

Table S1. Information about soil sampling sites from Maramureş, Romania

| Sam- ple code | Num- ber of sam- ples | Har- vest period | Soil details | Sampling depth (cm) | Geograph- ical origin | Distance from the source of pollution (~) km | Area/ Coun- try | Year of har- vest | Environ- ment | Anthropogenic influence |
|--|--------------------------------|------------------------|--|---------------------------|-----------------------------|--|-------------------------------|-------------------------|------------------|---|
| <i>Soil samples exposed to anthropogenic sources of heavy metals pollution</i> | | | | | | | | | | |
| S1-2019 | 3 | June July | The col- lected sam- ple corre- sponds to the hive where chestnut honey was obtained | 0 – 10 cm | Tăuții de Sus | 3.5 km to the set- tling ponds <i>Aurul</i> | Maramureş Country/ Romania | 2019 | Semi-rural | Near (~ 3.5 km distance) to the set- tling pond mining (decant pond) <i>Aurul</i> ¹ from Tăuții de Sus |
| S1-2020 | 2 | | | | | 4.0 km to the set- tling ponds <i>Aurul</i> | | 2020 | | Near (~ 4.0 km distance) to the set- tling pond mining (decant pond) <i>Aurul</i> ¹ from Tăuții de Sus |
| S1-2021 | 2 | | | | | 3.8 km to the set- tling ponds <i>Aurul</i> | | 2021 | | Near (~ 3.8 km distance) to the set- tling pond mining (decant pond) <i>Aurul</i> ¹ from Tăuții de Sus |
| S2-2018 | 1 | June July | The col- lected sam- ple corre- sponds to the hive where chestnut honey was obtained | 0 – 10 cm | Tăuții Măgherauş | 9.0 km to the Nistru mine and 6.0 km to the Băiţa mine | Maramureş Country/ Romania | 2018 | Rural | Near (~ 9.0 km distance) to the Nistru mine and (~ 6.0 km distance) to Băiţa mine |
| S2-2019 | 1 | | | | | 11.0 km to the Nistru mine and 8.0 km to | | 2019 | Rural | Near (~ 11.0 km distance) to the Nistru mine and (~ 8.0 km distance) to Băiţa mine |

| | | | | | | | | | | | | | |
|---------|---|-----------|--|-----------|------------------|---|------------------------------|------------|--|------|------------|---|--|
| | | | | | | | | | | | | | |
| | | | | | | the Băița mine | | | | | | | |
| | | | | | | 11.2 km to the Nistru mine and 8.3 km to the Băița mine | | | | | | | |
| S2-2021 | 2 | | | | | | 2021 | Rural | Near (~ 11.2 km distance) to the Nistru mine and (~ 8.3 km distance) to Băița mine | | | | |
| S3-2019 | 2 | | | | | 8.0 km to the settling ponds <i>Aurul</i> | Maramureș Country/Romania | 2019 | | | | | |
| S3-2020 | 2 | | | | | | | | | | | | |
| S3-2021 | 3 | June July | The collected sample corresponds to the hive where chestnut honey was obtained | 0 – 10 cm | Baia Mare | | | | | 2021 | Semi-rural | Near (~ 8.0 km distance) to the settling pond mining (decant pond) <i>Aurul</i> ¹ from Tăuții de Sus | |
| | | | | | | | | | | | | | |
| S4-2021 | 1 | June July | The collected sample corresponds to the hive where polyfloral honey was obtained | 0 – 10 cm | Tăuții Măgherauș | 6.5 km to the settling ponds <i>Aurul</i> | 2021 | Semi-rural | Near (~ 8.0 km distance) to the settling pond mining (decant pond) <i>Aurul</i> ¹ from Bozânta Mare | | | | |

