suza 1925). In addition, he studied the lichen floras of other European countries, most importantly those in the Balkans.
- O. Klement was a student of Josef Anders and member of the German community, and collected about 20,000 herbarium specimens (stored in PRM), mainly in north-eastern and western Bohemia. After the WW II he had to leave Czechoslovakia and worked with Reinhold Tüxen on lichen communities. In 1956, he published a paper on the lichens on one of highest mountains of the Sudetes, Králický Sněžník (Klement 1956). He finished and published Grummans work on the bibliography of lichens and biographies of lichenologists (Klement 1974).
- J. Nádvorník, described many species and several genera, and in the 1940s published two important family monographs (Nádvorník 1942, 1947).
- M. Servít contributed to the lichen flora of former Yugoslavia, produced a monograph on species of *Verrucariaceae* in Czechoslovakia (Servít 1954) and described numerous pyrenocarp lichens and also some from abroad.
- Z. Černohorský was probably the first, to use UV light for determining lichens (Černohorský 1950). Černohorský et al. (1956) published the first volume of a key dealing with macrolichens known from Czechoslovakia. Unfortunately, the planned volume II (microlichens) was never finished.
- In 1999, Vězda & Liška published a complete list of lichens of the Czech Republic (Vězda & Liška 1999).
- Liška et al. (2008) published a checklist and Red List of lichens of the Czech Republic.
- A Czech lichenologist who influenced lichenology in other countries was A. Vězda (1920–2008), a taxonomist who published more than 300 papers and the largest exsiccata in the history of lichenology (Lichenes selecti exsiccati), and was a coauthor of keys for determining European lichens (Poelt & Vězda 1977, 1981); he published many monographs of various groups of microlichens and also was a specialist on foliicolous lichens, which occur mainly in subtropical and tropical zones.

Milestones in bryological research

The history of the beginning of bryological research was similar to that of the research on other plants. That is, initially there were only data on individual species collected only at a few localities. The first list for Bohemia was published by Opiz in his list of cryptogams for Germany (Opiz 1822). Later, there was a similar study by Corda (1829) of hepatics. Opiz did a lot within the framework of his exchange, Naturalientausch. The development of research on bryophytes reflected to a high degree that occurring in Germany and Austria (e.g. Schiffner). Towards the end of the 19th century, there was a tendency to publish books on this topic in Czech. The following are important milestones in the research on bryophytes in the Czech Republic.

- 1822: Opiz published his list of seed plants and cryptogams occurring in Bohemia (Opiz 1822). His contribution to bryology is evaluated by Váňa (2010 and 2011c).
- 1829: A. J. Corda published his Genera Hepaticarum (Corda 1829). His contribution to bryology is reviewed by Váňa (2011a).
- 1833–1838: C. G. Nees von Esenbeck published monograph on European hepatics containing data from the Czech Republic, especially the western Sudetes (Nees von Esenbeck 1833–1838).
- 1883: J. Dědeček published his book on hepatics in Bohemia (German version in 1886).
- 1885–1903: Limpricht's treatment of mosses in Rabenhorst's Kryptogamenflora, which includes data from the Czech Republic. This greatly influenced the studies of bryophytes, at least in central Europe.
- 1895: A. Weidmann studied mosses in Bohemia and published a prodromus (Weidman 1895).
- 1897, 1901–1903: Velenovský published his books on mosses and hepatics in Bohemia. Unfortunately, the fourth volume on hepatics was not completed.
- 1898 and later: E. Bauer published a series of exsiccata Bryotheca Bohemica and later Musci Europaei exsiccati (see Váňa 2011b).
- 1915: first volume of a new monograph on Bohemian hepatics was published by Kavina (1915).
- 1924: a key for identifying cryptogams was published by Podpěra (1924).
- 1948: Z. Pilous published a key for mosses occurring in Czechoslovakia (Pilous 1948).

