



Regional differences of beer styles in early modern Europe

Petr Holub* and Jaromír Fiala

Research Institute of Brewing and Malting, Lípová 511/15,
120 00, Prague 2, Czech Republic

* corresponding author: holub.petr@npu.cz

Abstract

There is a general concept of ancient beer styles brewed in the Czech Republic and in German speaking countries. It should be considered that some opinions are based on real facts, while others need to be modified. These views come mainly from romantic and pioneering research articles of the 19th century. Nowadays, old prints, dealing with brewing specialization since the 16th century, can be easily used as the basic research sources. A deeper analysis of this problem can be based on the oldest literature, archival sources and current opinion. Thus, it is possible to correct knowledge about beer styles brewed in particular regions of Central Europe as well as in the surrounding area, and also, to ask questions and look for the origin of current interpretations and opinions.

Keywords: beer; brown beer; white beer; wheat; barley; beer style; brewing history; hop substitutes; surrogates; Broihan; Convent; Märzen; Mumme; Samec; Gose; Bock; Salvator

1 Introduction

The history of beer style resources is relatively extensive and was frequently used in the past. The modern trend of resource digitization allows an easy access to the books that were not previously readily available, or were available only in a limited mode.

Archival sources play a rather representative role. Nevertheless, they can provide us with fragments of information concerning a particular detail, but not the whole matter. The typical examples are regional recipes including malt ratios, procedures, etc.

The oldest comprehensive prints on beer in the Central European region can be traced back to the 16th century. In Bohemia, it is mainly the work of Tadeáš Hájek of Hájek (Hájek, 1585), which clearly follows the older publication by Heinrich Knaust (Knaust, 1574). Hájek's work is written in Latin, a translation into the Czech language was made in the 19th century (Anonymus, 1878; Nademlejnský, 1884).

The aim of this work is to look into the history of beer styles and until now known beer brands in Central Europe. This overview observes different raw materials and their

variation in the course of time. It also attempts to separate myths from reality and to outline a period of transition from intuitive approach to scientific research in brewing.

2 Bohemian beers in 16th century

The importance of beer in the Czech lands is also indicated by the old saying that “*the wealth of the Czech lords lies in sheep breeding, brewing and pond farming*” (d'Elvert, 1870). However, we must say that the Czech lands were characterized by the uniformity of the beer style, especially in manorial breweries. The oldest Czech written text about beer is a part of treatise by Jan Kopp of Raumenthal. This work notes the differences in the methods of beer brewing, the proportion of grain and hops, the appearance and properties of beer. Young and old beers are distinguished in this text, which means wheat and barley-based beer. Jan Kopp of Raumenthal described wheat beer as a healthy drink and gave Prague beer as an example. He also stated

that wheat beers were more nutritious but less digestible than barley beers. Special emphasis was placed on water as a critical raw material and thus it was pointed out that only well-brewed beer could be a healthy drink. According to this historical work, it was not allowed to serve unhealthy beer, i.e. beer that was too young and/or turbid or acidic. Such beer caused health problems to consumers. Among the bitter (old) beers, the author listed **Freyberger beer** and **Saxon beer**, which he called **Mum** as well as **Einbeck** beer. He praised these beers for their good digestion. He also recognises light beers, which should not have been too fermented. Among the thick beers, he again comprised to Prague beer and also the beers from **Tábor**, **Rakovník** or **Šwidnica**. He described these beers as easily digestible and very nutritious and also as not too sweet, bitter or sour in taste. He valued them especially for their balanced taste (Kopp, 1536).

3 The oldest printed books on beer – transition towards a scientific attitude

In addition to the previously mentioned Knaust's work, we should highlight the oldest professional publications by Johann Brettschneider, a professor at the University of Gdańsk, known as Placotomus. He was a physician like the other authors of this time. Further, Szymon Syrenski, who wrote the oldest Polish book analysing the properties of beer, describing the various regional types and differences, can be listed here. This book was published in 1613 (Syrenski, 1613).

The rise of brewing literature can be observed at the end of the 17th and especially in the 18th century, after the Thirty Years' War calmed down (e.g. Tryon, 1691; Krünitz, 1784; Simon, 1771, etc.). At the turn the 18th and the 19th century, the number of published documents increased. From this time publications on scientifically grounded procedures and conclusions were published (Rupprecht, 1791; Wäser, 1793; Paupie, 1794a, b etc.).

The scientific approach to brewing prevailed in the professional literature in the first half of the 19th century. Its culmination was presented in the unrivalled and systematic work of Carl Napoleon Balling (Balling, 1845). With regard to the long-term nature of the initial data collection, it can be stated that the published data represented the diversity and variety of the recognised beer styles relatively well. For example, Balling monitored Prague beers in the period from December 1839 to January 1845, see Table 1 (Balling, 1843; 1845; 1846). A part of his research was to measure the difference between saccharide content in beer before and after boiling using a saccharometric test. Furthermore, he dealt with the content of the

wort extract, alcohol and the degree of fermentation, both in volume and weight percentage. Initially Balling also calculated a required grain bill based on the obtained values (Table 1 and 2). The data in Table 1 shows the relatively balanced quality and stable style of Prague beers. The tradition of beers with a lower degree of attenuation is also evident in the Prague agglomeration.

The period of these tests performed by Balling is substantial for research of the historical beer styles, because the traditional beers were analysed before the arrival of modern variants of Viennese, Munich or Pilsen lagers. Pilsner beer was tested by Balling in September 1844 (Sommerbier resp. summer beer) and January 1845 (Winterbier resp. winter beer). Table 1 demonstrates a clear difference between the so-called winter and summer beer as well as underlines the tradition of producing Bavarian style beers with a higher degree of attenuation in the Cheb region. For example, the above-mentioned Pilsner summer beer reached an extract proportion in the wort 12.3 % w/w (alc. 4.2 % w/w) and the values for winter beer were 11.056 % w/w (alc. 3.1 % w/w), see Table 1.

Table 2 indicates the different attenuation degrees of very strong export beers produced in London. From the point of view of the German countries, the obviously unbalanced production of beer in Saxony is worth noting. The typical higher degree of attenuation and alcohol content of Bavarian lagers compared to the lower degree of attenuation in Bavarian Bocks is also interesting.

4 Basic division of beer styles

The basic factor that distinguished between the two main groups of beers since the Middle Ages (Winter, 1906) has been the grain used for malting. Malting of wheat, from which the so-called white beers were brewed, prevailed in the Czech and German lands in the Middle Ages and early modern times.

General aspects that have gradually played a role in the transition of brewing from wheat to barley are the following: brewing of wheat beers can be associated with periods of climatic optimum and political calm. Wheat is a demanding plant and the success of its cultivation depends on the quality of soil, altitude and sufficient annual rainfall. The fact, that its price is most unstable due to possible crop failure, should be considered as well. It tends to fluctuate significantly during a year. On the contrary, barley is a less demanding cereal that can be successfully grown also in less favourable conditions. The transition to the production of barley beers took place mainly as a result of the Thirty Years' War, i.e. before the middle of the 17th century. During this

Table 1 Table of Czech and Moravian beers from the 1940s and early 1850s according to Balling (1843; 1845; 1846; 1854).