| Table 1. Sampling locations and details of honey samples collected | | | | | | | | | | |
|--|-----------------|----------------|--|--------------------|--------------------|--|-------------------------------|------|-------------|---|
| Sample ID | Number of hives | Month | Location | Distance from hive | Distance from mine | Distance from settlement | Country | Year | Environment | Notes |
| S ₅₋₂₀₁₉ | 2 | July August | The collected sample corresponds to the hive where polyfloral honey was obtained | 0 – 10 cm | Baia Sprie | 8.0 km to the Herja mine | Maramureş Country/ Romania | 2019 | Rural | Near (~ 8.0 km distance) to the Herja mine |
| S ₆₋₂₀₂₀ | 1 | July August | The collected sample corresponds to the hive where acacia honey was obtained | 0 – 10 cm | Baia Mare | 8.0 km to the settling ponds <i>Aurul</i> | Maramureş Country/ Romania | 2020 | Semi-rural | Near (~ 8.0 km distance) to the settling pond mining (decant pond) <i>Aurul</i> ¹ from Tăuţii de Sus |
| S ₆₋₂₀₂₁ | 1 | July August | | | | | | 2021 | Semi-rural | |
| S ₇₋₂₀₁₇ | 1 | July August | The collected sample corresponds to the hive where polyfloral honey was obtained | 0 – 10 cm | Baia Borşa | 5.1 km to the Băile Borşa mining flotation | Maramureş Country/ Romania | 2017 | Rural | Near (~ 5.1 km distance) to the Băile Borşa mining flotation |
| S ₇₋₂₀₁₉ | 1 | July August | | | | 7.3 km to the Băile Borşa mining flotation | | 2019 | Rural | Near (~ 7.3 km distance) to the Băile Borşa mining flotation |
| S ₇₋₂₀₂₀ | 1 | July August | The collected sample corresponds to the hive where polyfloral | 0 – 10 cm | Baia Borşa | 9.0 km to the Băile Borşa mining flotation | | 2020 | Rural | Near (~ 9.0 km distance) to the Băile Borşa mining flotation |

| Background soil samples | | | | | | | | | | |
|-------------------------|---|-------------|--|-----------|-------------------|--|-------------------------------|------|------------|--|
| | | | honey was obtained | | | | | | | |
| S7-2021 | 1 | July August | The collected sample corresponds to the hive where polyfloral honey was obtained | 0 – 10 cm | Baia Borşa | 8.0 km to the Băile Borşa mining flotation | Maramureş Country/ Romania | 2021 | Rural | Near (~ 8.0 km distance) to the Băile Borşa mining flotation |
| S8-2021 | 2 | July August | The collected sample corresponds to the hive where polyfloral honey was obtained | 0 – 10 cm | Satulung | 5.0 km to the European Road (E 58) | Maramureş Country/ Romania | 2021 | Semi-rural | Near (~ 5.0 km distance) to the European Road (E 58) |
| S9-2020 | 1 | July August | The collected sample corresponds to the hive where polyfloral honey was obtained | 0 – 10 cm | Săcălăşeni | 8.0 km to the European Road (E 58) | Maramureş Country/ Romania | 2020 | Semi-rural | Near (~ 8.0 km distance) to the European Road (E 58) |
| Background soil samples | | | | | | | | | | |
| S10-2020 | 2 | August | The collected sample corresponds to the hive | 0 – 10 cm | Groşii Țibleşului | - | | 2020 | Rural | - |

| | | | where polyfloral honey was obtained | | | | | | | |
|----------|---|--------|--|-----------|--------------|---|-------------------------------|------|------------|---|
| S11-2018 | 2 | August | The collected sample corresponds to the hive where polyfloral honey was obtained | 0 – 10 cm | Vişeu de Sus | - | Maramureş Country/ Romania | 2018 | Rural | - |
| S11-2019 | 1 | August | The collected sample corresponds to the hive where polyfloral honey was obtained | 0 – 10 cm | Vişeu de Sus | - | Maramureş Country/ Romania | 2019 | Semi-rural | - |
| S11-2020 | 2 | August | The collected sample corresponds to the hive where polyfloral honey was obtained | 0 – 10 cm | Vişeu de Sus | - | Maramureş Country/ Romania | 2020 | Urban | - |

