OP-218 [Beekeeping Technology and Quality]

Toward the development of an easy, fast and reliable screening method for the detection of adulterated honeys: first results of a European study

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The honey market is currently facing a major crisis mainly due to the strong presence in commercial circuits of products that do not comply with European directives. A recent investigation sponsored by the European Commission revealed that more than half of the operators had exported honey consignments suspicious of being adulterated with extraneous sugars. The practice of adulteration negatively impacts the beekeeping sector, as the efforts of beekeepers to provide the consumer with genuine honeys are countered by the presence in the market of adulterated honeys, sometimes completely counterfeit, sold at derisory prices against which beekeeping companies cannot compete. Some high-performance analytical techniques, also used in the aforementioned investigation, can reveal with a high degree of accuracy the presence of adulterants in honeys. However, such techniques are expensive, time-consuming and require the intervention of experienced and highly skilled personnel. The fight against the illicit practice of adulteration must come through the application of fast, practical, and on-site screening approaches, which allow for the early determination of which honeys are suspect and which do not require further investigation. Near-infrared spectroscopy is a simple and practical analytical technique that has proved to be useful for the individuation of adulterated honeys. Nevertheless, the studies proposed by scientific literature are focused on a too limited number of samples coming from delimited areas and deriving from a few botanical sources. To explore the possibility of implementing this type of strategy at a European level, as part of the activities of Cost Action CA22105, a collection of nearly 1.000 honey samples coming from 19 different countries and belonging to a wide variety of floral sources, was performed. Samples were randomly adulterated with three different syrups, each characterized by different sugar compositions, applying adulteration levels ranging from 0 to 60 percent. NIR spectra were acquired using a portable device, and various classification models able to correctly discriminate among the different adulteration levels were developed. Prediction accuracies varied between 85 and 97%, revealing the great potential of this type of approach also on a large scale.

Toward the development of an easy, fast and reliable screening method for the detection of adulterated honeys: first results of a European study.

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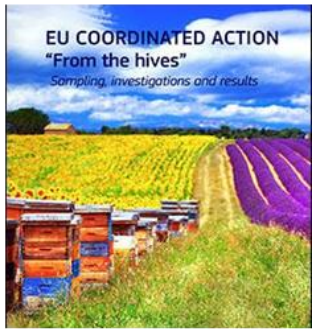
APIMONDIA
SCANDINAVIA
SWEDEN | DENMARK | NORWAY
23-27 SEPTEMBER
2025
COPENHAGEN

EU coordinated action «From the Hives»

OLAF
EUROPEAN ANTI-FRAUD OFFICE



European Commission
Directorate-General for Health and Food Safety (DG SANTE)



- Sugar syrups to adulterate honey and lower its price
- Lab analysis to adapt honey/sugar blends and elude fraud detection
- False geographical origin declarations

How scientific research can help



Creation of databases



Advanced analytical procedures



Screening methodologies

FT-NIR spectroscopy





THERMAL TREATMENTS



ADULTERATION



FLORAL/GEOGRAPHICAL SOURCE



PHYSICAL AND CHEMICAL PROPERTIES

Cozzolino et al., 2011, Applied Spectroscopy Reviews, 46 (7), 523-538.