Czech beers	Date of analysis	Saccharometer test		Wort extract (% weight)	Degree of attenuation	Containing 100 weight portions of beer (i.e. weight percentage – author's notes)			Grain bill needed		
		Beer	Boiled beer			Alcohol	Extract	Water	For 100 lb of worth	For barrel of worth (170 Maß)	
									in Viennesse pounds		in Viennesse measures
I. Beers of town Prague											
Mr. Wanka's brewery	21. 12. 1839	3.650	5.200	11.881	0.690	3.447	5.200	91.353	22.900	103.290	2.060
Mr. Wanka's brewery	21. 12. 1839	5.925	7.658	15.036	0.600	3.873	7.658	88.469	29.000	132.400	2.640
Mr. Wolf's brewery	9. 1. 1840	4.525	5.775	11.186	0.590	2.781	5.775	91.444	21.600	97.100	1.940
Mr. Wolf's brewery	9. 1. 1840	3.675	5.100	11.268	0.670	3.170	5.100	91.730	21.700	97.790	1.950
Mr. Czižowsky's brewery	3. 3. 1840	6.300	7.463	12.476	0.490	2.596	7.463	89.941	24.100	108.800	2.170
Mr. Karásek's brewery	1. 7. 1840	5.725	7.000	12.495	0.540	2.846	7.000	90.154	24.100	109.000	2.180
Strahov brewery	5. 12. 1841	5.075	6.075	10.422	0.510	2.225	6.075	91.700	20.100	90.210	1.800
Křižovníků brewery (bottled)	19. 12. 1841	4.350	5.750	11.784	0.630	3.113	5.750	91.137	22.700	102.420	2.040
Mr. Kunz's brewery	20. 12. 1841	5.825	6.902	11.564	0.490	2.400	6.902	90.698	22.300	100.460	2.000
Mr. Klenka's brewery	20. 12. 1841	6.268	7.683	13.730	0.540	3.150	7.683	89.167	26.500	120.440	2.400
Mr. Labutka's brewery	3. 1. 1843	9.121	10.904	18.353	0.500	3.958	10.904	85.138	35.400	164.040	3.280
Mr. Labutka's brewery	3. 1. 1843	5.850	7.463	14.356	0.590	3.605	7.463	88.932	27.700	126.250	2.520
taproom of Mr. F. Náprstek brewery, light, clear brownbier	17. 8. 1844	3.400	5.000	11.896	0.710	3.558	5.000	91.442	22.980	103.590	2.070
II. Czech landbeers											
A) Neighbourhood of Prague											
Kbely brewery	22. 8. 1841	4.650	6.585	14.819	0.610	4.322	6.585	89.093	28.650	130.560	2.610
Kbely brewery	29. 12. 1841	5.500	6.731	12.037	0.540	2.743	6.731	90.526	23.270	104.500	2.090
Nusle brewery	9. 12. 1841	4.150	5.675	12.248	0.660	2.398	5.675	90.927	23.680	106.700	2.130
Pakoměřice brewery	15. 11. 1839	6.500	7.500	11.810	0.440	2.224	7.500	90.277	22.900	102.600	2.050
Libeň brewery	15. 11. 1839	4.025	5.600	12.388	0.640	3.516	5.600	90.884	23.950	108.000	2.160
Vršovice brewery	10.6.1840	3.400	4.900	11.393	0.700	3.343	4.900	91.757	21.930	98.900	1.980
Vršovice brewery	3.7.1840	4.675	6.005	11.737	0.600	2.957	6.005	91.038	22.690	102.000	2.040
Vršovice brewery	27.1.1841	5.025	6.317	11.883	0.570	2.872	6.317	90.811	22.980	103.300	2.060
Motol brewery	27.4.1841	6.050	7.463	13.500	0.550	3.145	7.463	89.392	26.100	118.300	2.360
Zbraslav brewery	19.4.1841	3.500	5.100	12.000	0.700	3.560	5.100	91.340	23.200	104.300	2.080
Michle brewery	9. 12. 1841	4.150	5.675	12.260	0.660	3.404	5.675	90.921	23.500	106.600	2.130
B) more far from Prague											
Sedlec brewery (bottled Damenbier) – hell	10.5.1839	6.463	8.332	16.251	0.600	4.189	8.332	87.479	31.420	144.000	2.880
Sedlec brewery (bottled Damenbier) – brown	12.6.1839	4.625	6.853	16.292	0.710	4.993	6.853	88.154	31.600	144.400	2.880
Rokycany, manorial brewery	20.9.1839	3.050	4.548	11.032	0.720	3.332	4.548	92.120	21.330	95.700	1.910
Brewery of town Brandýs	25.7.1841	4.100	5.925	13.724	0.700	4.063	4.925	90.012	26.540	120.400	2.400
Chlumec brewery	19.10.1841	3.225	4.600	10.569	0.690	3.056	4.600	92.344	20.410	91.480	1.820
Dolní Břežany brewery	20.7.1840	3.650	5.100	11.377	0.670	3.232	5.100	91.668	21.970	98.790	1.970
Popovice brewery	9.2.1840	2.350	3.875	10.505	0.770	3.394	3.875	92.731	20.280	90.900	1.810
Škvorec brewery	9.2.1840	3.200	4.650	10.927	0.700	3.220	4.650	92.130	21.110	94.710	1.890
Hluboš brewery	4.6.1840	2.625	4.000	9.978	0.730	3.054	4.000	92.946	19.270	86.150	1.720
Řitka brewery	6.6.1840	4.000	5.350	11.107	0.630	2.959	5.350	91.691	23.310	96.340	1.920
Dolní Počernice brewery	17.11.1840	4.375	5.775	11.809	0.620	3.113	5.775	91.112	22.810	102.720	2.050
Přerov brewery	30.8.1842	2.750	4.075	9.835	0.720	2.937	4.075	92.988	19.000	84.870	1.690
Švabín brewery	30.12.1842	2.750	4.250	10.743	0.740	3.330	4.250	92.420	20.750	93.050	1.860
Hořetice brewery	16.4.1839	2.320	3.550	8.921	0.760	2.728	3.550	93.722	17.220	76.700	1.520
Nižbor brewery	2.10.1843	3.200	4.875	12.094	0.730	3.732	4.875	91.393	23.370	105.500	2.110
Pilsner lager (summer beer)	19.9.1844	2.325	4.200	12.281	0.810	4.177	4.200	91.623	23.730	107.030	2.160
Pilsner lager (winter beer)	19.1.1845	3.725	5.100	11.056	0.660	3.061	5.100	91.839	21.360	95.870	1.910
Vimperk, lager	25.8.1853	3.675	-	10.977	0.660	2.998	5.025	91.977	-	-	-
Němčice	31.8.1853	3.100	-	10.959	0.710	3.275	4.575	92.150	-	-	-
Skalná (summer beer)	11.5.1852	2.850	-	13.661	0.790	4.573	4.900	90.522	-	-	-
Skalná (summer beer)	11.5.1852	2.525	-	12.976	0.800	4.404	4.500	91.096	-	-	-
Skalná (winter beer)	11.5.1852	2.200	-	10.355	0.780	3.389	3.725	92.886	-	-	-
Cheb – Frankenthaler	15.5.1852	2.550	-	11.577	0.780	3.787	4.250	91.963	-	-	-

Table 2 Table of the foreign beers tested by Balling and his contributors in the 1840s and 1850s (Balling 1843, 1854).