| | | | | | | | | | | |
|---|---|--------|--|-----------|--------------|---|-------------------------------|------|----------------|---|
| S11-2021 | 1 | August | The collected sample corresponds to the hive where polyfloral honey was obtained | 0 – 10 cm | Vișeu de Sus | - | Maramureș Country/ Romania | 2021 | Non-urban area | - |
| S = soil sample (it does not refer to sites); the collection of soil samples from 9 sites was carried out strictly according to the type of honey and to the year of production, e.g., from Tăuții de Sus site, three main soil samples were collected (subsamples n = seven), these correspond to the chestnut honey obtaining in the 2019-2021 years (e.g., for the chestnut honey produced in 2019 were collected three soil subsamples); N° of samples = number of soil samples harvested form each site, depending of the type of honey and the year in which it was obtained. | | | | | | | | | | |

Table S2. Information about honey sampling sites from Maramureș, Romania

| Sample code | Number of samples | Harvest period | Honey details | Denomination | Geographical origin | Distance from the source of pollution (~) km of the hives | Area/ Country | Year of harvest | Type of extraction | Environment | Anthropogenic influence | Bee species |
|---|-------------------|----------------|-------------------------|-------------------|---------------------|---|---------------------------|-----------------|--------------------|-------------|--|-----------------------|
| <i>Honey samples exposed to anthropogenic sources of heavy metals pollution</i> | | | | | | | | | | | | |
| H1-2019 | 2 | June July | Raw artisan honey | Chestnut honey | Tăuții de Sus | 3.5 km to the settling ponds <i>Aurul</i> | Maramureș Country/Romania | 2019 | Manual | Semi-rural | Near (~ 3.5 km distance) to the settling pond mining (decant pond) <i>Aurul</i> ¹ from Tăuții de Sus | <i>Apis mellifera</i> |
| H1-2020 | 1 | | | | | | | 2020 | | | | |
| H1-2021 | 3 | | | | | | | 2021 | | | | |
| H2-2018 | 1 | June July | Raw artisan honey | Chestnut honey | Tăuții Măgherauș | 9.0 km to the Nistru mine and | Maramureș Country/Romania | 2018 | Manual | Rural | Near (~ 9.0 km distance) to the | <i>Apis mellifera</i> |
| H2-2019 | 1 | | | | | | | 2019 | | | | |

| | | | | | | | | | | | |
|---------------------|---|----------------|-------------------------|---------------------|---------------------|--|------|------------|---|---|---|
| | | | | | | | | | | | |
| H ₂₋₂₀₂₁ | 1 | | | | | 6.0 km to the Băița mine | 2021 | | Nistru mine and (~6.0 km distance) to Băița mine | | |
| H ₃₋₂₀₁₉ | 2 | June July | Raw artisan honey | Chestnut honey | Baia Mare | 8.0 km to the settling ponds <i>Aurul</i> | 2019 | | Near (~ 8.0 km distance) to the settling pond mining (decant pond) | <i>Apis mellifera</i> | |
| H ₃₋₂₀₂₀ | 2 | | | | | | 2020 | Manual | Semi-rural | | <i>Aurul</i> ¹ from Tăuții de Sus |
| H ₄₋₂₀₂₁ | 3 | June July | Artisan honey | Polyfloral honey | Tăuții Măgherauș | 6.5 km to the settling ponds <i>Aurul</i> | 2021 | Mechanical | Semi-rural | Near (~ 6.5 km distance) to the settling pond mining (decant pond) <i>Aurul</i> ¹ from Bozânta Mare | <i>Apis mellifera</i> |
| H ₅₋₂₀₁₉ | 1 | July August | Artisan honey | Polyfloral honey | Baia Sprie | 8.0 km to the Herja mine | 2019 | Manual | Rural | Near (~ 8.0 km distance) to the Herja mine | <i>Apis mellifera</i> |
| H ₆₋₂₀₂₀ | 2 | July August | Artisan honey | Acacia | Baia Mare | 8.0 km to the settling ponds <i>Aurul</i> | 2020 | | | Near (~ 8.0 km distance) to the settling pond mining (decant pond) | <i>Apis mellifera</i> |
| H ₆₋₂₀₂₁ | 1 | | | | | | 2021 | Mechanical | Semi-rural | <i>Aurul</i> ¹ from Tăuții de Sus | |
| H ₇₋₂₀₁₇ | 1 | July August | Artisan honey | Polyfloral honey | Baia Borșa | 5.1 km to the Băile Borșa | 2017 | Manual | Rural | Near (~ 5.1 km distance) to the Băile Borșa | <i>Apis mellifera</i> |