Our previous study





Asphodel



Thistle



Eucalyptus



Rosemary

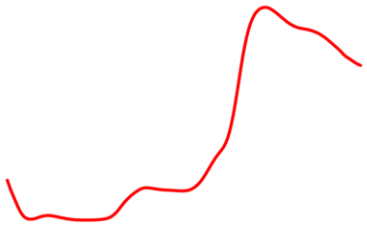


Multiflora



Strawberry-tree





GENETIC ALGORITHMS





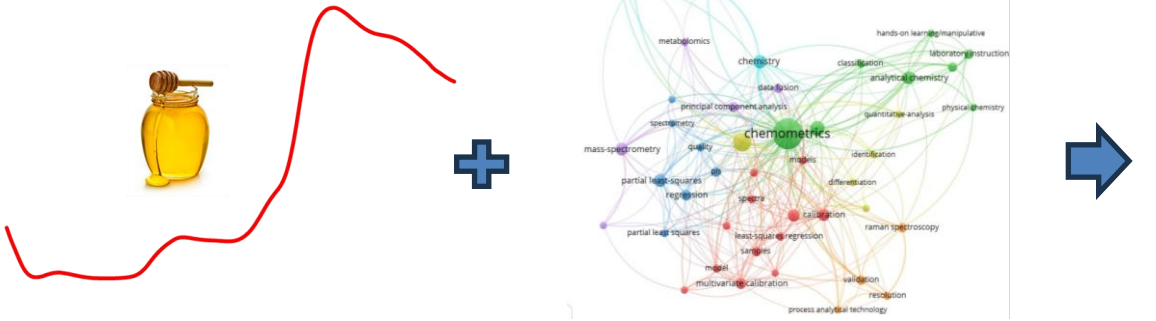
ORIGIN CLASSIFICATION (90-95%)

ADULTERANT QUANTIFICATION RMSECV < 5%

The DISCERNER project



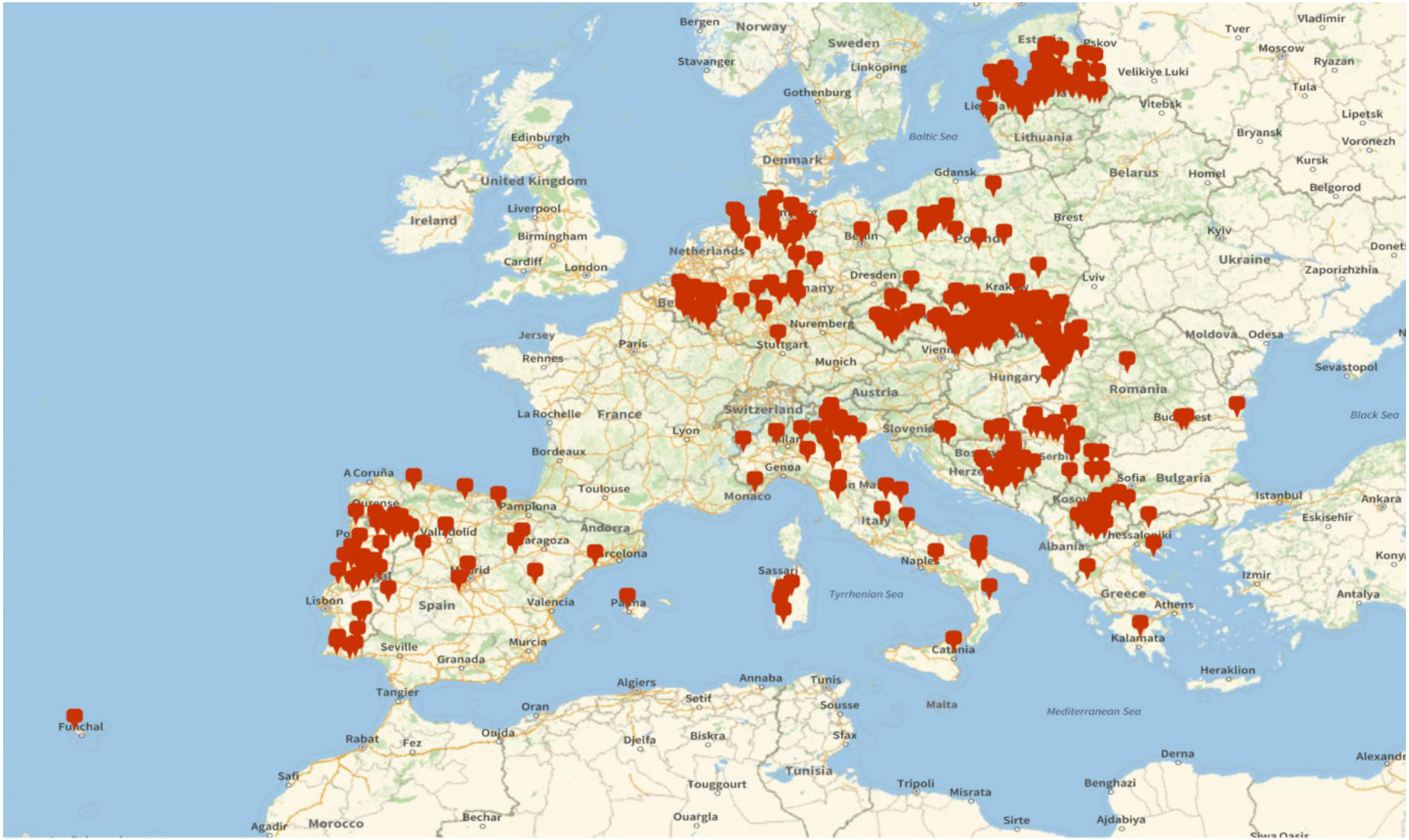
Development of an on-s**I**te **SC**reening strat**E**gy for the authentication and t**R**aceability of ho**N**eys in the **E**uropean ma**R**ket