- 1942–1973, 1954: Josef Podpěra prepared two "opera magna": Bryum generis monographiaea prodromus and Synopsis muscorum europaeum (last volumes of both books were published after his death).
- 1960: Z. Pilous and J. Duda published a determination key for bryophytes in Czechoslovakia (Pilous & Duda 1960).
- 1988: V. Pospíšil published a list of mosses occurring in Moravia, which included their degree of rareness and endangerment (Pospíšil 1988).
- 1993, 1995: J. Váňa published preliminary Red Lists of mosses and hepatics for the Czech Republic
- 1997, 1998: annotated check lists of Bryophytes of the Czech Republic were published by J. Váňa
- 2003: new check list (and Red List) of bryophytes of the Czech Republic was published by Kučera & Váňa (2003); the same authors produced an enlarged version written in Czech (2005).
- There were also bryologists in this country, who substantially contributed to the world wide knowledge of bryophytes. Viktor Felix Schiffner (1862–1944) was an assistant to Professors Willkomm and Wettstein in Prague, later extraordinary Professor in Prague (till 1902) and ordinary Professor in Vienna (from 1901). He produced (Schiffner 1893) the section on hepatics in "Die natürliche Pflanzenfamilien" by Engler and Prantl. In addition to his work in central Europe he also published exsiccata, extensively worked on the bryophytes of Indonesia (expedition in 1893–1894), Brazil (expedition 1901) and published many papers on the bryophytes of India (Bhutan), Middle East and Japan.
- Josef Podpěra's contribution is mentioned above; outside Czechoslovakia he studied bryophytes in Russia and Siberia. He was the most important bryologist in this country in the first part of the century and, as a university teacher, he had many students, not only bryologists. His successor at the university was Jan Šmarda, also a bryologist, who was active mainly in Moravia and Slovakia.
- Jiří Váňa published a monograph on *Jungermanioideae* in the 1970s (Vols 1–10 in Folia Geobotanica et Phytotaxonomica 1973–1976); later on he produced monographs on many other groups of hepatics (cf. Kučera 2001). Together with Josef Duda, Jiří Váňa published 65 contributions (with maps) on the distribution of hepatics in Czechoslovakia in 1967–1995.

History of research on vegetation

This field has a substantially shorter history than the studies on the flora and did not start until the beginning of the 20th century. Probably the first author was Laus, who studied the flora in important habitats in Moravia. At the beginning of the 20th century, the formation approach prevailed. The most important series was Domin's monographs on individual regions, e.g. České středohoří (1904), Rudohoří (1907), and Císařský les (1924). In the period after the WW I František Schustler became interested in plant sociology and one of his first pupils was A. Zlatník, who first worked in the Krkonoše Mts, České středohoří hills and also on *Sesleria* communities in the 1920s. Karel Domin (1923) published a useful book on methods. There were some other people in Prague at the Czech and German Universities, who became good phytosociologists: R. Mikyška, P. Sillinger, V. Krajina, E. Hadač at the Czech University, F. Firbas and K. Preis at the German University. In Brno, J. Podpěra worked on phytosociology, but the leading person in this field was J. Suza. He was interested also in the phytosociology of cryptogams as was his successor J. Šmarda.

At that time, J. Klika, who worked at the Technical University in Prague, became the leading authority on Czech phytosociology. He published many papers, the most important being those on thermophilous vegetation. In addition, Klika started to compile a list of units of vegetation for Czechoslovakia which were published during the war. Klika et al. (1941) published a manual on phytosociological and ecological methods, which became popular and was published in an enlarged version later (Klika et al. 1954). In that first edition, Klika included the first list of plant communities of Czechoslovakia and described several classes, such as *Phragmito-Magno-Caricetea*, *Potametea*, *Koelerio-Corynephoretea*. Later, Klika & Hadač (1944) published an important paper, in which they built up the

