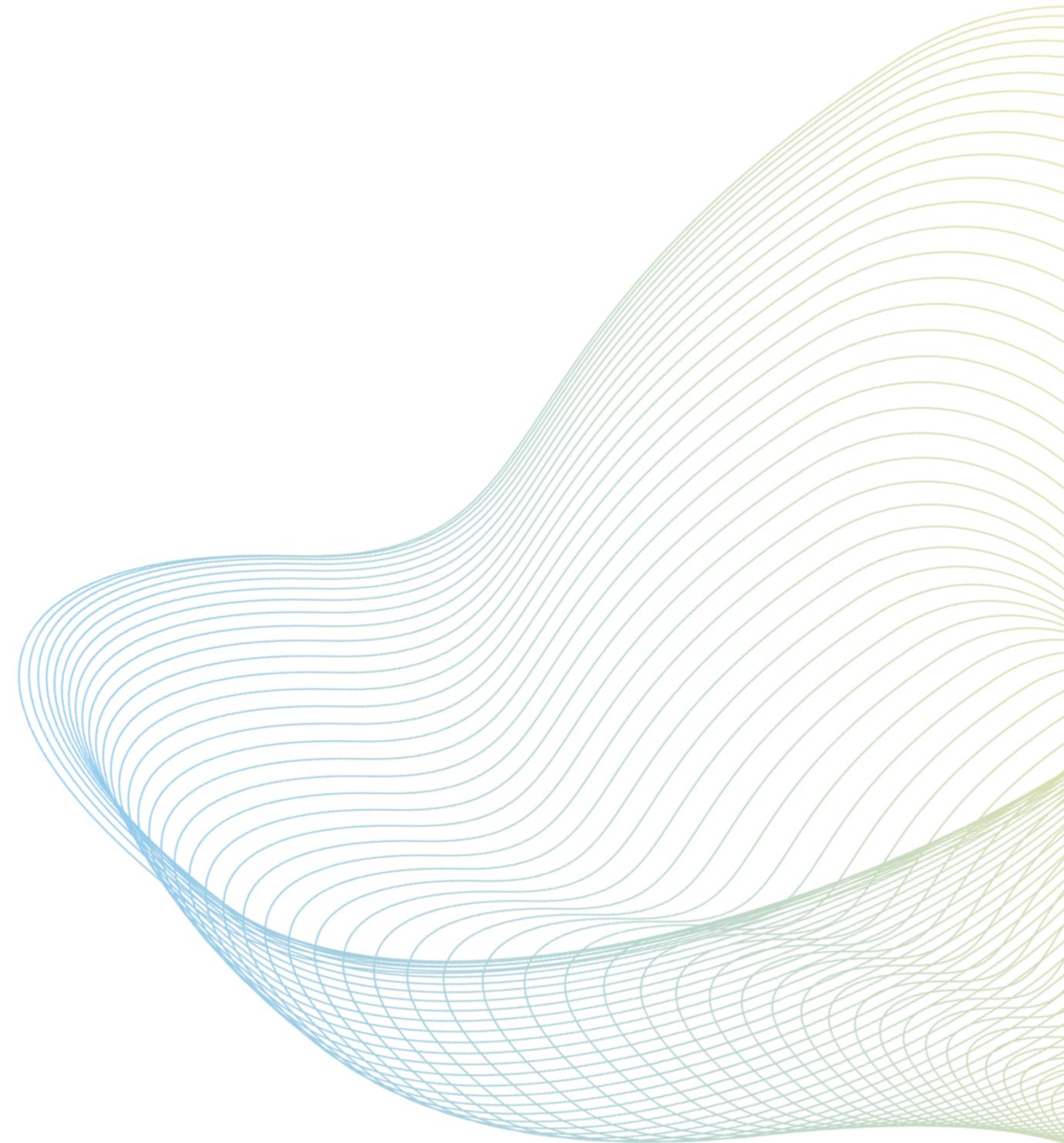




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HONEY RESEARCH/ TESTING



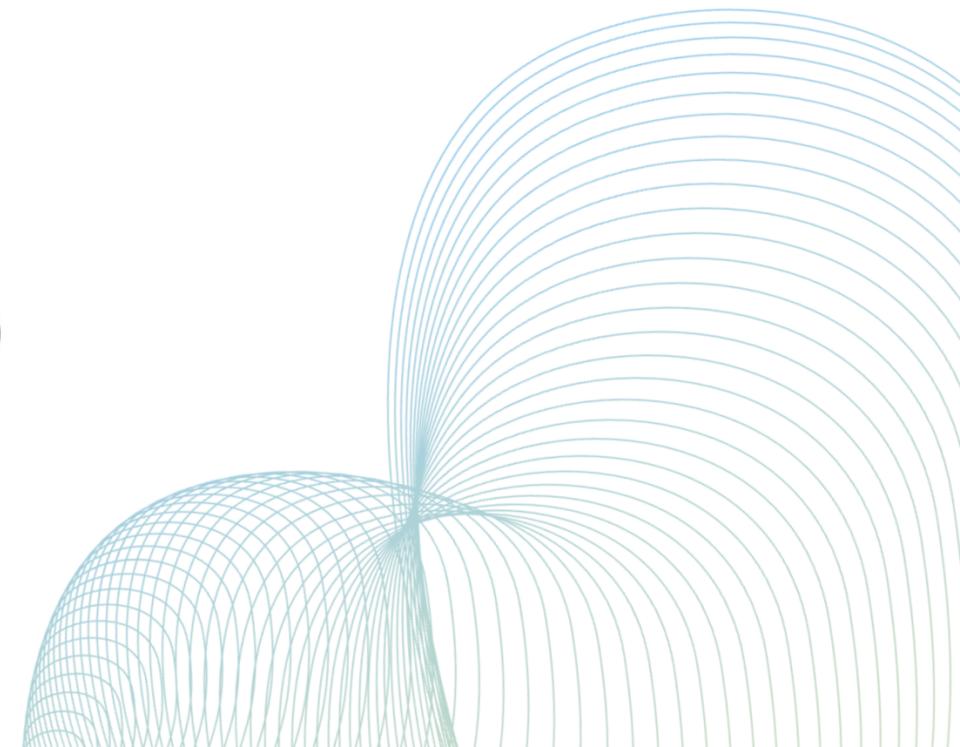
Dr. Faisal Mohammed
Department of Chemistry
UWI, St. Augustine



Faculty of Science and Technology
Department of Chemistry

HONEY RESEARCH

- 2016
- Undergraduate students
- Masters Students (M.Phil.)
- Other honey based projects (additional funding)
- Special thank you to the beekeepers!