Foreign beers	Date of analysis	Wort extract (% weight)	Degree of attenuation	Containing 100 weight portions of beer (i.e. weight percentage – author's notice)		
				Alcohol	Extract	Water
A) Barley beers of England						
Ale from London	7.5.1841	29.99	0.58	8.08	15.88	76.04
Porter from London	7.5.1841	16.53	0.67	4.77	7.53	87.71
Porter from London	17.5.1844	19.63	0.80	6.91	6.81	86.28
B1) Barley beers from Saxony						
Braunbier, manorial brewery Machern	23.12.1845	10.25	0.60	2.56	5.25	92.19
Erlanger beer, manorial brewery Machern	5.1.1846	10.53	0.65	2.84	5.00	92.16
Lagerbier, manorial brewery Machern	24.1.1846	10.51	0.79	3.45	3.80	92.75
Brewery of town Zwickau, felsenkeller lager	31.1.1846	12.64	0.82	4.33	4.28	91.30
Brewery of town Wurzen, braunbier	9.2.1846	7.14	0.49	1.44	4.28	94.29
Brewery of town Wurzen, lager	28.2.1846	12.50	0.69	3.62	5.53	90.86
Brewery of town Altenburg	16.2.1846	12.33	0.71	3.68	5.20	91.12
Manorial beer from Gähren, in taproom Gambrinus in Leipzig	19.2.1846	11.29	0.71	3.34	4.80	91.86
Manorial beer from Lützenscha bei Leipzig, lager	28.2.1846	14.21	0.72	4.35	5.88	89.77
Town beer in Nicolaikirchhof in Leipzig, braunbier	1.3.1846	7.98	0.52	1.73	4.58	93.70
Manorial beer from Lichtenheim, taproom Höpfner Leipzig	6.3.1846	8.90	0.83	3.05	2.90	94.05
Manorial beer from Hof Löbnitz, Bitterbier	6.3.1846	12.48	0.38	2.01	8.61	89.38
Bavarian Schwabe, in taproom Gambrinus in Leipzig	7.3.1846	12.68	0.69	3.68	5.60	90.72
Brewery Walschlösch Dresden, in taproom bei Johne in Leipzig	18.3.1846	11.88	0.73	3.62	4.88	91.51
Knauthain, Castle lager, taproom Gähne in Leipzig	18.3.1846	11.45	0.74	3.79	4.63	91.59
Zerbster bitterbeer, taproom Dürr in Leipzig	21.3.1846	12.68	0.57	3.79	4.63	91.59
Knauthain, Healthbeer, taproom Hähle in Leipzig	29.3.1846	10.71	0.45	2.00	6.78	91.22
Meißen, felsenkeller lager	29.3.1846	12.58	0.73	3.85	5.18	90.98
Manorial brewery Oelzschauer, lager	9.4.1846	10.38	0.75	3.22	4.08	92.70
Manorial brewery Thammenhayn	10.4.1846	7.48	0.69	2.10	3.30	94.60
Ponitz brewery	25.4.1846	7.44	0.74	2.27	2.93	94.80
Farmer brewery Thanhausen bei Crimischau	25.4.1846	10.19	0.78	3.29	3.76	92.96
Manorial brewery Hainichen	25.4.1846	6.51	0.75	1.99	2.53	95.48
Farmer brewery and tap Tettau	26.4.1846	8.98	0.75	2.78	3.53	93.70
Brewery Mr. Naumann Leipzig, Bockbeer	20.7.1846	15.33	0.66	4.36	7.07	88.57
B2) unhopped wheat beers from Saxony						
Manorial brewery Döllnitz (Gose)	28.2.1846	12.68	0.75	4.01	4.95	91.04
Wiendorf, at Flemming in Leipzig (Gose)	9.4.1846	10.99	0.62	2.78	5.58	91.64
Berlin beer, in Oehmigen taproom Leipzig	9.4.1846	9.46	0.67	2.61	4.33	93.06
Wernesgrün beer, in Dürr taproom Leipzig	21.3.1846	12.00	0.78	3.94	4.38	91.69
Modnitz beer, in Beier taproom Leipzig	29.3.1846	8.67	0.79	2.83	3.10	94.07
C) beers from the duchy of Hesse						
Brewery Mr. Oertge Zum Schiff, Worms, lager	25.8.1846	14.53	0.75	4.61	5.70	89.69
Brewery Mr. Kaspar Franz, Worms, lager	27.8.1846	12.43	0.75	3.93	4.83	91.24
Brewery Mr. Friedrich Weeger, Worms, lager	27.8.1846	10.18	0.80	3.39	3.55	93.06
B. Tag Widow's brewery, lager	28.8.1846	9.06	0.80	3.02	3.13	93.86
D) beers from the province Rhineland-Bavaria						
Brewery Jähnisch, Keiserslautern, felsenkeller lager	5.9.18945	11.94	0.77	3.85	4.50	91.65
E) beers from the duchy of Baden						
Brewery Nuf & Comp. Heidelberg, brewed in december 1845	21.9.1846	10.99	0.62	2.84	5.48	91.69
F) beers from the kingdom of Württemberg						
Neuenstadt an der Linde	16.1.1847	10.09	0.71	3.00	4.23	92.77
Neuenstadt an der Linde	31.1.1847	7.06	0.63	1.83	3.43	94.75
Neuenstadt an der Linde	5.2.1847	9.51	0.79	3.12	3.40	93.48
Widdern	2.2.1847	5.97	0.57	1.38	3.20	95.42
Gundelsheim	4.2.1847	9.75	0.67	2.72	4.43	92.86