system of vegetation units into classes (at that time, the word Czechoslovakia was forbidden and for that reason it was named a survey of central Europe). Several classes were described here for the first time, such as *Juncetea trifidi* and *Mulgedio-Aconitetea*. After the WW II, V. Krajina was appointed as a teacher of phytosociology at Charles University, but became involved in politics and ceased his botanical activities. His assistant was S. Hejný, who became a leading authority and specialist on aquatic, wetland and ruderal plant comunities (see Krahulec 2002). Later, Z. Kropáč studied weeds. After 1948, J. Klika got a position at Charles University and had many successful graduate and postgraduate students: J. Jeník, J. Slavíková, J. Němeček (who later became well known in the field of soil science), J. Moravec, R. Neuhäusl, M. Husová and Z. Neuhäuslová. All of them pursued their careers as researchers. In 1948, J. Klika published a basic textbook on phytosociology, the second edition of which was published in 1955. It was the only Czech-language textbook for almost 40 years, that is until Moravec et al. (1994) published another one. Rudolf Mikyška and J. Moravec started the Geobotanical Laboratory within the Academy of Sciences (1954) with the objective of producing a Geobotanical map of Czechoslovakia, which was published at the end of the 1960s and beginning of the 1970s (Mikyška et al. 1968, 1972). In parallel with the Geobotanical Laboratory in Průhonice, a similar one was established in Brno in 1955 with the same objective, and lead by J. Šmarda with the assistance of R. Neuhäusl. At this time there was a group of people there interested in the history of the vegetation, E. Rybníčková, K. Rybníček, later V. Jankovská, M. Peichlová and H. Svobodová (Svitavská). At Masaryk University in Brno, J. Šmarda began doing research on vegetation and worked in the Hrubý Jeseník Mts and southern Moravia, and mainly in Slovakia, in the High Tatras. J. Vicherek was the leading botanist at this university and produced a monograph on the remnants of halophyte vegetation in Czechoslovakian part of Pannonia (Vicherek 1973). He also studied plant communities in other countries and published a study of vegetation growing on sand in the Ukraine and Black sea area (Vicherek 1971, 1972). His further career was unfortunately interrupted as he had to leave university for political reasons in 1975. For many years he was not allowed to publish, but was able to return to the university in 1990.

Robert Neuhäusl moved to Průhonice, where he was a member of the Department of Geobotany of the Institute of Botany, Czechoslovak Academy of Sciences, and was one of the leading botanists there. R. Mikyška, J. Moravec, M. Husová, R. Neuhäusl and his wife Z. Neuhäuslová, and later also D. Blažková and J. Kolbek, formed a strong phytosociological group. Adolf Češka was also a member of this group, but he emmigrated to Canada after 1968. Z. Kropáč, K. Kopecký and V. Jehlík all studied ruderal and weed vegetation. E. Balátová-Tuláčková who was in Brno studied wet meadows and K. Rybníček peatbogs. In the second half of the 1960s, the need for a new list of plant communities was so great, that Holub et al. (1967) published a survey of higher vegetation units. At that time, a new series of monographs on vegetation was initiated (Vegetace ČSSR – Vegetation of Czechoslovakia). Jaroslav Moravec directed his and other teams to produce bigger monographs, which resulted, among others, in the monograph on *Fagetalia* forests (Moravec et al. 1982). His other activity was the preparation of the rules to be followed when naming vegetation units and served as a secretary of Nomenclature Committe and co-authored the Code of Phytosociological Nomenclature (Barkman et al. 1976). At that time, a Red List of plant communities was published (Moravec et al. 1983). It was a full list of vegetation units to the level of association with the degree of their

endangerment and rarity. [In the same month a similar list was published for Schlesswig-Holstein (Dierssen 1983); these two booklets were the first Red Lists of communities.] Many regional monographs and surveys of particular types of vegetation were published: Kopecký & Hejný (1971, 1974, 1978) developed a deductive method for classifying plant communities, which was especially useful for ruderal communities. There is a history of the research on vegetation for the period 1948–1978 in Hejný et al. (1978).

