

Supplementary Materials

Table S1. Characteristics of the average values of selected indicators showing the climatic conditions of the studied cities in the vegetation season of 2019¹.

Locality	Warsaw		Szczecin		Gorzów Wlkp.	
	Months	Climatic factors		Temperature [med. °C]	Precipitation [mm]	Temperature [med. °C]
		Temperature [med. °C]	Precipitation [mm]			
April	7.9	33	7.9	38	9.6	38
May	13.3	53	12.9	50	14.3	52
June	16.8	67	16.5	59	17.7	60
July	18.2	71	18.0	65	19.7	70
August	17.4	58	17.6	56	18.9	59

¹ [https://pl.climate-data.org/europa/polska/..](https://pl.climate-data.org/europa/polska/)

Table S2. A set of data on the concentration of MMs in honeys from EU countries¹.

Publications about MMs concentration in honeys from old countries of the EU

Austria (Bibi et al., 2008), Finland (Zakhimzadeh and Lodenius 2000), France (Devillers et al., 2002; Millour et al., 2012; Saunier et al., 2013; Losfeld et al., 2014; Samarghandian et al., 2017), Greece (Ioannidou et al., 2005; Pohl, 2009; Krakowska et al., 2015; Fakhri et al., 2019), Spain (Rodriguez-Oter et al., 1995; Latorre et al., 1999; Terrah et al., 2004; Fernández-Torres et al., 2005; Terrah et al., 2005; López-García et al., 2007; Pisani et al., 2008; López-García et al., 2009; Alda-Garcilope et al., 2012; Krakowska et al., 2015; Bilandžić et al., 2017), Italy (Leita et al., 1996; Conti, 2000; Buldini et al., 2001; Pisani et al., 2008; Krakowska et al., 2015), Portugal (Silva et al., 2009; Bilandžić et al., 2017) Ireland (Downey et al., 2005; Pisani et al. 2008; Pohl, 2009), Germany (Barišić et al., 2002; Bibi et al., 2008; Siede et al., 2013; Fakhri et al., 2019).

Publications about MMs concentration in honeys from new countries of the EU

Bulgaria (Jivan et al., 2008; Yurukova et al., 2008; Zhelyazkova et al., 2010; Solayman et al., 2016; Fakhri et al., 2019), Croatia (Barišić et al., 2002; Bilandžić et al., 2014; Gašić' et al., 2015; Bilandžić et al., 2017; Samarghandian et al., 2017), Czech Republic (Lachman et al., 2007; Pohl, 2009; Batelkova et al.; 2012, Solayman et al., 2016), Lithuania (Matusevicius et al., 2010; Fakhri et al., 2019), Latvia (Vincevica-Gaile et al., 2012), Malta (Borg and Attard, 2020), Poland (Radwan, 1991; Jabłoński et al., 1995; Przybyłowski and Wilczyńska 2001; Piekut et al., 2004; Madejczyk and Baralkiewicz 2008; Chudzinska and Baralkiewicz 2010; Formicki et al., 2013; Staniak, 2014; Krakowska et al., 2015; Sitarz-Palczak et al., 2015), Romania (Matei et al., 2004; Pohl, 2009; Tudoreanu et al., 2012; Oroián et al., 2016), Slovakia (Kacaniová et al., 2009), Slovenia (Barišić et al., 2002; Golob et al., 2005; Pohl, 2009), Hungary (Fodor and Molnar 1993; Pisani et al., 2008; Czipa et al., 2015; Samarghandian et al., 2017; Conti et al., 2018; Bodó et al., 2020).

1. ¹: Alda-Garcilope, C., Gallego-Picó, A., Bravo-Yagüe, J.C., Garcinuño-Martínez, R.M., Fernández-Hernando, P., 2012. Characterization of spanish honeys with protected designation of origin „Miel de Granada” according to their mineral content. Food Chemistry, 135, 1785–1788.
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Table S3. Honey MMs concentrations in the twenty-seven sites.

