Analysis of honey from around the world for a broad scope of pesticides – A collaboration between the EURL-AO and the EURL-SRM

B. Sauer[1], A.K. Schäfer[1], A. Muzyka[2], C. Riemenschneider[2], A. Büttner[2], D. Mack[1], S. Fieberg[1], A. Barth[1], B. Hardebusch[2], E. Scherbaum[1] and M. Anastassiades[1]

[1]EURL-SRM hosted at CVUA Stuttgart, Fellbach, Germany
[2]EURL-AO hosted at CVUA Freiburg, Freiburg, Germany

E-Mail: ma@cvuas.bwl.de

Introduction

Honey has always been a staple food in human diet as it combines calorie-richness and storage stability. Nowadays, it is still a popular spread and ingredient around the world.

Large quantities of honey are produced in and imported into the EU [1]. Among the Latin American honey exporters to the EU, Argentina, Mexico, Chile, Brazil and Cuba are the main ones [1]. Recently, the EU recommended honey to be included in national monitoring programs on pesticides, raising the need for highlighting a reasonable scope of target pesticides [2]. It was therefore decided to run a pilot monitoring study among the EURL-AO and the EURL-SRM to explore the current residue situation of pesticides, veterinary drugs and of some contaminants. The results of this study, are presented here.

Samples

In total, 187 honey samples from all continents, including 37 from Latin America, were analysed in the study (collected 2022 - 2024). Products labelled as being of a single origin came from 30 different countries. The other ones were declared as being mixtures of different origin or were non-specified (**Fig. 1**). The study included honeys of >25 different specified varieties but most honeys were labelled as multifloral (30%) or were not further specified (39%). Among the single-variety honeys, the most represented ones were acacia (8x), orange blossom (6x), forest (5x), lavender (5x) and rape flower (3x). The majority of the samples was purchased at retail level, but 50 of them originated from business-to-business trade.

Analyte scope and methods employed

The EURL-AO focused on MRM compounds, covering ~390 compounds via QuEChERS and LC-Q-ToF and ~230 via SweEt and GC-Orbitrap.

The EURL-SRM covered ~1450 compounds, thereof 723 using measurement methods allowing direct quantification and the rest using targeted screening methods. Extractions were conducted using QuEChERS for MRM- and QuPPe for SRM-compounds [3,4]. LC-MS/MS, GC-MS/MS, LC-ToF and GC-Orbitrap were used for measurement. A positive screening was mostly followed by a quantitative reanalysis.

More details on the scope, the methods used, and the validation results, can be found in the *consolidated report* (see QR-Code to the right).