Foreign beers	Date of analysis	Wort extract (% weight)	Degree of attenuation	Containing 100 weight portions of beer (i.e. weight percentage - author's notice)		
				Alcohol	Extract	Water
Neckarsulm	23.2.1847	10.63	0.50	2.22	6.30	91.48
G1) beers from the kingdom of Bavaria - lagers						
Bavarian double lager	19.6.1840	11.00	0.73	3.39	4.40	92.21
Bavarian lager	19.12.1841	12.35	0.79	4.13	4.38	91.50
Bavarian lager	1.7.1842	13.07	0.78	4.34	4.70	90.96
Erlanger beer	1.7.1842	10.99	0.72	3.34	4.50	92.16
G2) beers from the kindom of Bavaria - sommerbeers						
Wunsiedel	21.5.1852	11.53	0.71	3.45	4.85	91.70
Culmbach	24.5.1852	12.83	0.74	4.01	5.10	90.89
Bamberg, Max	25.5.1852	13.72	0.76	4.41	5.28	90.31
Nürnberg, Rothen Kreuzt	25.5.1852	11.24	0.77	4.02	4.60	91.38
Augsburg, Hartmann	29.5.1852	11.24	0.75	3.45	4.53	92.03
Munich, Augustiner	06/1852	14.42	0.72	4.41	6.02	89.56
Munich, Hackerbräu	06/1852	13.89	0.68	4.01	6.22	89.77
Munich, Wagnerbräu	06/1852	14.51	0.71	4.41	6.12	89.46
Munich, Pschorr	06/1852	12.44	0.62	3.28	6.12	90.60
Munich, Spatenbräu	06/1852	13.84	0.71	4.19	5.83	89.89
Munich, Hallerbräu	06/1852	12.68	0.69	3.68	5.60	90.72
Münich, Maderbräu	06/1852	13.36	0.66	3.73	6.22	90.05
Munich, Leistbräu	06/1852	14.86	0.69	4.39	6.52	89.09
Munich, Stubenvoll	06/1852	14.51	0.65	4.04	6.83	89.13
Munich, Hofbrauhaus	06/1852	13.33	0.72	4.06	5.55	90.39
G3) beers from the kingdom of Bavaria - wheat beers						
Munich, Hofbrauhaus	06/1852	11.42	0.79	3.79	4.10	92.11
Munich, Knorr	06/1852	12.22	0.66	3.39	5.65	90.96
Munich-Au, Zacherl	06/1852	12.91	0.65	3.57	6.05	90.38
G4) beers from the kingdom of Bavaria - Bock beers						
Munich-Au, Zacherl	12.3.1853	18.88	0.52	4.28	10.91	84.81
Munich, Maderbock	29.3.1853	17.83	0.58	4.47	9.46	86.07
Munich, Spatenbock	11.4.1853	18.21	0.61	4.86	9.12	86.02
Munich, Leistbock	10.4.1853	19.96	0.64	5.61	9.63	84.75
Munich, Löwenbock	17.4.1853	18.94	0.52	4.28	10.98	84.75
Munich, Hofbrauhaus	12.5.1853	17.64	0.59	4.52	9.18	86.30
Bamberger Bockbier	25.5.1852	17.51	0.74	5.61	6.98	87.41
H) beers from Austria						
City brewery Linz	06/1852	11.28	0.75	3.56	4.35	92.09
Wien, St. Marx, lager	08/1852	17.30	0.77	5.75	6.54	87.71
Wien, Fünfhaus, lager	08/1852	14.33	0.73	4.64	6.00	89.36
Laibach, top fermented	08/1852	12.39	0.70	3.96	4.98	91.07
Trieste, Altes Brauhaus, lager	08/1852	11.76	0.78	3.84	4.33	91.33

period, the peak of a very cold climatic period, the so-called Little Ice Age (Fagan, 2007), joined the political uncertainty of the long-lasting war and resulted in the need for changes at many levels of social life. Nevertheless, wheat was still used in production and was added to barley beers.

In general, barley is associated with the so-called old beers, which had a longer durability and were hopped more. Wheat beers contained less hops, were intended for immediate consumption and were used for the preparation of beer soups or warm and flavoured (herbal) beers. An archival example of a beer recipe from the Brno brewery from 1815 reported that the higher price of wheat could be partially offset by a lower malt ratio, i.e. instead of 30 measures of barley 20 measures of wheat (measure – in original *měřice* or *Metze* – is an old volume unit derived from a volume of wooden vessel and usually the value of 1 measure correspond to 61.49 l).

However, not only the difference in malt, but the distinction beer style also played a role in some areas. In Berlin, water from the River Spree was used in the production of the **Berliner Weissbier**, while well water was used to brew brown barley beers (Krünitz, 1784). The details for beer brewing from the river Elbe in Hamburg and Stade, listed below, can be compared.

Despite its marginal significance malting of other cereals used for beer brewing should be mentioned. They often played an important role in some regions or specific products. For example, oats were widely used for beer production in Horn, Lower Austria. From there, beer was also imported to Vienna, where it was reportedly very popular. Further, oats were used to produce **Harlem beer** in the Netherlands or **Koete** in the Rhineland. Oats were surrogate even in unmalted form, for example in **Bredaier beer**. This beer was based on barley malt, but the malt was made as follows: the malt was dried over a very low heat and then wheat and some oats or buckwheat were added. In the 19th century, oats were very rarely used for beer production. This cereal was used especially in mountainous areas, again due to the harsh climate, in which this cereal was able to succeed.

Millet was sometimes used instead of wheat. However, millet was not of great significance in modern times due to its yield. Millet was consumed more in the east. The Tatars in Crimea named millet beer **Buza**, and in East Turkmenistan **Bakosun**, in the Ruthenians **Braka** as well as in Sikkim at the foot of the Himalayas they named this beer **Murva** (Schranka, 1892 b, c). One of the types of wheat with lower yields is also spelt, which is mentioned for brewing beer around 800 AD in St. Dennis. Spelt beer called **Bulion** was brewed for instance in Lutich, Belgium.

A brief introduction to hop growing and its use in beer production cannot be omitted before we proceed to discussion on particular beer styles. The oldest hop-growing areas began to consolidate just in the Middle Ages. For example, since the 14th century, Buckow was one of the most valuable hop gardens in Brandenburg. However, the high taxation of local hops caused that in the 19th century, Buckow hop gardens were only a torso of its former fame, and Buckow became a poor village. Another important hop-growing area with documented hop exports was around Gadelegen city from the 15th century. Tadeáš Hájek already mentioned that hops had an effect on beer preservation and added that hops were mainly used for barley (bitter) beer, less than for wheat (sweet) one. He also noticed that the English beers known as **Alla** were hop-free in early modern age. Bitter beers included, for example, the so-called **Braunschweiger Mumme**, while the historical literature states that **Bavarian** and **Brandenburg beers** should be included into the group of less hopped beers. An interesting mention from the point of view of the Czech hop industry is **Geithainer beer**, which had the character of **Märzen** and was hopped exclusively by Czech hops (Krünitz, 1784; Schranka, 1892e). It can be noted that the export of Czech hops from the Klatovy region was mentioned at the end of the 16th century by Karel the Elder of Žerotín (d'Elvert, 1870). In general, that hop export areas have been associated with the eastern region below the Ore Mountains (Krušné hory) since this time.

