

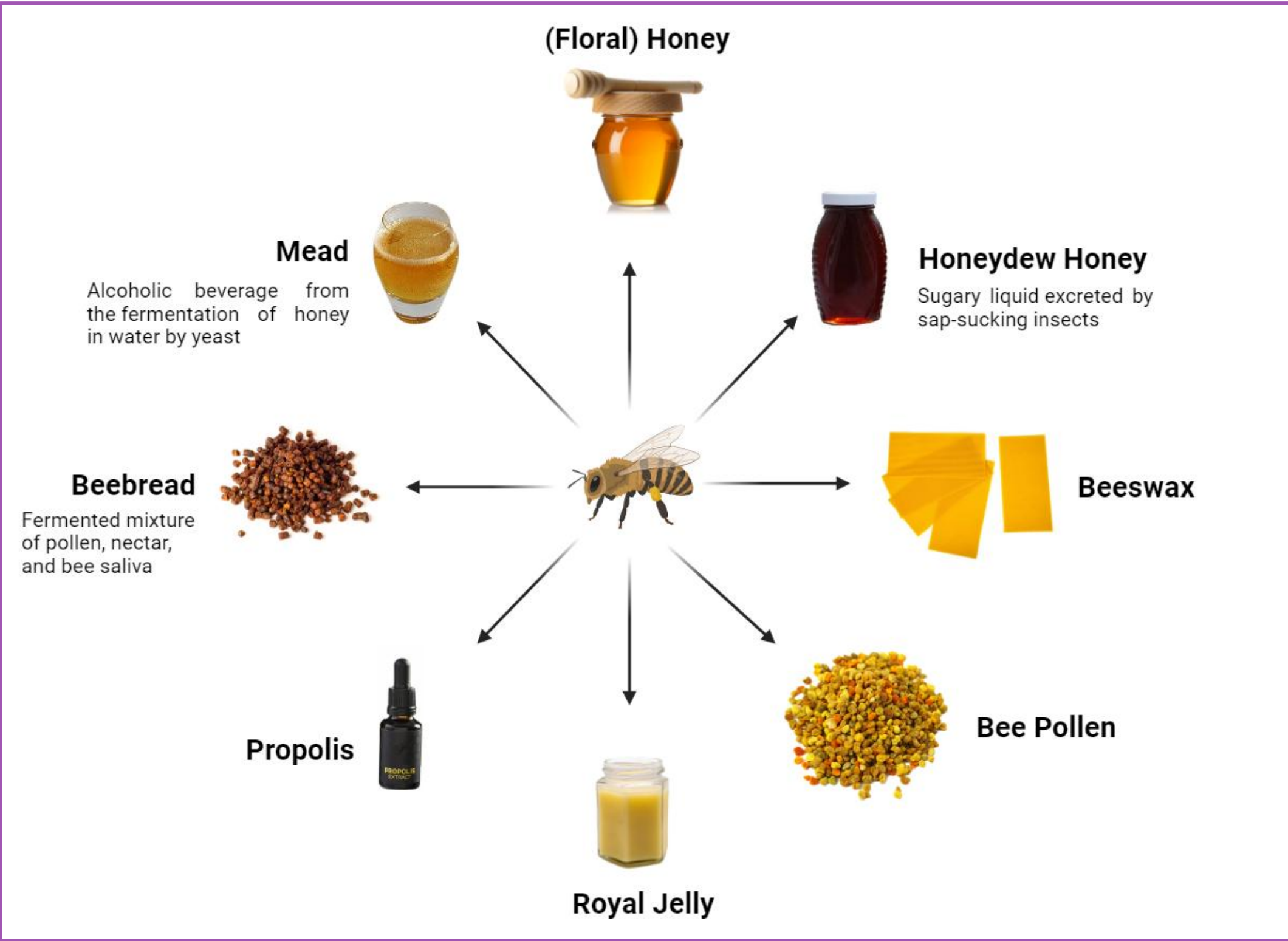
Apicultural Contaminants as Emerging Food Safety Hazards: The Case of Acaricides

Adrián Fuente-Ballesteros^{1*}, Zehra Hajrulai-Musliu², Mila Arapcheska³, Iveta Pugajeva⁴, Ana M. Ares¹, José Bernal¹, Anton Gradišek⁵, Maj Smerkol⁵

¹Analytical Chemistry Group (TESEA), I. U. CINQUIMA, Faculty of Sciences, University of Valladolid, 47011, Valladolid, Spain. ²University “Ss. Cyril and Methodius” – Skopje; Faculty of Veterinary Medicine – Skopje; North Macedonia. ³University “St. Kliment Ohridski” – Bitola; Faculty of Biotechnical Sciences – Bitola; North Macedonia. ⁴Institute of Food Safety, Animal Health and Environment BIOR, Riga, Latvia. ⁵Department of Intelligent Systems, Jožef Stefan Institute, Ljubljana, SI-1000, Slovenia. adrian.fuente.ballesteros@uva.es

INTRODUCTION & AIM

Bee products are widely consumed and highly valued for their nutritional, medicinal, and therapeutic properties. Honeybees produce a variety of products as displayed in the following figure. These products not only contribute to human health and nutrition but also serve as sensitive indicators of environmental contamination and colony management practices.