Sites	MMs (mg/kg WW)											
	Mn	Zn	Cu	Fe	Sr	Mg	Ca	K	Na	B	P	S
1	1.059	5.06	0.636	3.04	0.158	21.7	96.4	1626	59.37	4.35	58.9	58.9
2	0.292	2.14	0.330	2.40	0.179	14.8	59.2	1760	23.67	2.38	42.1	27.1
3	0.752	2.40	0.410	3.83	0.150	18.1	63.2	1610	18.36	8.94	55.9	66.3
4	0.528	2.55	0.455	4.26	0.240	32.3	86.5	1543	20.51	3.86	116.4	50.2
5	0.466	5.05	0.217	3.33	0.101	14.5	97.2	326	14.59	14.71	51.7	31.4
6	0.426	3.65	0.310	3.31	0.077	16.3	68.3	391	15.78	10.88	69.5	35.4
7	3.764	12.80	0.582	5.32	0.333	71.7	157.9	2563	55.94	10.25	321.6	110.4
8	0.416	2.53	0.161	3.37	0.285	20.7	140.2	1627	17.96	3.14	64.5	32.1
9	1.835	2.66	0.826	9.73	0.477	109.3	200.2	3490	26.41	9.91	405.1	130.8
10	0.326	2.85	0.257	3.38	0.187	30.0	94.7	1564	11.32	4.17	139.7	37.6
11	3.283	2.87	0.443	2.03	0.057	23.2	49.7	843	21.84	5.01	121.6	50.1
12	1.654	2.72	0.420	2.42	0.139	33.9	89.8	1585	21.26	4.71	156.3	47.7
13	0.771	3.02	0.227	1.14	0.024	20.4	28.0	625	11.98	3.42	88.5	26.0
14	0.670	3.13	0.080	1.43	0.048	16.7	73.1	413	12.98	10.83	52.7	27.6
15	0.105	3.00	0.106	1.01	0.029	7.0	31.6	430	28.40	4.13	64.1	35.0
16	0.120	1.97	0.047	1.78	0.027	6.8	29.0	402	2.98	4.11	57.0	17.8
17	0.130	3.54	0.097	1.52	0.101	14.2	51.0	1844	8.81	4.38	66.4	27.1
18	0.166	5.92	0.114	1.36	0.160	13.8	75.3	1602	10.78	3.65	72.2	26.9
19	0.222	5.44	0.165	1.75	0.150	20.0	88.1	1723	8.39	3.21	83.0	30.6
20	0.207	3.14	0.141	1.23	0.124	14.7	57.8	1735	8.72	2.92	72.8	26.6
21	0.223	3.76	0.159	1.40	0.128	16.9	76.9	1274	10.64	3.21	82.9	27.9
22	0.294	3.13	0.238	1.21	0.050	11.5	50.5	706	6.94	3.23	71.6	32.1
23	0.226	3.39	0.176	1.16	0.047	10.0	44.2	733	4.28	4.76	87.0	30.0
24	0.672	4.70	0.497	2.51	0.083	20.9	72.6	1501	7.72	6.30	106.2	56.7
25	0.384	3.70	0.263	1.63	0.072	16.7	55.2	783	4.96	5.59	114.6	38.5
26	0.466	3.34	0.319	1.74	0.070	19.8	64.4	1009	6.11	6.79	122.8	44.9
27	0.363	4.22	0.067	2.39	0.078	12.6	77.5	166	2.99	10.40	65.8	23.6

Table S4. Average annual values of dusts and their concentration of metalloid and HMs in three selected EU countries (Vienna¹, Brno^{2,3}, Göttingen⁴) with a similar number of inhabitants as in the analyzed cities in Poland.

Cities	Dusts			Metalloid and HMs in dusts		
	PM10 mg/dm ³	PM2.5 mg/dm ³	As(PM10)	Cd(PM10)	Ni(PM10)	Pb(PM10)
				µg/dm ³	µg/dm ³	µg/dm ³
Vienna	20.0	14.0	0.3	0.3	0.6	2.0
Brno	24.4	16.7	0.7*; 0.5	0.1; 0.2	0.6; 1.4	4.4, 5.1
Göttingen	19.0	11.0	0.52	0.10	1.55	3.4

*: the number of published results is related to the different frequency of measurements in air monitoring for individual cities.

¹: IG-L Annual Report Vienna, 2019. Annual report 2019, Air quality measurements by the environmental protection department of the city of Vienna in accordance with the immission control Act-Air MA 22 – 376947/2020 July 1, 2020, Vienna, 74. <https://www.wien.gv.at/umwelt/luft/pdf/luftguete-2019.pdf> (In German).