| H7-2019 | 1 | | | | | | Mining Flatation | 2019 | | | | Mining Flatation |
|--------------------------|---|----------------|------------------|---------------------|----------------------|--|------------------------------|------|------------|------------|---|---------------------------|
| <hr/> | | | | | | | | | | | | |
| H7-2020 | 1 | | | | | | | 2020 | | | | |
| <hr/> | | | | | | | | | | | | |
| H7-2021 | 1 | | | | | | | 2021 | | | | |
| <hr/> | | | | | | | | | | | | |
| H8-2021 | 2 | July August | Artisan honey | Polyfloral honey | Satulung | 5.0 km to the European Road (E 58) | Maramureş Country/Romania | 2021 | Mechanical | Semi-rural | Near (~ 5.0 km distance) European Road (E 58), with intense traffic of vehicles | <i>Apis mellifera</i> |
| H9-2020 | 1 | July August | Artisan honey | Polyfloral honey | Săcălăşeni | 8.0 km to the European Road (E 58) | | 2020 | Mechanical | Semi-rural | Near (~ 8.0 km distance) European Road (E 58), with intense traffic of vehicles | <i>Apis mellifera</i> |
| Background honey samples | | | | | | | | | | | | |
| H10-2020 | 2 | August | Artisan honey | Polyfloral honey | Groşii Țibleşului | - | Maramureş Country/Romania | 2020 | Mechanical | Rural | - | <i>Apis mellifera</i> |
| H11-2018 | 3 | August | Artisan honey | Polyfloral honey | Vişeu de Sus | | | 2018 | Manual | Rural | - | <i>Apis mellifera</i> |

| | | | |
|----------------------|---|------------|-------------------|
| H ₁₁₋₂₀₁₉ | 1 | 2019 | Semi-rural |
| | | Mechanical | |
| H ₁₁₋₂₀₂₀ | 2 | 2020 | Urban |
| | | | |
| H ₁₁₋₂₀₂₁ | 3 | 2021 | Manual |
| | | | Non-urban area |

¹Settling Pond Mining *Aurul* resulting from the processing of blank ores in the Baia Sprie Mine Preparation Plant and which contains approximately 13.5 tons of mine tailings stored in the 1965-2003 period. At present Settling Pond Mining *Aurul* is the property of the National Company Remin SA Baia Mare (*Compania Națională Remin SA Baia Mare*) [47].

Table S3. The program of the microwave oven Milestone START D Microwave Digestion System

| Step | Target Temp (°C) | Pressure Max. (psi) | Temperature Ramp (min.) | Hold Time (min.) | Power (%) |
|-------|------------------|---------------------|-------------------------|------------------|-----------|
| Soil | | | | | |
| 1. | 220 | 800 | 10 | 20 | 100 |
| 2. | 220 | 800 | 10 | 15 | 60 |
| 3. | 35-40 | 800 | - | 45 min. cooling | - |
| Honey | | | | | |
| 1. | 200 | 800 | 10 | 20 | 100 |
| 2. | 200 | 800 | 10 | 15 | 55 |
| 3. | 35-40 | 800 | - | 45 min. cooling | - |