However, these products are increasingly at risk of contamination due to the routine use of acaricides in apiculture to control *Varroa destructor*, a major parasitic threat to honeybee colonies. When improperly applied or overused, these chemical treatments can leave residues in bee-derived foods, representing an emerging hazard to food safety and consumer health.



OBJECTIVE: Overview of the occurrence of pesticides residues in bee products in European countries and Turkey with a particular focus on acaricides.

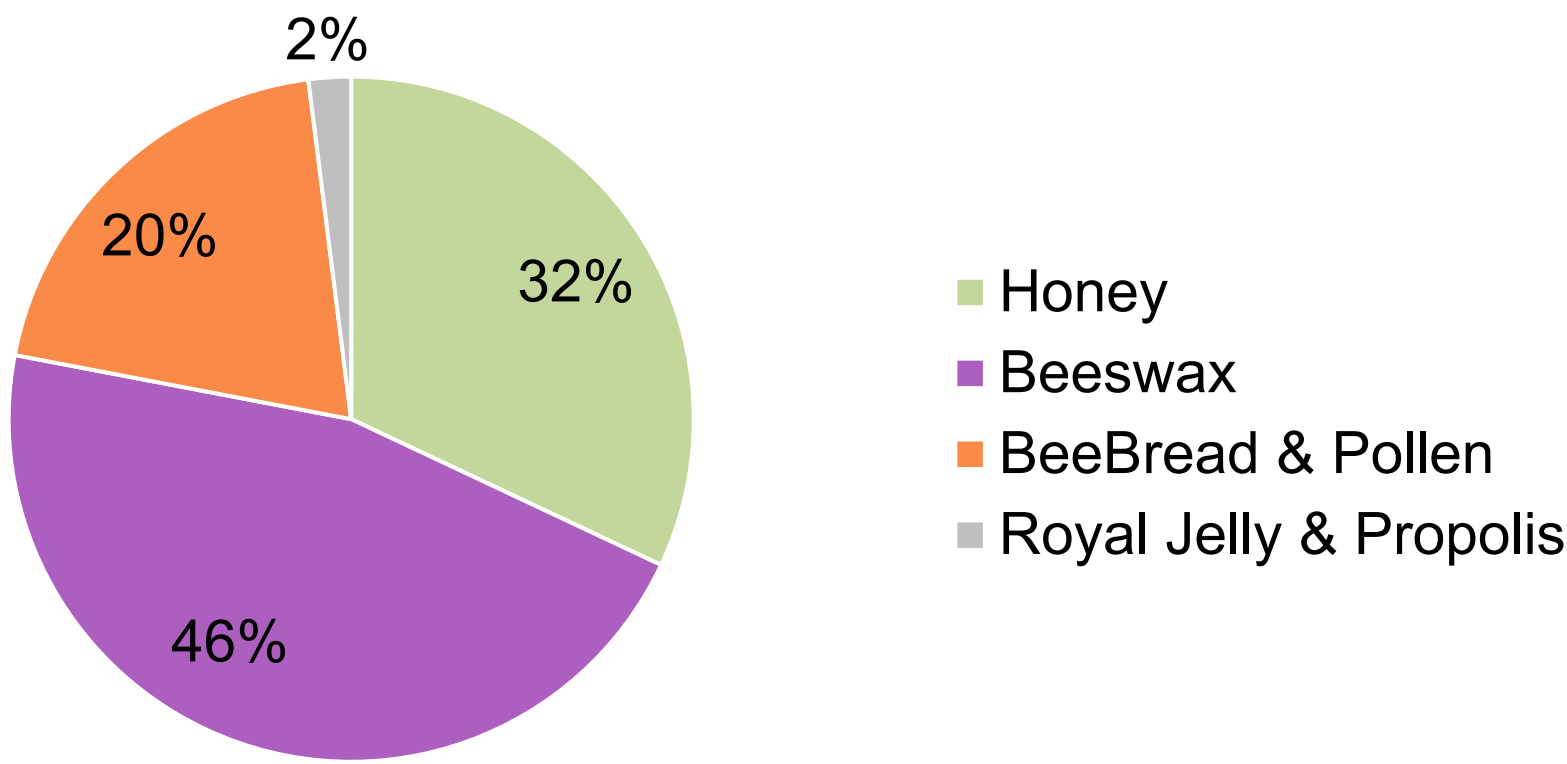
METHOD

The restriction parameters used to review the literature are shown in the following table.