In addition to hops, hop substitutes have to be mentioned. Traditional raw materials were very often applied for beer preservation and flavouring long before beer hopping was generally used. It is known that fern leaves were traditionally adopted instead of hop (Farrenkrautbier), in Siberia. In northern Germany and the Netherlands, a sweet gale (*Myrica gale*) was added to a beer called **Grutt** or **Gruyt**, mentioned as early as 998 AD in Utrecht. It was not until the 14th century that hops began to compete this herb. The hop competition intensified so much that Emperor Charles IV imposed a tax on hopped beers. However, Grutt beer did not disappear, as evidenced by the fact, that around 1447, Dortmunder Grutt was highly praised. According to available sources, this beer was brewed in Dortmunder until 1543, when it was replaced by **Koete (Keute) beer**. Koete was brewed also in Cologne and the malt consisted of two-sevenths of wheat and five-sevenths of oats (Schranka, 1892f). Heath tips (Haidenkrautbier) or juniper (Wacholderbier) were also often used in place of hops.

4.1 Wheat beers

As mentioned above, wheat beers have generally been called white beers since the Middle Ages. The distribution of white beer production, that is mentioned in historical works, is illustrated in Figure 1. Knaust (1574) invested **Hamburger beer** a king of white beers. According to the description, it had a sweet-wine after-taste. This source also stated that red beer was brewed in Hamburg until 1233, then white and finally, from 1374, even yellow beers followed (Schranka, 1892a). Krünitz (1784) claimed that it was prepared from a mixture of wheat and barley malt. All beers in the Hanseatic towns were comparable to the beer from Hamburg. It should be added that the economy of these towns was based on trade, which was also linked to the brewing of various beer styles. In addition to white beers, the so-called old beers were brewed and often shipped abroad. Apart from the Hamburg beer, also **Lübecker beer** had a very good reputation in the 16th century (Knaust, 1574). A written record from this period states : “... which like beer from Hamburg is sought after and called *Israhel*. This beer is similarly powerful to Hamburg’s one, but not as strong.

That is why it is easier to drink because it does not cause such a heavy head. Red beer is also brewed in this free Imperial city, which tastes similar to spicy beers and represents a noble and healthy drink. And it is given by God to both cities, Bremen and Lübeck, that both beers are brewed here and are so nutritious”.

It is impossible to forget **Bremen beer** along with **Stade beer** brewed nearby. Stade is the city, as Knaust writes “... five miles and across the Elbe from Hamburg, where beer is brewed from the same Elbe, wheat, hops and other ingredients, in the same way and procedure as in Hamburg and between Hamburg’s and Städer’s one is a minimal difference in taste. But in density and strength we find differences between them. It is also called *Käter* (cat) because it can scratch in the head just like a cat next morning, if a person drinks too much”. On the territory of today’s Poland, there was a famous white beer from **Wrocław**, which was said to be the Silesian Malvaz (Schranka, 1892b). **Hanoverian Broihan** belonged among the famous white beers as well. Due to its quality, this beer had a number of imitations throughout northern Germany. Knaust (1574) wrote that “two different

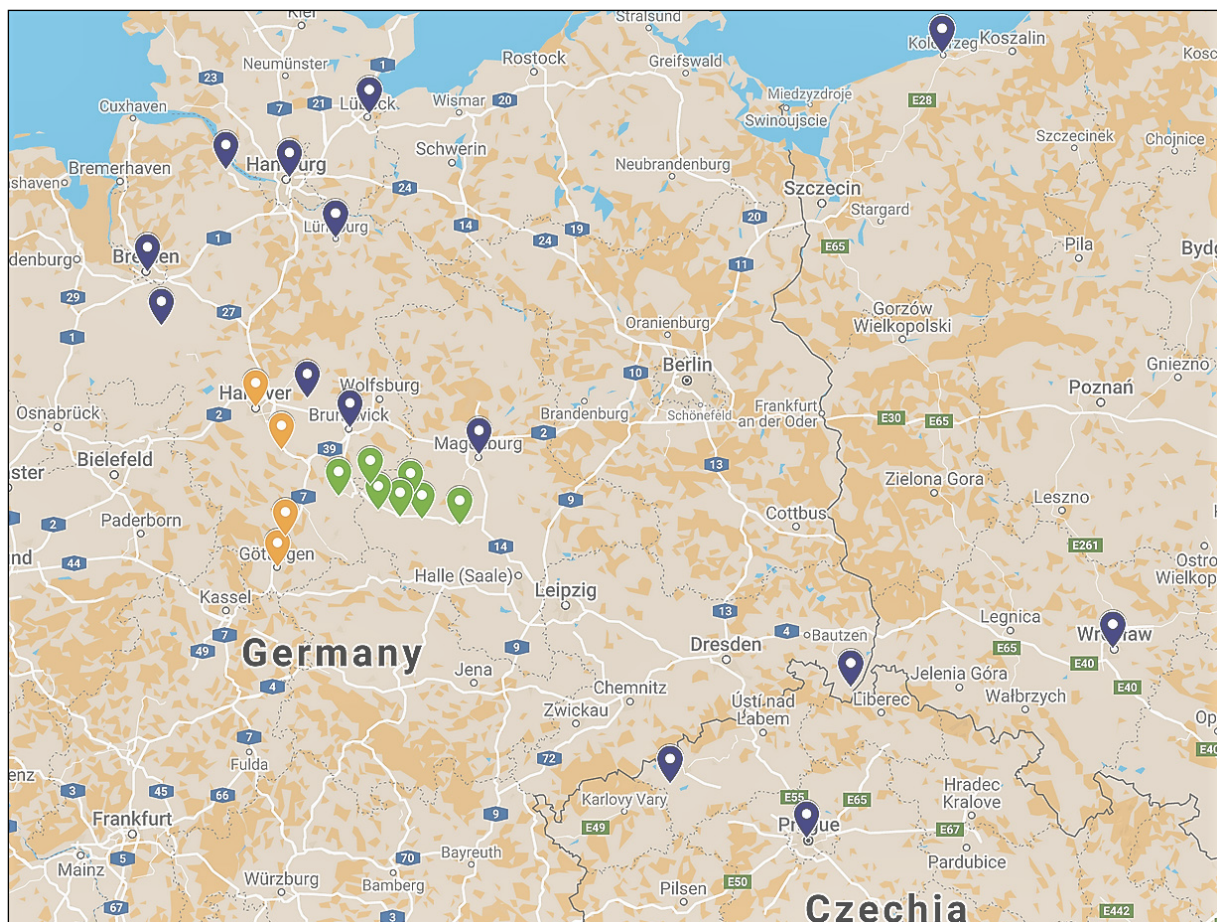


Figure 1 White beers featured in historical works (based on Google maps)
Blue - named beers, green - region of Gose, orange - region of Broihan