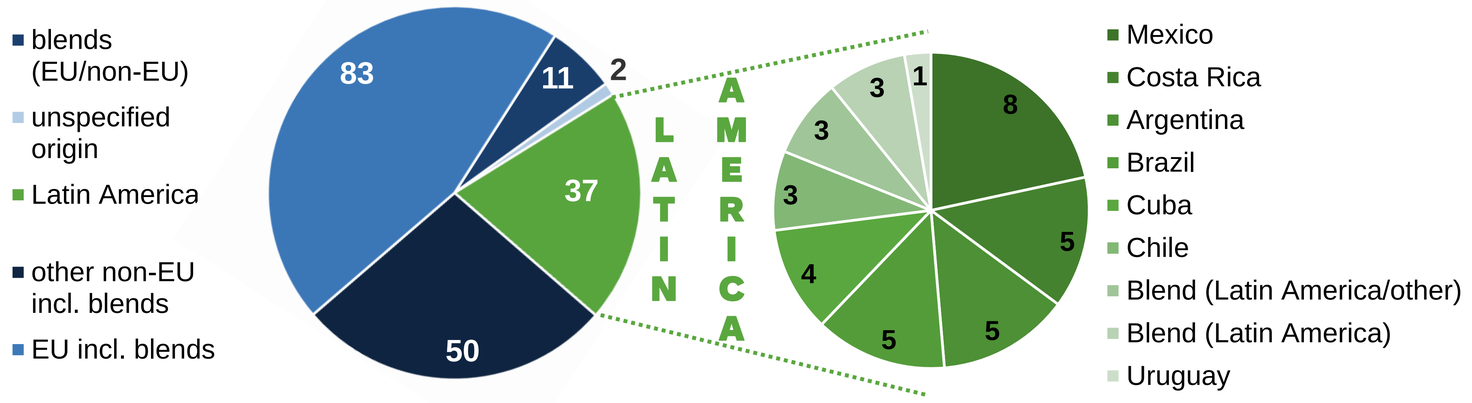


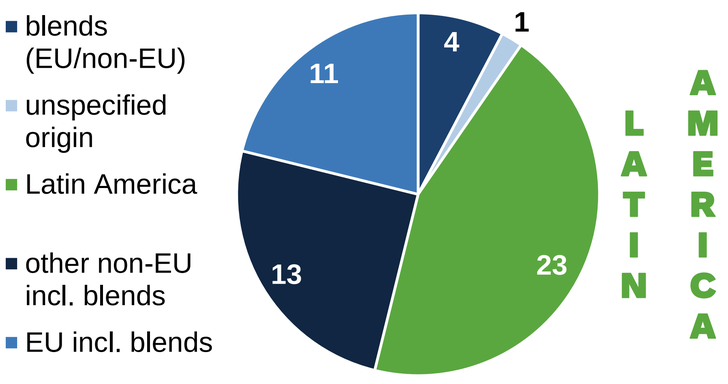
Fig. 1: Origin and number of analysed honey samples.

Results

All analysed samples contained levels of at least one of the targeted compounds. In total, >140 different compounds were encountered (pesticides & metab., contaminants, vet. drugs). The ubiquitous compounds bromide, phosphonic acid and copper were encountered in all analysed samples. Compounds with a findings frequency >80% were bromide, cyanuric acid, perchlorate and TFA. Compounds with a findings frequency between 20% and 80% were 2,4-D, acetamiprid, coumaphos, amitraz metab. DMPF, carbendazim, chlorate, melamine, mepiquat, nicotine, and thiacloprid.

Consolidated Report:

2,4-D was one of the compounds with a notably higher frequency of findings in products from Latin-America (62%, see **Fig. 2**) in comparison to those from the EU (13 %).



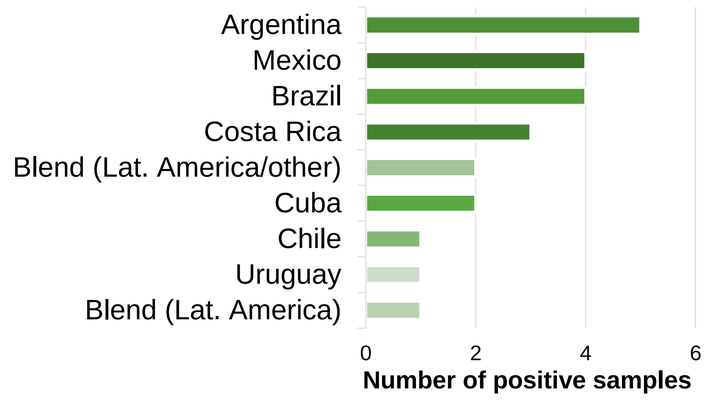


Fig. 2: Number of findings of 2,4-D.

Similarly, glyphosate was more frequently detected in honeys from Latin America than from the EU (37% vs. 13%). By contrast, some substances were more frequently encountered in samples from the EU than from Latin America, e.g. acetamiprid (33% vs. 11%); coumaphos (47% vs. 22%) and mepiquat (37% vs. 3%).

The current MRL of bromide ion (0.05* mg/kg) was exceeded in almost all cases. This MRL obviously needs adjustment to consider natural background levels. Further MRL exceedings concerned: glyphosate (4x: USA, DE, RA, BR), chlorate (2x: both TR), matrine (2x: CN, unknown) and azoxystrobin (1x: PL).

[1] Honey - Detailed information on honey production in the European Union: https://agriculture.ec.europa.eu/farming/animal-products/honey_en; Presentation (11 October 2024);| European Commission |(last accessed on 26.02.2024).
[2] Working document on pesticides to be considered for inclusion in the national control programs to ensure compliance with MRLs of pesticides residues in and on food of plant and animal origin. SANCO/12745/2013; 21-22 Nov 2023 rev. 15(3).
[3] EN 15662: Foods of plant origin - Multimethod for the determination of pesticide residues using GC- and LC-based analysis following acetonitrile extraction/partitioning and clean-up by dispersive SPE - Modular QuEChERS-method. 2018-07.
[4] Quick Method for the Analysis of Highly Polar Pesticides in Food Involving Extraction with Acidified Methanol and LC- or IC-MS/MS Measurement - I. Food of Plant Origin (QuPPe-PO-Method) – V. 12.3 (published on EURL-SRM website on July 23, 2021); M. Anastassiades; A.-K. Schäfer; E. Eichhorn; D. I. Kolberg; H. Dias; A. Benkenstein; S. Zechmann; D. Mack; C. Wildgrube; A. Barth; B. Sauer; I. Sigalov; S. Goerlich; D. Dörk and G. Cerchia. https://www.quppe.eu/quppe_doc.asp. (last accessed 26.02.2025).

LAPRW 2025

Co-funded by the European Union

Baden-Württemberg