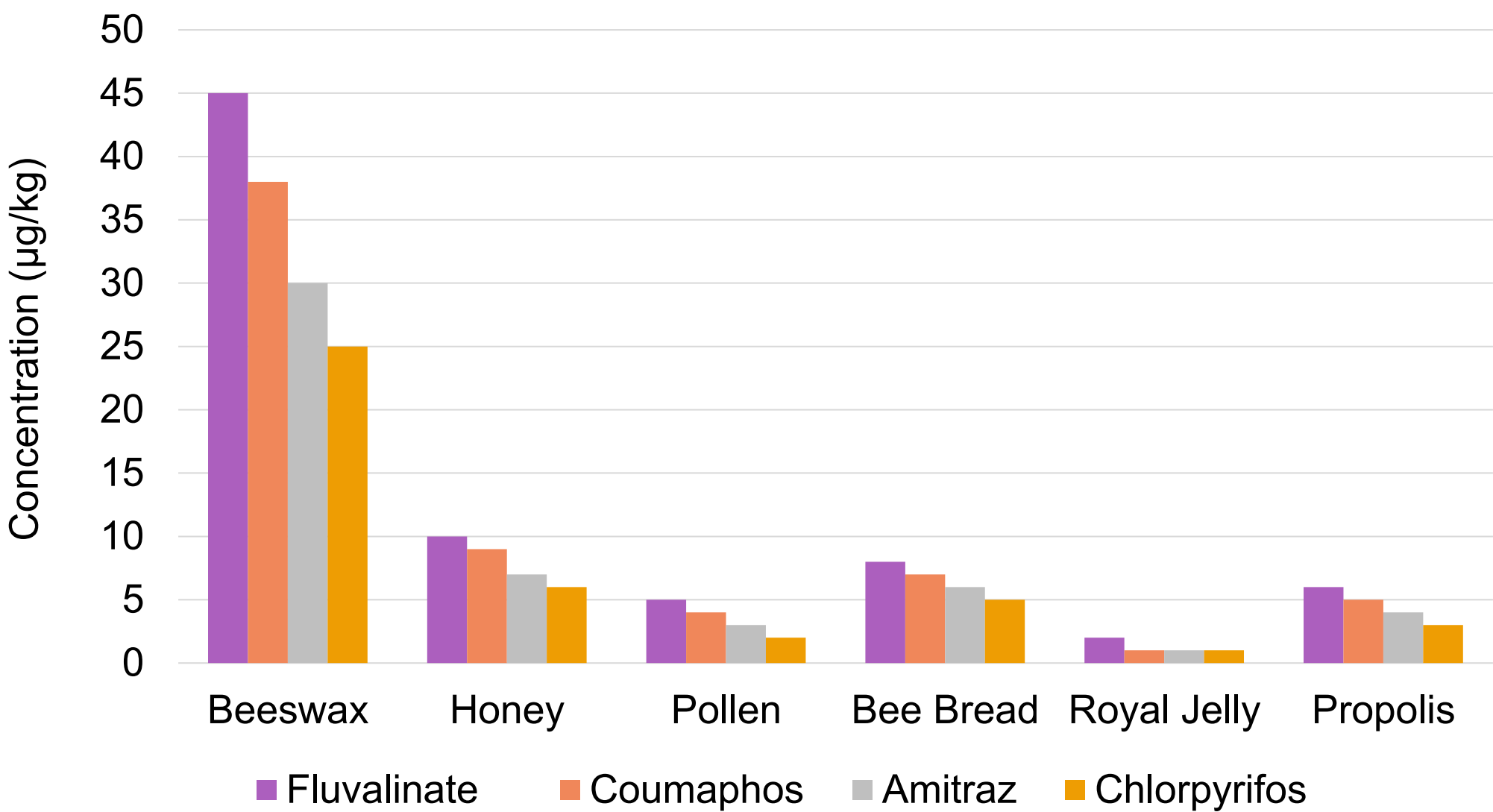
Databases	Scopus, Web of Science & PubMed
Matrix	Bee-related products (pollen, beebread, honey, beeswax, royal jelly, propolis)
Compounds	Acaricides
Countries	European countries & Turkey
No. samples	> 15
Analytical Methods	Validated methods
Years	Six years (2019-2024)
Language	English
Publication types	Original research articles
Team	+20 international collaborators from COST Action

RESULTS & DISCUSSION

This figure illustrates which bee-derived matrices have been most frequently analyzed in acaricide residue studies over the last years.



The following figure shows the distribution of four commonly detected acaricide residues in bee products from 2019 to 2024. Beeswax shows the highest accumulation, particularly of fluvalinate and coumaphos, due to its lipophilic nature.



CONCLUSION

- Knowledge of the distribution of pesticide residues within the hive matrices from different countries plays an important role in assessing their environmental impact and it is crucial to ensure the safety use of bee products by humans.
- This comprehensive overview of the literature can provide data for future research related to this topic.

FUTURE WORK

Future research include promote natural pest control, enhance residue detection tools, apply food safety in pest management, harmonize regulations, and raise awareness among beekeepers and consumers.

ACKNOWLEDGMENTS

Authors acknowledge the support from the BeSafeBeeHoney COST Action (CA22105).