beers are brewed in Hildesheim and Hanover, called Broihan, which are classified as white beers. Both are strong and sweet in taste, with a strong core and very nutritious. Both beers are considered good and healthy, but as with many others, it is not appropriate to drink them excessively". In the 19th century, as it was typical for the idea of romantic concept, Schranka (1892b) already provided this beer with folk tales associated with the origin of the beer and the origin of its name. He wrote that „according to legend, the name came from an allegory that the beer is so warm that a rooster (German Hahn) could be boiled in it. This is the source of the name Broihahn. The emergence from Hannover (Hanover) is also considered in addition to the etymological interpretation of the origin from a rooster. And the third explanation of the word lies in the story that the beer was apparently invented by a wealthy citizen and merchant from Hamburg. This merchant brought the brewer Conrad Broihan to Hamburg where he brewed this beer first in 1526. Historically, the brewer Broihan is documented in the village of Stöcken, a mile away from Hamburg, where he was appointed a brewmaster's assistant. He allegedly brewed the first batch of this beer named after him at Hans von Sodens's on May 31, 1526. In the beginning, the beer was only made from wheat and hops, barley was added later. After the brewmaster's death, in 1570, the Hanoverians had a coin minted in his honour in 1609, depicting a rooster (perhaps the legend of a boiled rooster comes from here). This coin had to go with each brew, and each brewer received one with their apprenticeship certificate. The beer Broihahn was often imitated, and in other cities more or less successfully brewed". In 1688, in the city of Celle, eleven measures of barley malt and three measures of wheat malt per 40 barrels were prescribed for a brew of Broihan. Eight measures were dosed from Easter until the feast of St. Michael, and from St. Michael to Easter it was six himbts of hops (in original *Himpten*, is a volume unit of measure corresponding to approx. 30 l). On top of this only grown hop could be used, the use of wild hop was forbidden (Continuatio, 1719).

Goslar's white beer, generally called after the river from the town of its origin, **Gose**, was also mentioned as one of the significant types of white beers. As Knaust (1574) wrote, „it is brewed mainly from wheat in the imperial free town of Goslar in Hartz. It is sweet at first, followed by a wine taste. Among wheat beers, it is on average natural, highly nutritious, it warms and makes good blood. It can work also against stones (meant kidney stones – author's note)".

Heinrich Knaust's description of the character of Goslar beer indicated no difference from other white beers. Characterization of its taste was the same as for the beer from Hamburg, although it must be said that younger

literature admitted – according to the medieval sources – that Goslar beer was also exported to Hamburg and was reportedly very popular there (most recently Allen, 2018, where we can find also an overview of older and historical literature). It is a question when the “Gose” of today's style was developed and we can also speculate that it was after the production was moved to Leipzig, or even during the 19th century. At that time, a yeast strain was reportedly sequenced and a specific beer style with controlled top-fermentation and other technological processes was slowly developed from the originally, probably spontaneously, fermented beer.

Apart from Gose, modern age literature knows several types of Goslar beer, such as **Breyhan**, **Vier Pfannerbier**, **Hopf Krug**, **Allerley Krug** and **Besten Krug**, **Starck Bier**, **4mgr. Bier** and **common Bier**, some of which were intended for mixing according to the city's regulations of 1717. Section designated as §4 of this regulation stated „and if someone made beer too strong, not with water, but with beer Konvent or common beer Goslar, it will be blended so that it is milder, preserves a good taste and supports appetite. These light beers are called barrel Hippie and common Hippie“ (Schranka, 1892d; Kohl, 1735). The early mention of bottling Goslar beer, stated in §5 of this regulation, is very interesting as well.

Numerous other types of white beers are also mentioned in the literature (cf. the list of mentioned literature), which were mostly classified as derivatives of the above-mentioned types. These were mainly **Lüneburg**, **Braunschweig**, **Magdeburg**, **Zittau** beers in today's Germany then **Kolobrzeg** in today's Poland, **Prague**, **Kadaň**, **Domažlice** and finally the excellent **Hradec Králové** beer mentioned in the Czech territory. Hájek described the beer from Hradec Králové as follows: „thin people get fat after this beer and it is so good that no one has yet managed to imitate it“.

In addition to white and brown/red beers, there is a third category of beers, mentioned in publications of the early modern period, namely **spicy or herbal beers**. In the modern period as well as in the contemporary literature, this type of beers was usually merged with the category of white beers, or it was often completely neglected. Nevertheless, the 16th century authors assign great importance to this type of beer, especially in the field of healing effects. Hájek mentioned a double way of spicing, i.e. cold and hot. According to him, wormwood, dianthus, mint, laurel or pimpernel were the herbs for cold beer seasoning, while ginger, cinnamon, Illyrian iris, calamus, laurel, nutmeg and dianthus were suitable for hot spicing. Early Modern England was abundant spicy beers such as Aleberry, Aloeale, Braket. **Anisbier**, i.e. beer with the addition of anise seed, was especially

popular on the continent, among other things for its colic and flatulence effects, as well as for treating digestion. **Beifussbier** – name for wormwood beer, was considered the noblest beer for ladies who suffered from infertility or needed to strengthen the stomach, but also to treat headaches and help remove stones from the body. Further, **Birkenbier** – birch beer that was suitable for removal stones; **Eichenblätterbier** – oak beer – was believed to work against cholera, dysentery, inflammation of the urinary tract and excessive menstrual bleeding in ladies; **Ingwerbier** – ginger beer was recommended as an anti-flatulence and diarrhea agent. **Eierbier**, i.e. egg beer, represented a special sub-type which was one of the drinks prepared from beer, specifically it was warm beer with an egg. However, eggs were sometimes added in cold beer as well to treat a sore throat (hoarseness, scratchy throat). Egg beers can also include the so-called **Flips**.

At the end of this chapter and to move from white to the category of brown beers we should mention **Konvent**. Originally it was a lighter type of monastery beer (hence the name Konvent), but later its name also served as a synonym for „nachbier“ or semi-beer. It was also named as Schemper, Klosterbier, however a number of general and regional designations such as **Halbander**, **Halbbier**, **Dünnbier**; **Hansel**, **Hengst**, **Papenkonvent**, **Fratresbier**; **Hausbier**, **Griessbier**; **Hinterbier**, **Afterbier**, **Mittelbier**, **Frischbier** can be found. It was basically a very light beer for daily drinking.

4.2 Brown/red beers

The category of brown/red beers was associated exclusively with barley malt. These were hopped beers and generally had a longer shelf life. From today's point of view, they would be classified as lagers, although brown beers can comprise products of both fermentation methods, i.e. top and bottom. Historically, no differences were made between the two methods of fermentation until the 18th century, therefore it has been difficult to assign the type of yeast used in particular beers. The location of the brown beer production, mentioned in the historical works, is shown in [Figure 2](#).