While at the Charles University in Prague, Jan Jeník published his book on the vegetation and ecological relationships in the High Sudetes (Jeník 1961). This book reviews the basic literature not only on plant communities on high mountains in the Czech Republic but also on the repartitioning of these communities. This monograph clearly formulates the relationship between disturbance and vegetation diversity. Unfortunately, it was published in Czech with a German summary and as a consequence remained hidden from western ecologists. Jeník had many students who studied thermophilous vegetation and "river phenomenon". In my opinion, his most important achievement was that he founded a school that specialized in studying mountain vegetation (e.g. Věra Komárková, Jan Štursa, Zuzana Burešová and Leoš Bureš).

The study of phytosociology was not only limited to universities and the Institute of Botany. Local, sometimes of them even hobby botanists made significant contributions: Jaromír Sofron for western Bohemia, Tomáš Sýkora especially for northern parts of the country, František Pišta published a monograph on forests in the southern part of the Šumava Mts (Böhmerwald), František Grüll wrote a monograph on ruderal plants at Brno. Jaroslav Rydlo greatly contributed to the knowledge of aquatic vegetation, especially of rivers and fishponds. Local lists of vegetation units were published, e.g. for western Bohemia (Pyšek 1981, Hadač & Sofron 1985).

In parallel with the schools of phytosociology, two schools of forest typology were established. Both were based on phytosociology and their aim was to develop rules for the proper management of forests based on habitat conditions. In Prague, a system was developed by Mezera, Mráz and Samek, based on classical phytosociology using accepted units, which was used in Bohemia. In Brno, the school founded by Alois Zlatník proposed specialized terminology, which was used in Moravia and also Slovakia.

After 1990, a new book and map of potential vegetation (Neuhäuslová et al. 1998) and a second edition of a list plus a Red List of plant communities (Moravec et al. 1995) were published. However, the centre of research on plant communities moved to Brno, where a new group was formed, initially under the leadership of Jiří Vicherek. Later on, this group was supervised by Milan Chytrý. They assembled a database of relevés from localities within the area of the Czech Republic (Chytrý & Rafajová 2003), which provided new possibilities for synthesizing existing data. This resulted in a modern monograph on Czech vegetation (Chytrý et al. 2007–2011). This series had many contributors; the data were used in nature protection, formed the basis of the Natura 2000 project, and of two editions of the Habitat Catalogue of the Czech Republic (Chytrý et al. 2001, 2010). During the work on vegetation surveys, a new formalized approach to classification of plant communities was developed (Chytrý 2000, Kočí et al. 2003), which was made available to a wider public, together with a toolbox of methods for analyzing data on vegetation, for use in the program JUICE (Tichý 2001), which is at present widely used in the Czech Republic and beyond.

Czech phytosociologists working abroad

Some activities of Czech phytosociologists were carried out in other countries; here I mention a few of the more important people and studies.

Emilie Balátová-Tuláčková (1926–2005) published many papers on grassland communities in central Europe, and in the 1980s on savanna vegetation in Cuba, which were published during the 1980s in Folia Geobotanica et Phytotaxonomica.

Emil Hadač (1914–2003) worked in the fields of geobotany (plant communities) and taxonomy. Before and at the beginning of WW II he worked in Norway, together with Eilif Dahl, especially on Svalbard, after the WW II in Iceland as member of a Czech expedition. Later he published papers on the vegetation of Reykjanes peninsula, and also on Iraq (together with Andrew Agnew).

Jan Jeník (1929–) worked in West Africa, on the Accra plains (Jeník & Hall 1976) and published many papers on ecology (especially root systems of tropical trees).

In the second half of 1980, there was a revival of the political relations between communist parties and goverments in Czechoslovakia and North Korea. This resulted in several botanical expeditions to North Korea and the participants collected rather unique material. After the political change in 1989, relationships were established with botanists in South Korea, which resulted in a monograph on east Asian forests (Kolbek et al. 2003).