Table S4. Instrumental (a) and data acquisition (b) parameters of ICP-MS

| (a) Instrumental parameters | | (b) Data acquisition parameters for quantitative mode | |
|---|-------------|---|--|
| RF power/W | 1.4 kW | Measuring mode | Standard (Ar 5.0) Q Cell (Collision Cell) (He 6.0) |
| Argon (Ar) gas flow, Helium (He) gas flow | | Point per peak | 3 |
| Nebulizer | 1.0 L/min. | Scans/Replicate | 7 |
| Plasma gas low rate (Ar 5.0) | 18.0 L/min. | Replicate/Sample | 7 |
| Auxiliary gas flow rate (He 6.0) | 0.20 L/min. | | |
| Lens voltage | 37 V | Dwell time (ms) | 3 |
| Mirror lens right | 32 V | | |
| Mirror lens bottom | 31 V | | |
| Sample uptake rate | 90 s | Integration time | 1-5 ms |
| Temperature spray chamber | | | 2.10 °C |
| Background correction | | | 2 points/peak |
| Injector tube | | | quartz 2-mm id |
| Sample cone | | | Sample Cone 4450 |
| Skimmer cone | | Ni – Skimmer iCAP Q 0.5 mm insert version | |
| Nebulizer | | MicroMist Nebulizer 0.4 mL/min. | |

Table S5. Instrumental conditions for the determination of each element using the ICP-MS technique

| Element | Correlation coefficient | LoD (µg/L) | LoQ (µg/L) | BEC (µg/L) | Element | Correlation coefficient | LoD (µg/L) | LoQ (µg/L) | BEC (µg/L) |
|---------|-------------------------|------------|------------|------------|---------|-------------------------|------------|------------|------------|
| Cu | 0.9996 | 0.0414 | 1.545 | 1.258 | Zn | 0.9999 | 0.079 | 1.203 | 1.310 |
| Pb | 0.9996 | 0.231 | 0.231 | 0.649 | Cd | 0.9997 | 0.007 | 0.069 | 0.0031 |
| Ni | 0.9997 | 0.045 | 0.181 | 0.096 | Co | 0.9997 | 0.051 | 0.136 | 0.152 |
| As | 0.9999 | 0.006 | 0.743 | 0.018 | Cr | 0.9999 | 1.607 | 5.533 | 0.637 |
| Hg | 0.9999 | 0.043 | 0.1379 | 0.128 | | | | | |

LoD = Detection limit; LoQ = Quantification limit; BEC = Background equivalent concentration.

Table S6. Validation parameters of the analytical procedure for the determination of heavy metals (soil)

| Element | Certified reference material analysis | | Validation parameters | |
|-------------------------|---------------------------------------|--------------------------------------|-----------------------|-----------------|
| | The result declared by de manufacture | The results obtained in our research | Recovery (%) | Uncertainty (%) |
| Cu (mg/kg) ^a | 34.6 ± 0.7 | 32.45 ± 2.78 | 96.7 | 19 |
| Zn (mg/kg) ^a | 106 ± 3 | 100.1 ± 3.04 | 95.2 | 18 |
| Pb (mg/kg) ^b | 18.9 ± 0.5 | 19.16 ± 0.84 | 96.0 | 11 |
| Cd (mg/kg) ^a | 0.38 ± 0.01 | 0.37 ± 0.01 | 99.1 | 12 |
| Ni (mg/kg) ^a | 88 ± 5 | 85.8 ± 2.36 | 85.3 | 16 |
| Co (mg/kg) ^a | 13.4 ± 0.7 | 13.97 ± 0.75 | 95.5 | 21 |
| As (mg/kg) ^a | 17.7 ± 0.8 | 16.7 ± 0.94 | 92.6 | 22 |
| Cr (mg/kg) ^a | 103 ± 4 | 101.21 ± 2.36 | 98.8 | 18 |
| Hg (mg/kg) ^a | 1.4 ± 0.08 | 1.29 ± 0.02 | 98.7 | 13 |

1. ^a SRM – 2709a Standard Reference Material „San Joaquin Soil” Baseline Trace Element Concentration.