It was **Gdańsk beer**, which Knaust called the king of brown beers. Its alternative name was **Preusing**, and the Dutch called it **Joopenbier** (from Joop that means juice or syrup) because it was as thick as syrup. Its strength led to the saying that „*Gdańsk beer is stronger than four oxen*“. It was reportedly the best beer in Prussia and one of the best barley beers ever. Since 1379 it has also been called ship beer, in Latin *cerevisia navigalis* (Knaust, 1574).

Beers from Pomerania or Hanseatic cities were well known as well. As an example we can list **Barthian beer**, once a famous brown Pomeranian beer, which was exported over long distances. **Bergt Bergius (1792)** mentioned the export of this beer to Sweden and Denmark in his work *Über der Leckereyen*. Furthermore, there was **Bremen beer**, which was supposedly red in colour and was often exported especially to Holland. This name had a good reputation as early as in 1272.

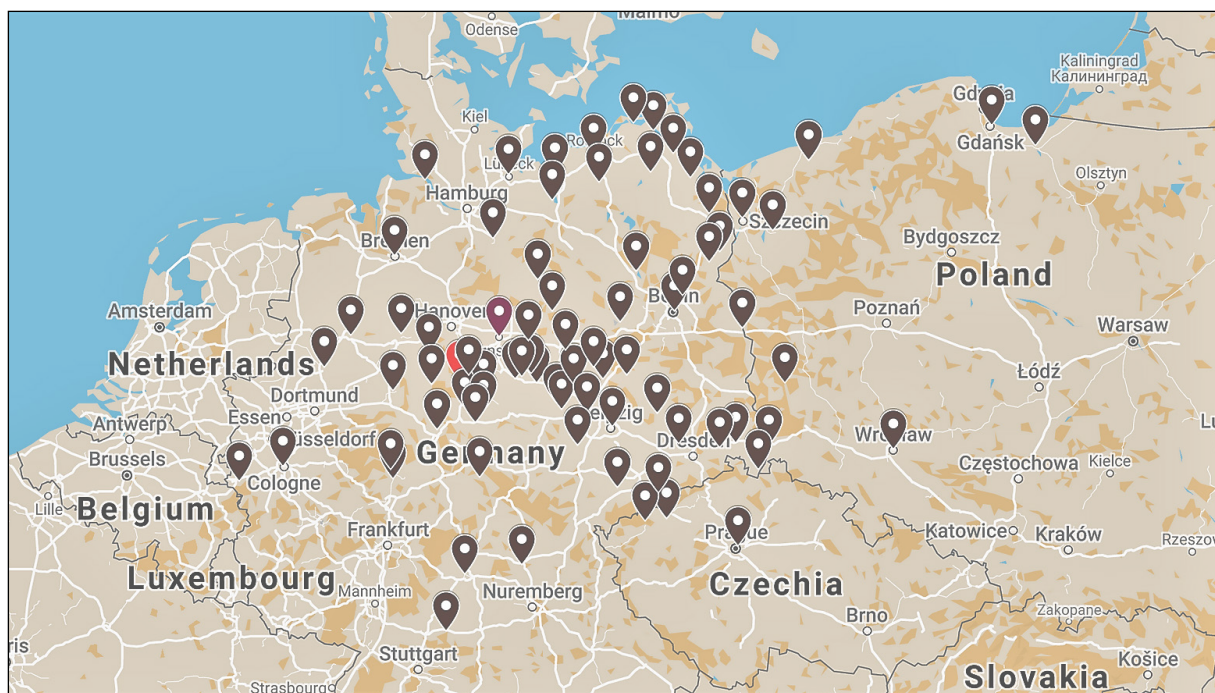


Figure 2 Brown beers featured in historical works (based on Google maps)
Brown – named beers, violet – Braunschweiger Mumme, red – Einbeck's beer

As far as Bohemia is concerned, the Lower Silesian beer was a phenomenon, especially *Šwidnica*, but also Kłodzko beer. There was a free trade between *Šwidnica*, Wrocław and Prague confirmed by a monarchical decree from the 14th century. This meant a strong export of local beer through Prague to Bohemia and the southern parts of Germany, and through Wrocław further east, to Poland and Russia. This beer was normally transported from March to May and then before Christmas in November and December. Generally, it could be said, that beer was not transported at all in the warmest summer months, and only exceptionally in frosty winter months, probably depending on the current climate. Beer stored in cellars had a long shelf life. During the first half of the 16th century this beer disappeared from Bohemia and Moravia and was replaced by domestic beers, such as Jihlava, Prague, Rakovník or the aforementioned Kłodzko.

Einbeck beer was famous in both the Middle Ages and in the Modern Age. As *Knaust (1574)* stated: *„It takes preference over all summer light beers or hopped barley beers and its brand is exported very far by water as well as by land. Every third grain is wheat. In summer it is a very healthy and refreshing drink that does not warm one up like other beers. It is not as nutritious, so it does not make people go fat as much as other beers. This beer does not go into the head as fast as other strong beers, therefore it is often imported instead of other beers in the summer. This is a cold beer; it is good and pleasant in taste and removes stones. And as experience shows, this beer surpasses others in its bitterness. So, it is not just the hop, that causes the beer to warm you up, but also the barley, which is more abundant in other beers”*. *Krünitz (1784)* already spoke of this beer and its fame in the past: *„It was so highly valued in the past that it was exported to Rome, Amsterdam and Hamburg, and from there to Jerusalem. It is a delicate and drinkable beer, at the beginning it feels bitter, but then sharply. It affects the urine and bile, it is a suitable drink when one has fevers”*. From the above-mentioned, it can be concluded that the original Einbeck beer contained one third of wheat malt, so it should have been classified rather as wheat beers. During the Modern Age, the recipe possibly changed and only barley malt started to be used. This may be the reason why the fame of this drink gradually declined as well. Considerations that all Bock-type beers have their origin in this beer have dated back to the 19th century and it is a question whether this is only a traditionally accepted mistake or not.

As mentioned above, Einbeck beer was weaker compared to the typically strong **Bocks** or **Doppelbocks**. Moreover, the Bock label, which was used for a particular beer style, probably does not appear in any materials before 1800. References to Bock beer have multiplied since

the late 1820s, and in all cases, it was already a specific Bavarian beer. *Josef Maria Mayer (1868)* was the first, who provided information on the etymological origin of the name Bock, stating that Bock was allegedly first brewed in Munich some time after 1771. It is necessary to consider the fact that even if the etymological interpretation of the name is correct, a direct continuity of both beers cannot be proved. Therefore we can assume that a completely new beer style was probably developed, which later (but much later, only during the 19th century) was adopted in Europe.

A beer known as **Salvator**, or commonly referred to as Gott Vater Bier, comes from Munich too. Originally it was a monastery beer of the Paulanians of Munich from the suburb of Au. The recipe was later bought together with the monastery by Zacherl brewery, which continued in the tradition and production. This beer and its tap were related to the exact part of the year – it was only tapped in the spring, at the beginning of April. The 19th century literature describes it as a highly alcoholic beer (over 5.5% alcohol), bottom-fermented, of dark colour and distinctive hop aroma (*Zimmermann, 1860; Mayer, 1868*). Today, the beer is referred to as Doppelbock (the label states: *Paulaner Salvator seit 1634, Doppelbock*), but its history is older than Bock brewing in Munich.