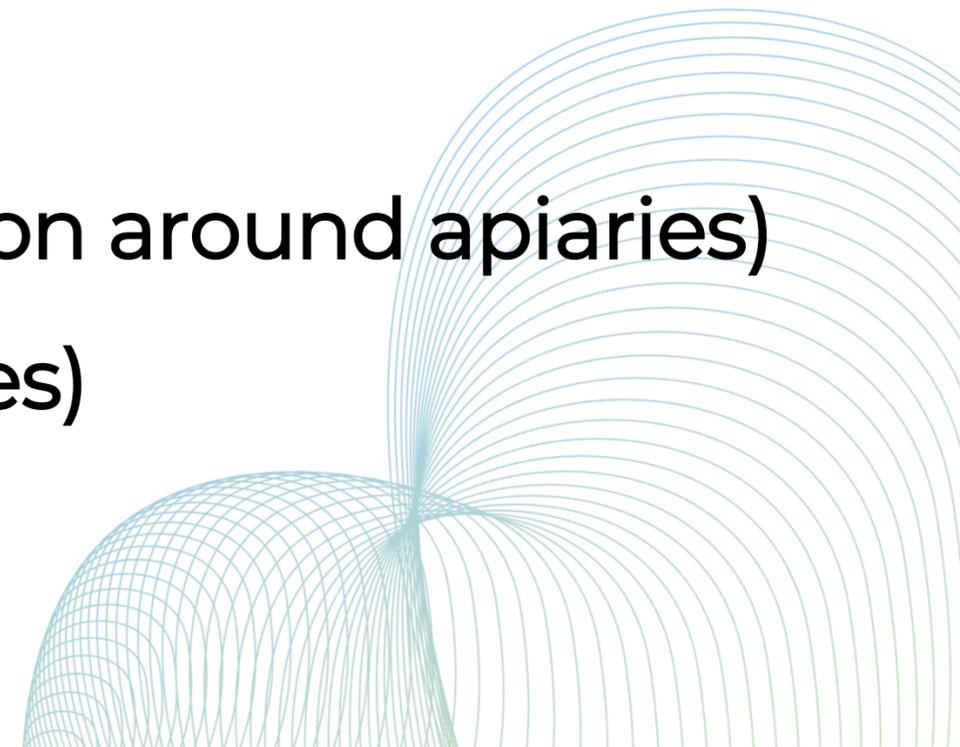




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HONEY RESEARCH

- Physicochemical properties (quality parameters)
- Antioxidant properties (honey as a superfood)
- Heavy metal contamination (what's in your honey?)
- Pollen as a bio-indicator of pollution (status of pollution around apiaries)
- Pollen identification (with Department of Life Sciences)
- Adulteration (real vs. fake?)