^{2, 3}: Škárová, H., Vlasáková, L., Sedláková, K., 2019. Air quality in the Czech Republic in 2019. Preliminary assessment, Part 1. Evaluation of concentrations of PM10, PM2.5, O₃, NO₂, SO₂ and CO. Czech Hydrometeorological Institute (ČHMÚ), Prague-Komorany, (In Czech); Brzezina, J., 2018. Measurement of air quality during the Brno fireworks show Ignis Brunensis 2018, Part 3. Czech Hydrometeorological Institute. <https://chmibrno.org/blog/2018/11/06/mereni-kvality-ovzdusi-behem-brnenske-prehlidky-ohnostroju-ignis-brunensis-2018-3-dil/> (In Czech).

⁴: AQM, 2019. Air Quality Monitoring (AQM) in Lower Saxony, Annual Report 2019. State Trade Inspectorate Hildesheim, Central Support Office for Air Quality Control, Noise, Hazardous Substances and Incident Prevention - ZUS LLGS, 88. file:///C:/Users/wksir/Downloads/Jahresbericht-2019.pdf. (In German)

Table S5. Firework emission¹ trace based on the Pb/element ratio in the tested honeys from Gorzów Wlkp. and Szczecin.

MMs	Cities			
	Gorzów Wlkp.		Szczecin	
	Pb/element	1 site [mg/kg WW]	Pb/element	4 sites [mg/kg WW]
Ca	850	200.2	1225	76.3
Mn	8	1.835	11	0.658
K	14813	3490	1225	1635
Zn	11	2.659	49	3.040
Cu	4	0.826	7	0.458
Fe	41	9.727	54	3.382
Na	112	26.41	489	30.48
Pb	1	0.236	1	0.062
Cr	0.112	0.026	0	0.000
B	42	9.914	78	4.883
Sr	2	0.477	3	0.182
P	1719	405.1	1096	68.3
Mg	464	109.3	349	21.7
Ba	1.2	0.293	0.1	0.003
S	555	130.8	812	50.6

¹: Pongpiachan, S.; Iijima, A.; Cao, J. Hazard Quotients, Hazard Indexes, and Cancer Risks of Toxic Metals in PM10 during Firework Displays. *Atmosphere* **2018**, *9*, 144.

Table S6. The rank order of HMs in honeys from Poland and neighbors countries from UE (mg/kg WW).

Countries	HMs
Poland ^{MD}	Fe (9.70) > Mn (5.40) > Zn (5.01) > Cu (1.21)
Germany ^{MD}	Fe (6.30) > Zn (0.47) > Cu (0.16) > Mn (0.14)
Czech Republic ^{MD}	Mn (1.16) > Zn (0.40) > Cu (0.11) > Fe (0.02)
Lithuania ^{MD}	Zn (1.24) > Cu (0.21)
Slovakia ^{MD}	Cu (0.39)
UE ^{MD}	Fe (8.36) > Zn (3.60) > Mn (2.66) > Cu (0.96)
Poland ^{PS}	Zn (3.80) > Fe (2.58) > Mn (0.73) > Cu (0.29)

^{PS}: Present studies; ^{MD}: Metadate on the Table S2.