Red strong beer was represented in medieval Bohemia by **Samec from Žatec**. It was allegedly a dark, strong, aromatic and bitter beer. However, given the meaning of the word *samec*, which means Männchen in German and male in English, it is clear that this beer was not probably so exceptional in its name or character. Samec is usually associated with Bock type beers. Based on the facts presented here, it is evident that this connection is likely to be wrong. In general, it can be assumed that these beers could have been brewed in the Märzenbier style, regionally referred to as Schöps in Wrocław (Schöps means male,), Stier in Šwidnica (Stier ~ bull), Bieffel in Frankfurt (Bieffel ~ buffalo), Maulesel in Jena (Maulesel ~ mule), Hund in Braunschweig (Hund ~ dog) or Kukuk in Wittenberg (Kukuk ~ cuckoo).

Märzenbier (Březňák/Marchbeer), is generally considered to be a traditional beer produced since the Middle Ages. In the oldest literature, such beer is often called after the towns where it was brewed. For instance in our country one can meet the name **Opava beer** (*Hájek, 1585*), derived from the town Opava, where about 160 batches of Märzen per year used to be brewed in the second half of the 16th century (*d'Elvert, 1870*). The older literature denotes Märzenbier beers as lager (Lagerbier) and they were sometimes called **Kufenbier** according to barrels in which they were transported (*Wäser, 1793*).

Krünitz's description of **Geithain** beer is interesting too. According to him, it was purely barley beer, brewed in March and hopped exclusively with Czech hops. To comment on brewing this beer, Krünitz wrote the following: *„... as soon as the beer is brewed, they (people of Geithain – author's note) bring it from the brewery into their houses and pour it into cooling tuns 3 spans high (old length unit derived from dimensions of human hand, one span is approx. equal 20 cm – author's note). Here, it remains for 15, 20 or even 24 hours, depending on the air temperature, then the temperature is tested with a finger. Following this the beer is poured into two large barrels (vats), which are wider at the bottom than at the top. Four quarters of beer (further old volume unit, one quarter corresponds to 5.8 l – author's note) are poured into each and one third of the vat is left empty for fermentation. The beer is left to stand here for a few days until the main fermentation from free particles starts (it is also called kräusen) and is half an elbow high. Such fermentation makes beer excellently drinkable and really strong. After 11 to 14 days, depending on the air it can be even longer, the fermentation decreases and turns brownish to black. Then birch branches are used to beat the beer for 1–2 hours, in the same manner as egg whites are usually whipped. Afterwards, the beer is filled into quarters or barrels, which are transported well bunged to the rock cellars. It can lie here until the tapping, as it is still drinkable and there is no need to do anything about it, only to wash the barrels and keep them clean. Eight days before the tap, the barrels must be opened and completely filled with clean well water. This procedure must be repeated on the 4th, 6th and 8th day to eliminate the ferment through the bung hole completely. One must not omit that, for example, a whole can of water, or maybe even more will be poured into a quarter, but it is still an excellent drink. However, if the beer in barrel is not draught out within 6 or 8 days, a little wheat flour is stirred in well water and this mixture is poured in the barrel and this is soon fermented” (Krünitz, 1784).*

Towns regulated brewing of Märzen beer. The beer was reportedly brewed for three mashes according to the decree of the city of Celle from 1688. Compared to Broihan (cf. above) there were 10 measures of barley per 20 barrels (Contunatio, 1719). The number of breweries that could brew this beer was limited. For example in the aforementioned Celle only 3–4 breweries a year could brew this beer, in Nuremberg it was as many as 35. The Statutes from 1350 issued in the town of Ilmer stated that the beer could be brewed only from the feast of St. Michael (September 29) to St. Walburga (May 1) and outside this time brewing was forbidden under penalty. This regulation corresponded to the low temperatures occurring during this period, which were probably needed for the fermentation of this particular type of beer. From the long-term statis-

tical data, it is known that the average monthly temperature, for example, in the second half of the 20th century¹ was below 8 °C until April and then it rose sharply to 12 °C in May. The temperature fell again below 8 °C in October. This temperature trend is in line with most regulations for brewing of historical „lager“ beers.

The famous brown beer was **Brunswick Mumme** (Knaust, 1574). The name allegedly came from the name of the first brewer. This beer was brewed as single or double Mumme. A single Mumme was said to be a good summer drink that cooled well. However, the double Mumme was said to be even better. It was brewed by five licensed cities (pentapolis), including Nuremberg and Erfurt, which amongst others brewed two other types of beer (Knaust, 1574).

Krünitz (1784) focused on this beer when he wrote: *„... the best is the so-called Schiff-Mumme. It can be transported over long distances without the risk of losing its quality. Well-dried barley malt from Braunschweig is put in the tun and water is added, the mixture is boiled for 5/4 hours. Then the mixture is placed in a vat, where it is left to lie. Later it is boiled again in a tun with quality regional hop for another three hours, but this time without malt. However, Stadt-Mumme is the most popular beer intended for general public. Basically, only a quarter of the hops applied in case of Schiff-Mumme is used on Stadt-Mumme, but if the beer should be stored for a long time, then 2/3 of the hops of Schiff-Mumme is used. The production of Aernde beer, which is made in the same way, requires more than 2/3 of the hops and after fermentation it is placed into well bung barrels”.*

5 Conclusion

The presented text briefly evaluates some findings about historical beer styles produced in modern Europe. Its aim is not to show ultimate knowledge, but rather to display some generally accepted inaccuracies. Taking into account the used literature, these are mainly beer styles with a direct connection to the territory of today's Germany, Poland and the Czech lands. Interestingly, except for general mentions, the territory of Bavaria is excluded from the brewing literature of the 16th century. There are sources that can clarify historical methods of beer brewing. Some conclusions may serve as the basis for future discussion.

Nevertheless, the authors believe that it is essentially impossible to reveal a continuous line of historical development of beer from the early modern period to the present. In addition, the connections between individual beer styles, especially in Germany, are often based on shaky foundations.

¹ For example in Czech republic: <https://faktaoklimatu.cz/infografiky/teplota-cr-mesice>

In general, it can be stated that quite frequently the name of a popular beer has apparently been retained, but the recipe changed over the Modern Age. This was especially the case when the beer production was relocated or the beer style greatly expanded across the region. Stabilization of recipes can be observed only together with the progress of chemical knowledge as well as with exact publications of recipes from the 19th century. However, at that time, these were completely different beers than those mentioned in the 16th century literature. The good reputation and tradition of the brand definitely exceeded the continuity of recipes.

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