Copenhagen, 24-09-2025

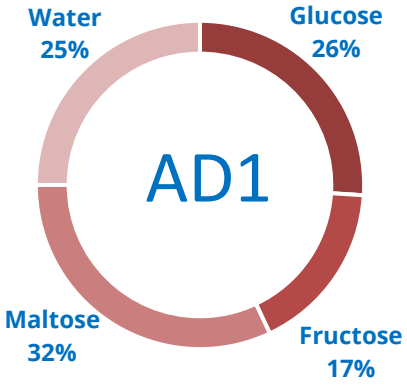
Sampling

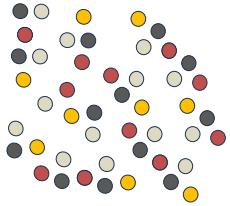


Bergen
Norway
Sweden
Stavanger
Linköping
Gothenburg
Baltic Sea
Lithuania
Vitebsk
Velikiye Luki
Pskov
Tver
Vladimir
Moscow
Ryazan
Tula
Lipetsk
Bryansk
Voronezh
Kursk
Belgorod
Homel
Belarus
Gdansk
Brest
Kyiv
Ukraine
Zaporizhzhia
Lviv
Edinburgh
United Kingdom
Ireland
Liverpool
Birmingham
Cardiff
London
Denmark
Netherlands
Dresden
Nuremberg
Stuttgart
Munich
Jersey
Paris
Rennes
Moldova
Odesa
Sevastopol
Hungary
Romania
Austria
Switzerland
Slovenia
Black Sea
La Rochelle
France
Lyon
Bordeaux
Genoa
Monaco
Sofia
Bulgaria
Istanbul
Ankara
Eskisehir
A Coruña
Toulouse
Pamplona
Andorra
Italy
Albania
Sassari
Naples
Izmir
Antalya
Lisbon
Spain
Valencia
Tyrrhenian Sea
Greece
Athens
Kalamata
Seville
Granada
Murcia
Catania
Heraklion
Tangier
Algiers
Annaba
Tunis
Setif
Sousse
Malta
Mediterranean Sea
Oran
Funchal
Rabat
Fez
Ouida
Djelfa
Biskra
Sfax
Derna
Safi
Tunisia
Touggourt
Tripoli
Misrata
Benghazi
Agadir
Morocco
Bechar
Ouargla
Sirte
Ajdabiya

Adulteration tests (0-60%)