History of studies on vegetation cover

For the Czech Republic the history of palynological studies was recently reviewed by Kuneš et al. (2009). Here I give only a brief outline. In the period between the WW I and II Prague was one of the centres of Quarternary studies. At the German University, Karl Rudolph and his colleagues, Franz Firbas and Hugo Salaschek provided a good basis for the study that was completed after the war by Franz Firbas. Unfortunately, there was not a similar group but only M. Puchmajerová at the Czech University. During the 1950s, Vlasta Kneblová-Vodičková and Eliška Rybníčková begun their research, both of whom studied at Kraków, at Szafer's school of palaeoecologists. Vlasta Kneblová-Vodičková worked with geologists. Her student was V. Jankovská, who was employed in Brno, in the group led by E. Rybníčková. Eliška Rybníčková was the leader of the group at the Institute of Botany at Brno and closely cooperated with her husband K. Rybníček, who was mainly interested in macroremains. Eliška Rybníčková had several students, M. Peichlová and H. Svobodová (Svitavská) were most active in palynology. In 1959 Emanuel Opravil established the first archaeobotanical laboratory, which was later (from 1970) associated with two Institutes of Archaeology belonging to the Czechoslovak Academy of Sciences. Emanuel Opravil analyzed the macroremains collected from archaeological sites from the whole the republic. Later on (the 1970s), Věra Čulíková worked with him and took over the analysis of macroremains from Bohemia.

During the 1990s, V. Jankovská taught several courses in Prague and České Budějovice, K. Rybníček in Brno and they had a number of successful students, who currently occupy positions at Charles University, University of South Bohemia, Masaryk University and Institute of Botany.

Parallel to this is the research more connected with the history of agriculture. František Kühn at the Agriculture University in Brno and Z. Tempír at the Agriculture Museum in Kačina were the most important. History of forests from medieval times was studied using written documents stored in different archives. Josef Nožička did several large scale studies; Hošek studied mainly the history of mountain forests in northern Moravia and Theodor Lokvenc in the mountains of eastern Bohemia. Unfortunately, at present research on this topic has almost ceased.

From the above survey it is evident there are two important conditions for good research: positions for professional botanists and a high possibility that the results will be published, both of which were slowly improved during 19th century. With the establishment of a new state, both strongly improved, which resulted in a great increase in knowledge.

Important contributions of botanists based in other countries

As stated in the introduction, many Czech and German botanists worked both in the present Czech Republic and other countries. Many foreign botanists spent part of their working life in the Czech Republic. Below is a short and incomplete list of those who I consider most important:

Jiří Camel (1661–1706). Member of Jesuit mission in Mexico, later owner of the first pharmacy in Luzon, Philippines. He collected many plants there, which are stored in Kew and Wrocław. The genus *Camelia* is named after him.

Karel Domin (1882–1953). Leading authority on botany in Czechoslovakia during the first half of the 20th century. He visited Australia and Indonesia; he introduced a narrower species concept and published descriptions of many new species (esp. tropical ferns).

Franz Firbas (1902–1964) was born in Bohemia, studied at the German University under Prof. K. Rudolph. For a short time he was assistant professor there before he left to go to Germany, where later he was appointed as a professor in Göttingen and published an account of the development of vegetation in central Europe during the Holocene (Firbas 1949, 1952).

Josef František Freyn (1845–1903) did a lot of floristic work throughout the whole Empire (Bohemia, Slovakia, Transsylvania) and in the Balkans and described many species in collections from the Middle East (especially *Astragalus*) and western North America (*Ranunculus*).

Eduard Hackel (1850–1928) was born in Bohemia, started his botanical activities here, later on, he was appointed professor at a secondary school in St. Pölten, Austria and produced a monograph on the genus *Festuca*.

