Bee-related Bioindicators

TDE Protocol | Beeswax and bee-collected pollen | 9 November 2026

1. Decisions adopted

Matrix	Decision	Role in the TDE system
Beeswax	EXCLUDED	The history of the wax and hive treatments make it difficult to attribute residues to the territory.
Bee-collected pollen	PERMITTED – OPTIONAL	Additional, non-exclusionary indicator of pesticide pressure in the bees' foraging area.

2. Pollen: analytical scope

Only multiresidue pesticide analysis by LC-MS/MS and GC-MS/MS is envisaged, covering approximately 540 substances, depending on the panel available at the laboratory. PFAS, metals and other contaminants are excluded: PFAS are already assessed through earthworms, water and sentinel vegetation; metals are already assessed in soils and mosses.

3. Numerical criterion and interpretation

Parameter: Σ pesticides quantified in pollen (µg/kg).

The sum is calculated by adding the concentrations of only those pesticides actually quantified (≥ the LOQ of the individual analyte). Values below the LOQ are not replaced by conventional values. The laboratory report must also list the detected analytes, their concentrations, the corresponding LOQs and the number of substances quantified.

Result	TDE operational assessment
Σ ≤ 100 µg/kg	Pollen indicator meets the TDE guidance value.
Σ > 100 µg/kg	Assessment of the indicator suspended: further investigation and comparison with the other matrices. No automatic exclusion of the territory.

The value of 100 µg/kg is a conventional guidance value adopted by the TDE system: it does not derive from a harmonised European environmental threshold and does not correspond to food maximum residue levels (MRLs). A compliant pollen result does not, on its own, qualify the entire territory.

4. Meaning and limitations of the indicator

- Pollen complements the environmental assessment by indicating the overall presence of pesticides in the area visited by bees; this foraging area may include land outside the TDE.

- The indicator is optional: the absence of beehives does not count against the territory. Exceeding the guidance value informs the integrated assessment of other indicators.
- Residues potentially attributable to beekeeping treatments require an assessment of their origin before being interpreted as external agricultural pressure.
- The summation criterion is an index of residue presence/load, not a measure of cumulative toxicity; individual results must remain available.
- Method sensitivity and matrix-specific LOQs must be documented. Sampling procedures are governed by operational protocol TDE-C04.

5. Rationale for excluding beeswax

Beeswax accumulates and retains lipophilic pesticides over long periods, including acaricides used in beekeeping; the use of recycled wax may introduce residues that cannot be attributed to the territory under investigation. It therefore does not provide sufficiently reliable source attribution for the purposes of TDE environmental qualification.

6. Scientific evidence and references

Tosi S., Costa C., Vesco U., Quaglia G., Guido G. (2018). A 3-year survey of Italian honey bee-collected pollen reveals widespread contamination by agricultural pesticides. Science of the Total Environment, 615, 208–218. DOI: https://doi.org/10.1016/j.scitotenv.2017.09.226. Italian study: 554 samples; 62% with at least one pesticide, 38% with multiple residues.

Friedle C., Wallner K., Rosenkranz P., Martens D., Vetter W. (2021). Pesticide residues in daily bee pollen samples (April–July) from an intensive agricultural region in Southern Germany. Environmental Science and Pollution Research, 28, 22789–22803. DOI: https://doi.org/10.1007/s11356-020-12318-2. German study: 102 samples; up to 13 residues in the same sample.

Perugini M. et al. (2018). Occurrence of agrochemical residues in beeswax samples collected in Italy during 2013–2015. Science of the Total Environment, 625, 470–476. DOI: https://doi.org/10.1016/j.scitotenv.2017.12.321. Beeswax study: 178 samples; 73.6% with at least one pesticide.

Note: These studies document the usefulness and limitations of bee-based biomonitoring; they do not constitute direct scientific validation of the internal guidance value of 100 µg/kg.