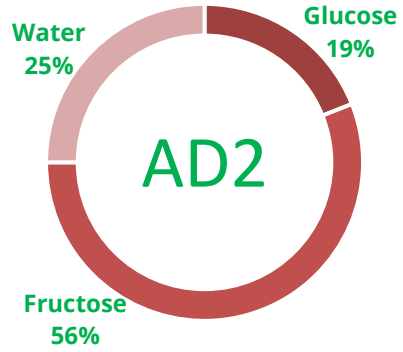


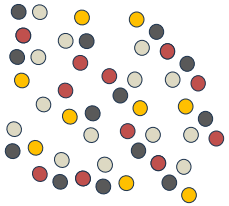




540 samples

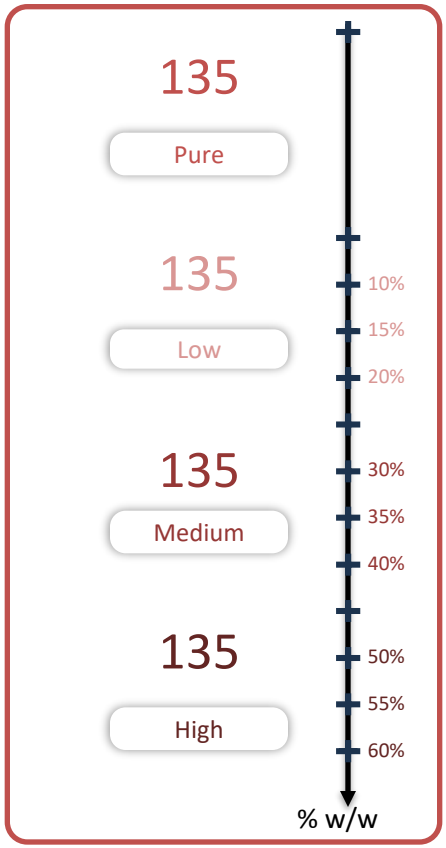
15 floral origins





540 samples

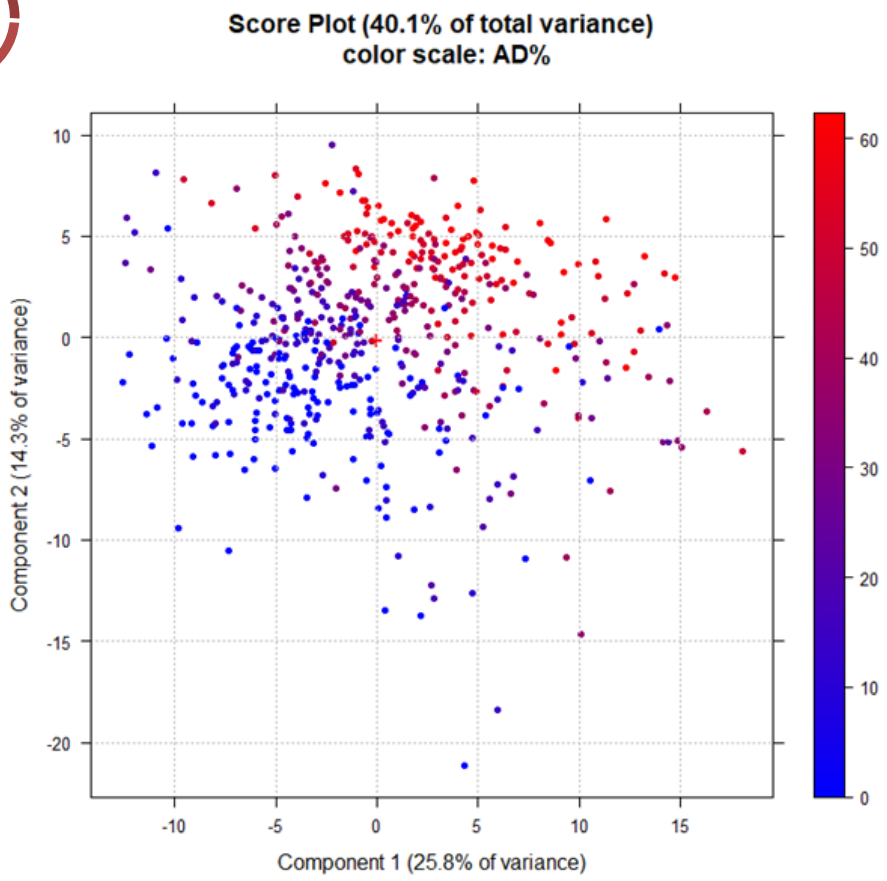
15 floral origins