Thaddaeus Haenke (1761–1816 or 1817) has already been mentioned as a member of the expedition to the Krkonoše Mts. He was employed as an assistant in the University in Prague (by Mikan) and Vienna (by Jacquin). In Austria, he collected plants in the Alps and described many species, such as *Campanula pusilla*, *Dianthus glacialis*, *Gentiana frigida*, *Festuca varia* etc. He was considered an excellent botanist and for that reason he became a member of Malaspin's expedition to the Pacific area organized by the Spanish King. He visited western parts of both the Americas and Philippines. He collected a large quantity of material and sent it to Prague. He continued doing botanical research in South America. He was the first botanist to collect for example *Sequoia sempervirens* (specimens stored in PR and PRC) and *Victoria regia*. He described many species, the collections he sent to Europe were stored for many years in the harbour in Hamburg and many years after they reached Europe they were bought for the National Museum. The Presl's brothers and some other botanists worked on them and described many species and genera on the basis of that material (Reliquieae Haenkeanae – Presl 1825–1835).

Věra Komárková (1942–2005) studied geobotany in Prague, did her diploma thesis in the High Tatras. She was an excellent mountaineer (Annapurna, Cho Oyu, etc.). She moved to Boulder, Colorado and during her stay at the university there she published a basic monograph on plant communities in a part of the Rocky Mountains (1979).

Vladimír Krajina (1905–1993). Before the WW II he worked in many countries, especially in Romania, and went on an expedition around the World. He published several papers on tropical flora (especially tropical ferns). After his emigration to Canada he became a professor of botany in Vancouver and studied forests, in particular their typology. He helped to establish a functional system of nature protection in British Columbia in Canada (Jeník 1992).

Johann Christian Mikan (1769–1844) went on an expedition to Brazil with Pohl and Berchtold, and published Delectus florae et faunae Brasiliensis (Mikan 1820).

František Nábělek (1884–1965) was a professor of botany in Brno and later in Bratislava, did a substantial part of his work outside Czechoslovakia, in the Balkans and Turkey. He is famous for his Iter Turcico-Persicum (Nábělek 1923–1929).

František A. Novák (1892–1964). Professor of botany at Charles University, Prague, published a lot of papers on the flora of Czechoslovakia and on the taxonomy of *Dianthus*. An important part of his work was on the flora on serpentines, both in Czechoslovakia and especially in the Balkans, in the former Yugoslavia.

Josef Podpěra (1878–1954). In addition to his work in Czechoslovakia, he studied the flora in Russia (southern Urals) and the Balkans.

Johann Emanuel Pohl (1782–1834). Author of Tentamen florae Bohemiae (Pohl 1809–1814), member of an expedition to Brazil with Mikan and Berchtold. He was employed in Vienna (in the Brasilianischen Museum) and published Plantarum brasileae hucusque ineditarum icones et descriptiones (Pohl 1827–1831)

Eduard Pospichal (1838–1905). His first papers were on the local flora in eastern Bohemia, after he was appointed professor in a secondary school in Trieste he published Flora der österreichischen Küstenlandes (Pospichal 1897–1899).

Karel (C.) Bořivoj Presl (1818–1852). As a student, he went on an expedition to Sicily and his dissertation was on grasses (Gramineae Siculae). Together with his brother and other contributors, he elaborated the rich material collected by T. Haenke in both Americas and published Reliquiae Haenkeanae (Presl 1825–1835). His other big studies were on *Lobeliaceae* (Presl 1836), pteridophytes (Presl 1837, 1847), *Hymenophyllaceae* (Presl 1845) and Flora Sicula (Presl 1826).

Josef Rohlena (1874–1944). In addition to his activities in Czechoslovakia, where he coordinated floristic research in Bohemia for many years, he visited regularly Montenegro and during the WW II he published Prodromus florae Montenegrinae (Rohlena 1942), which is the first flora for that region.

Franz Josef Ruprecht (1814–1870) was born in Prague, participated in Opiz Naturalientausch. Later, he became the custodian of the herbarium in Saint Petersburg, Russia, and published a number of papers on the flora of northern Russia, eastern Asia and the Amur region. He studied both vascular plants and algae.