Table S7. Validation parameters of the analytical procedure for the determination of heavy metals (honey)

| Element | Certified reference material analysis | | Validation parameters | |
|-------------------------|---------------------------------------|--------------------------------------|-----------------------|-----------------|
| | The result declared by de manufacture | The results obtained in our research | Recovery (%) | Uncertainty (%) |
| Cu (mg/kg) ^a | 4.70 ± 0.14 | 4.42 ± 0.31 | 96.87 | 23 |
| Zn (mg/kg) ^a | 30.94 ± 0.55 | 31.84 ± 0.86 | 100.12 | 17 |
| Pb (mg/kg) ^b | 0.167 ± 0.015 | 0.164 ± 0.003 | 96.78 | 22 |
| Cd (mg/kg) ^a | 1.517 ± 0.027 | 1.687 ± 0.147 | 90.32 | 23 |
| Ni (mg/kg) ^a | 1.582 ± 0.041 | 1.784 ± 0.084 | 98.70 | 18 |
| Co (mg/kg) ^a | 0.5773 ± 0.071 | 0.6541 ± 0.321 | 107.18 | 24 |
| As (mg/kg) ^a | 0.1126 ± 0.024 | 0.1126 ± 0.062 | 117.89 | 16 |
| Cr (mg/kg) ^a | 1.988 ± 0.034 | 2.124 ± 0.070 | 92.69 | 21 |
| Hg (mg/kg) ^a | 0.0341 ± 0.0015 | 0.023 ± 0.017 | 95.84 | 10 |

2. ^a NIST – 1573a Tomato Leaves Standard Reference Materials; ^b NIST – 1575a Pine Needles (*Pinus taeda*) Standard Reference Materials

Table S8. The influence of factors on the concentration of heavy metals in the soil sites from Maramureș, Romania

| Element / Factor | Cu | Zn | Pb | Cd | Ni | Co | As | Cr | Hg |
|--|------|-----|-----|-----|-----|-----|-----|-----|----|
| | Sig. | | | | | | | | |
| Area | *** | *** | *** | *** | *** | *** | *** | *** | - |
| Year | ns | ns | ns | ns | ns | ns | ns | ns | - |
| Distance from the sources of pollution | *** | *** | *** | *** | *** | *** | *** | *** | - |
| Anthropogenic influence | *** | *** | *** | *** | *** | *** | *** | *** | - |
| Environment | * | ns | ns | ns | ns | ns | ns | ns | - |
| Soil details* | *** | *** | *** | *** | *** | *** | *** | *** | - |

*The collected soil sample corresponds to the type of analyzed honey (chestnut, polyfloral, and acacia honey).

Table S9. The influence of factors on the concentration of heavy metals in honey sites from Maramureș, Romania

| Element / Factor | Cu | Zn | Pb | Cd | Ni | Co | As | Cr | Hg |
|--|------|-----|-----|-----|-----|----|----|-----|----|
| | Sig. | | | | | | | | |
| Area | *** | *** | *** | *** | *** | - | - | *** | - |
| Year | ns | ns | ns | ns | ns | - | - | ns | - |
| Distance from the sources of pollution | *** | *** | *** | *** | *** | - | - | *** | - |
| Anthropogenic influence | *** | *** | *** | *** | *** | - | - | *** | - |
| Environment | ** | ns | ns | ns | ns | - | - | ns | - |
| Honey details* | *** | *** | *** | *** | *** | - | - | *** | - |

*The collected soil sample corresponds to the type of analyzed honey (chestnut, polyfloral, and acacia honey).