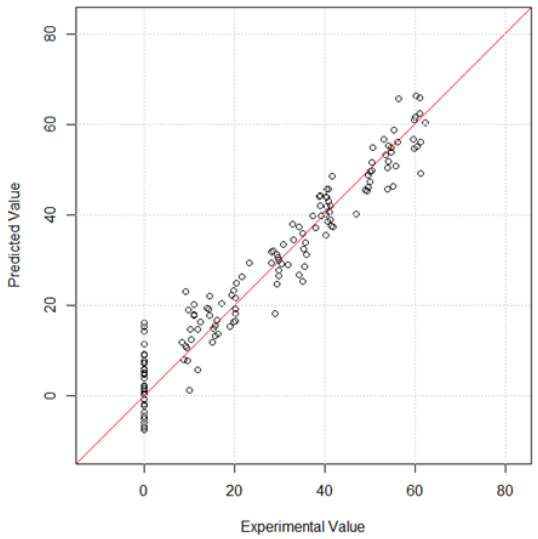


Adulteration tests (0-60%)

SNV + 2nd DER

AD1





PLS

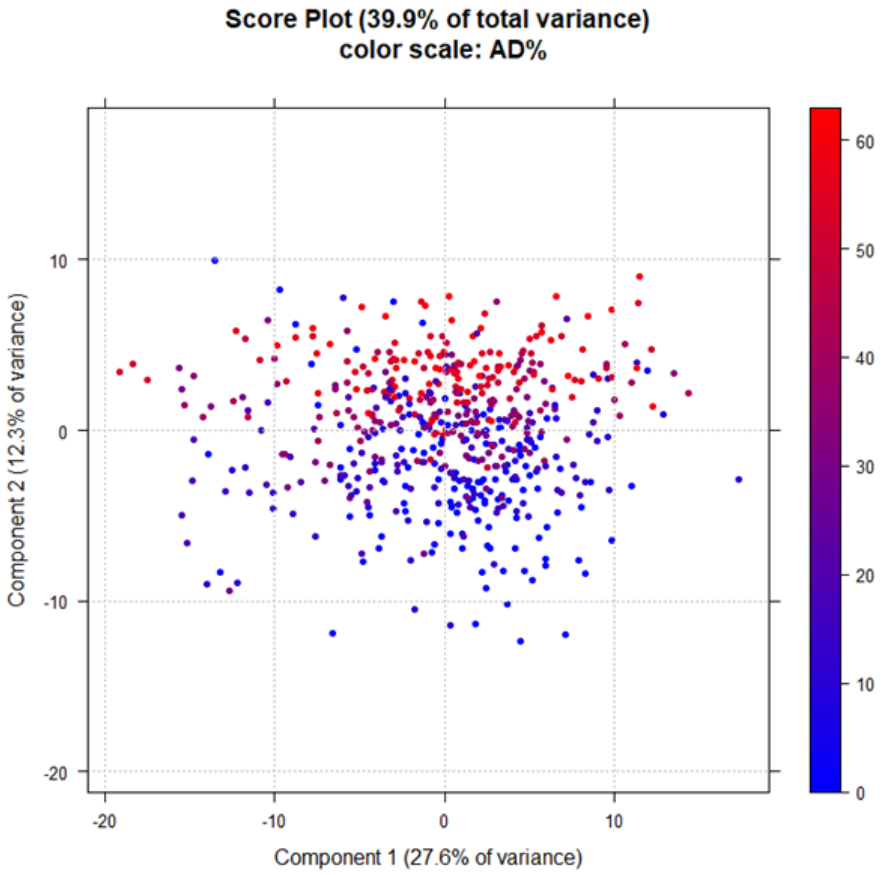
RMSEP
5.24%

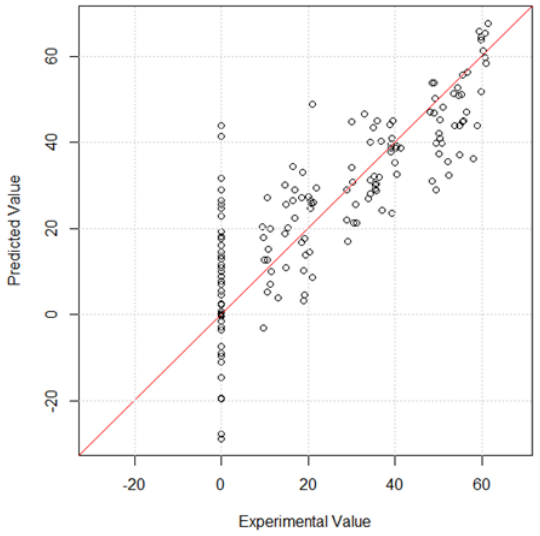


Adulteration tests (0-60%)