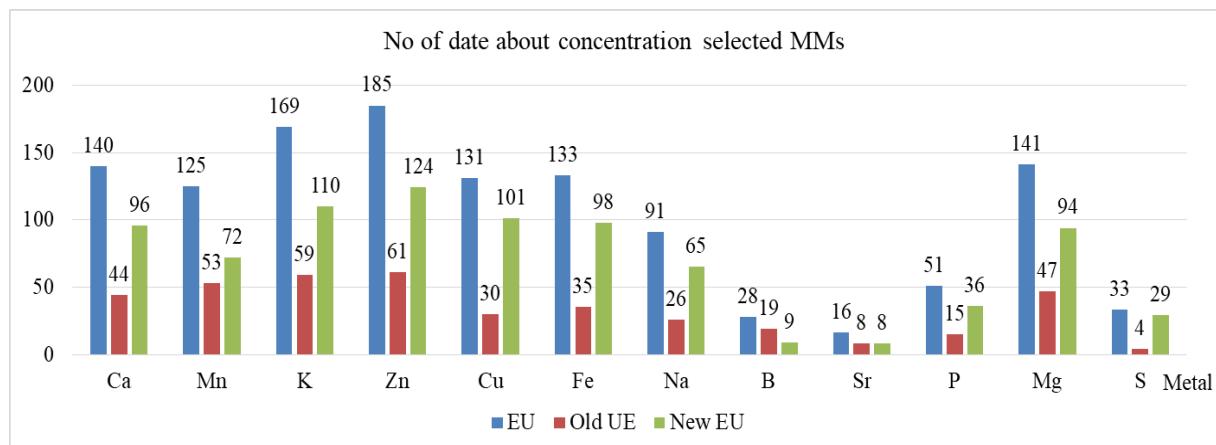
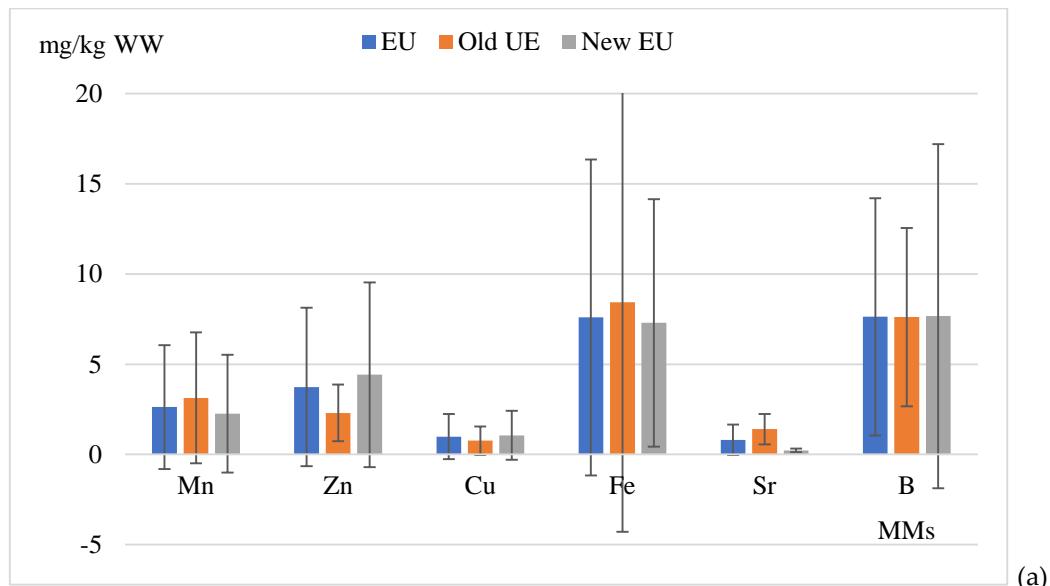


Figure S1. A set of data on the concentration of MMs in honeys coming from new and old EU countries.



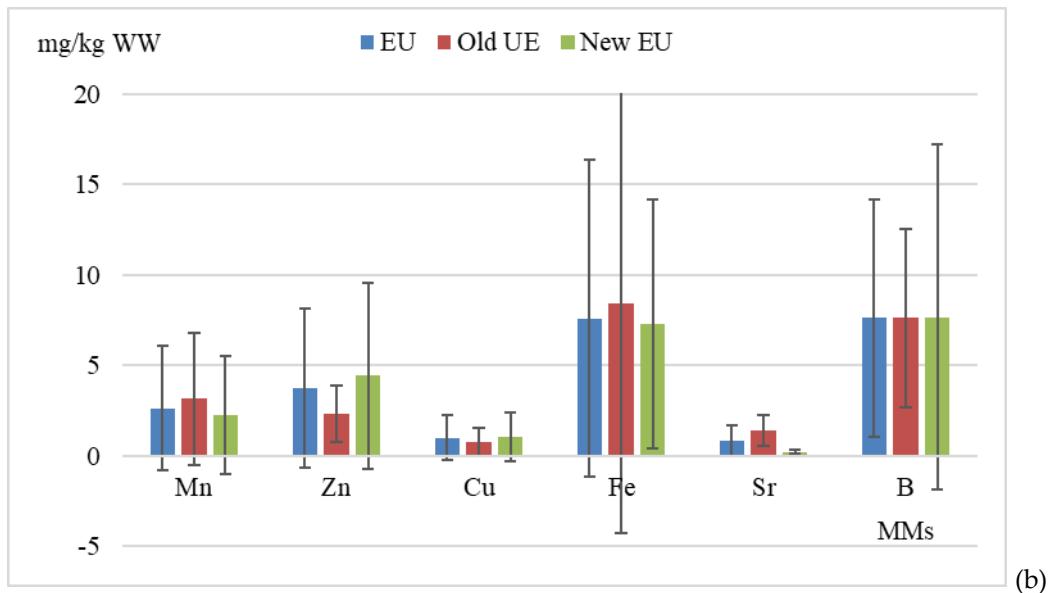


Figure S2. Mean concentration of MMs: macro- (a) and microelements (b) in honeys from new and old EU countries.