Johann Ferdinand Schur (1799–1878) retired to Moravia, but spent the whole of his active life in Transsylvania (present Romania); he was the author of many papers, the most important is Enumeratio florae Transsylvaniae (Speta 1994).

Franz Wilhelm Sieber (1789–1844) went on many expeditions to many countries around the world and amassed a rich collection of herbarium material and published exsiccata. Herbaria containg plants collected by him are mainly in Prague, Vienna and Munich.

Grigorij Ivanovič Širjaev (1882–1954). Associate professor in Charkiv (Ukraine), from 1922 in Brno and after the WW II in USA. He published taxonomic monographs on several genera of Viciaceae, especially *Astragalus*.

Karel Vandas (1861–1923) was a professor at the Technical University in Brno and did most of his work outside the area of later Czechoslovakia: his first contribution dealt with the present Ukraine (Volhynia), later on he studied the flora in the Balkans, especially in Yugoslavia (Serbia and Macedonia, where he died while on an expedition). He studied the large herbarium collection made by E. Formánek and published the results in Reliquiae Formanekianeae (Vandas 1909).

Josef Velenovský (1858–1949). Successor of Čelakovský in Prague. He was an author of the first Flora of Bulgaria (Flora Bulgarica) and subsequent contributions; he is considered to be one of fathers of botany in Bulgaria (Petrova 1996, Stanev 2010). He cooperated with a number of botanists, most of them of Czech origin (which are almost unknown in this country): Stříbrný, Škorpil, Mrkvička, but known in Bulgaria (Stanev 2001).

Friedrich Vierhapper (1876–1932) was born in Austrian Silesia and began studying botany there; later, he became professor of Botany in Vienna.

Moriz Heinrich Willkomm (1821–1895). Professor at the University in Prague, published Prodromus florae Hispanicae (Willkomm & Lange 1861–1880) and additions to it (Willkomm 1893), and Illustrationes florae Hispanicae insularumque Balearium (Willkomm 1881–1892).

Alexander Zawadzki (1798–1868) was born in Moravia, where he also retired. Most of his active years he spent in Galicia, present Poland and the Ukraine; he published important contributions on the flora of Galicia, the Carpathians and Bucovina: Enumeratio plantarum Galiciae et Bucovinae (Zawadzki 1835), Flora der Stadt Lemberk (Zawadzski 1836).

After the WW I, Czechoslovakia was founded and Czech botanists started extensive research into the flora of Slovakia and the present Transcarpathian Ukraine. This topic became very attractive, because of the high diversity of areas in the Carpathians and in their flora. To evaluate all this in a short review is impossible, for Slovakia it was done by Hendrych (1996) and Vozárová et al. (2010). The botanical research done by Czechs in the Ukrainian Carpathians, however, remains to be critically evaluated.

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Souhrn

V článku je stručně představena historie poznání květeny (od 2. poloviny 18. století) a vegetace (od začátku 20. století) na území dnešní České republiky. Práce se týká těchto skupin rostlin: lišejníky, mechorosty, kapraďorosty a semenné rostliny. Je ukázáno, jak vývoj poznání v sousedních zemích ovlivňoval vývoj poznání zde. Tento vývoj byl významně ovlivněn rozvojem společnosti a vytvářením vědeckých institucí, zejména universit, muzeí, vědeckých společností (ve 20. století i Botanické společnosti) a zároveň i nárůstem profesionálních míst v různých institucích. Výrazněji než v předchozích českých publikacích je zhodnocen i vývoj na Německé universitě ve 20. století. Je uveden i seznam botaniků, kteří pocházeli z území dnešní České republiky, či zde pracovali, a podstatně přispěli k poznání flóry a vegetace jiných území, a to jak v Evropě, tak i v jiných částech světa. Není zde ve větší míře uveden přehled botaniků, zabývajících se sbíráním floristického materiálu, ti jsou uvedeni ve speciálních publikacích.

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Appendix 1. – Important publications on the history of botany in the Czech Republic.

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