SNV + 2nd DER







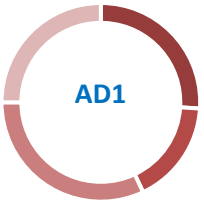
RMSEP
12.05%

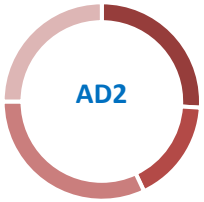
PLS

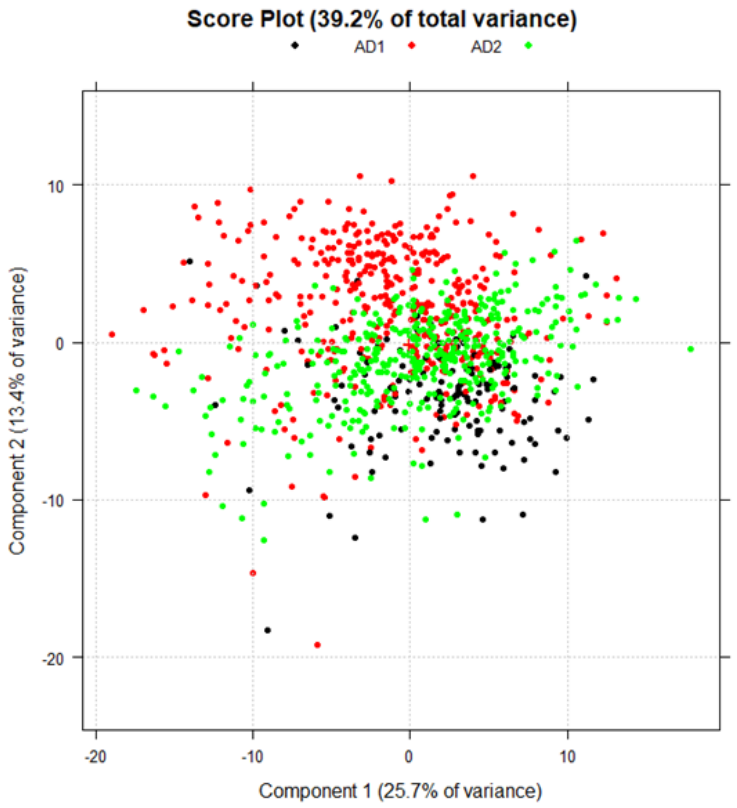


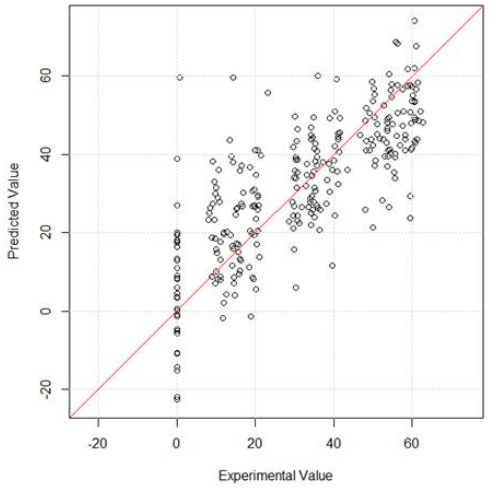
Adulteration tests (0-60%)

SNV + 2nd DER







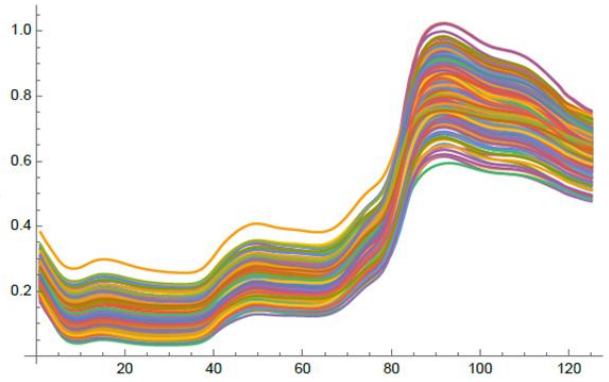


PLS

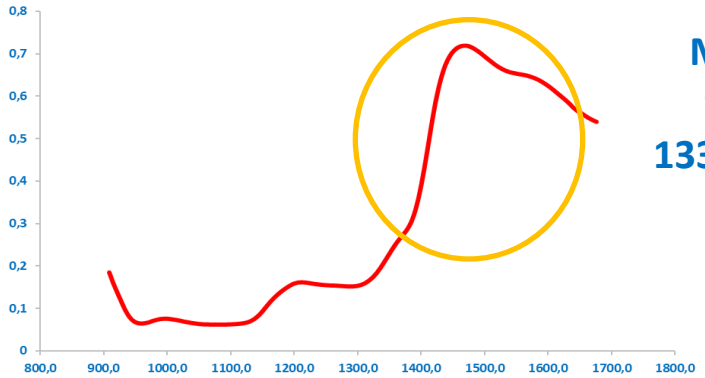
RMSEP
13.04%



Origin tracing

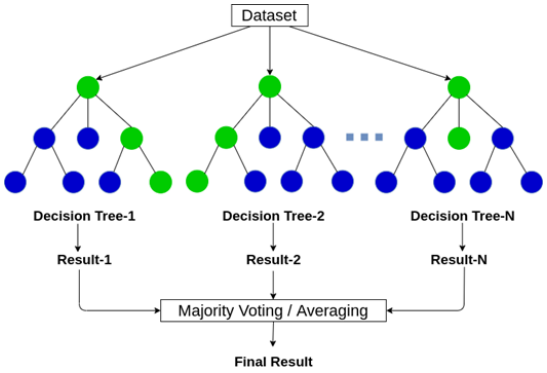


NIR spectra



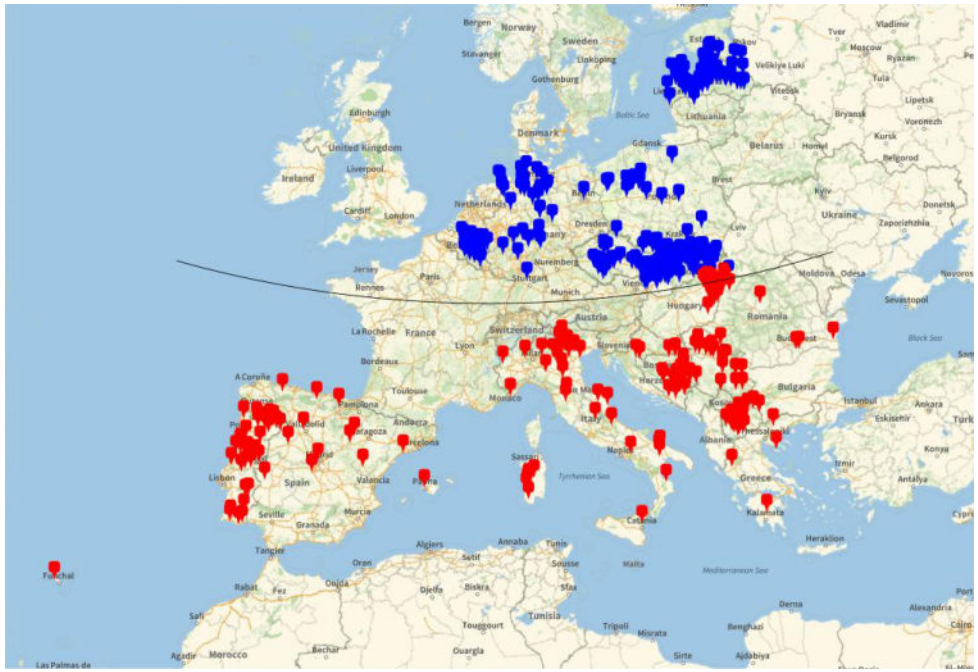
Maximum variance 1335-1645 nm





RANDOM FOREST

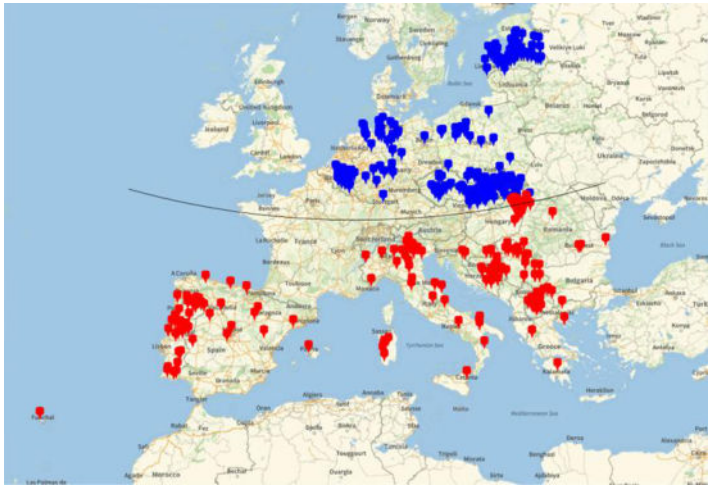
Origin tracing – North *vs* South

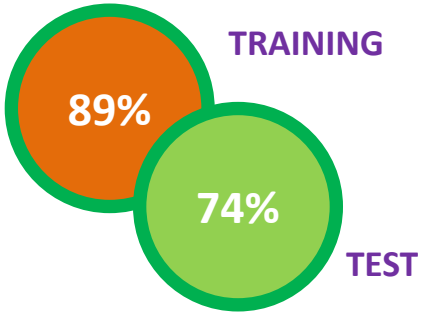


	Training (70%)	Test (30%)
1st deriv	85±4	66.6±0.3

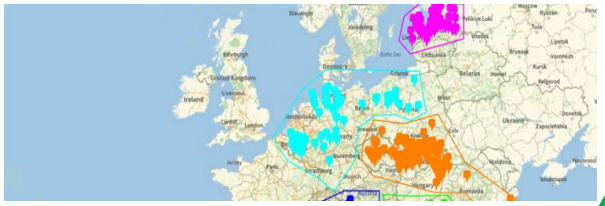
	Training (70%)	Test (30%)
1st deriv + BOT	89±1	74±2

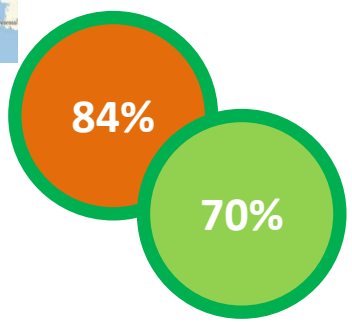
From large to small areas





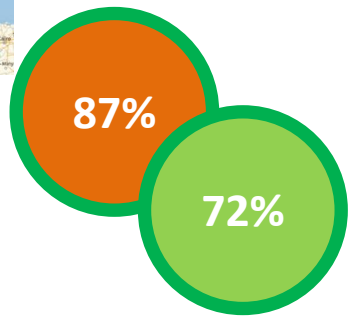
North honeys





South honeys





What's next?



- Extend the sampling area
- New adulterants
- Automatic selection of wavelengths

Acknowledgements



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Thank you!





UNIVERSITÀ di VERONA | Department of BIOTECHNOLOGY

FOOD ANALYSIS LAB



FT-NIR spectroscopy



1400-1500 nm
1st overtones of N-H and O-H stretching

1600-1800 nm
1st overtones of C-H stretching

1300-1420 nm
Combination bands (C-H)

950-1100 nm
2nd overtones of N-H and OH stretching

1100-1225 nm
2nd overtones of C-H stretching

Absorbance

0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0

800,0 900,0 1000,0 1100,0 1200,0 1300,0 1400,0 1500,0 1600,0 1700,0 1800,0

nm