HONEY RESEARCH

Physicochemical properties

Test	Purpose	Test	Purpose
Moisture	Quality	Total Soluble Solids	Quality
Ash/ Electrical Conductivity	Quality/Botanical origin/Mineral content	Insoluble Matter	Impurities
pH	Quality (taste)	Optical Density	Colour classification
Sucrose/Glucose/Fructose	Botanical origin/ Adulteration	Specific Rotation	Blossom vs. Honeydew
		Proline	Adulteration

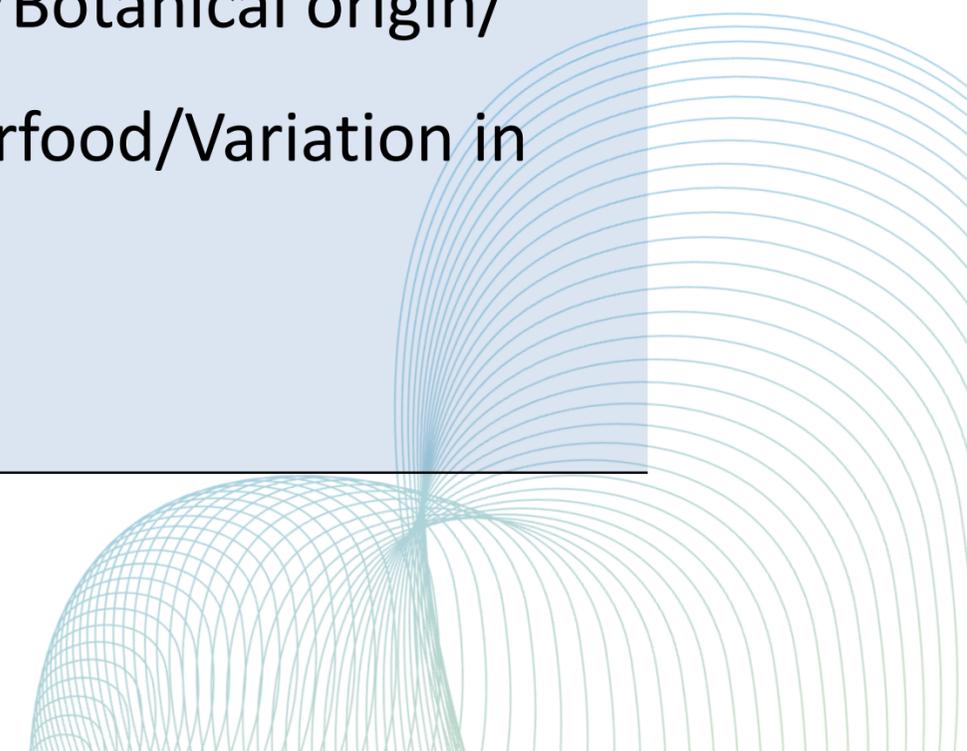


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HONEY RESEARCH

Antioxidant properties

Test	Purpose
Total Phenolic Content	Antioxidant properties/Botanical origin/ Classification as a superfood/Variation in feeding patterns
Total Flavonoid Content	
Ferric Reducing Antioxidant Power	
Radical Scavenging Activity	



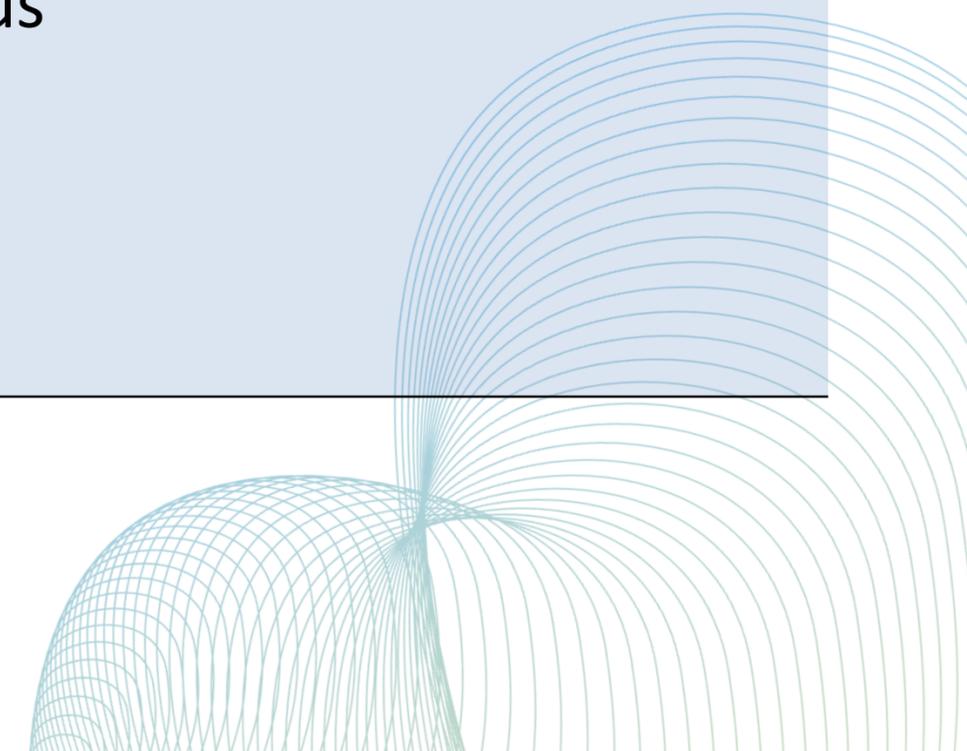


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HONEY RESEARCH

Elemental analysis

Test	Purpose
Heavy metals • Cadmium/Chromium/Copper/Lead/Manganese/ Nickel/Zinc	Contamination status
Essential elements • Calcium/Magnesium/Potassium/Sodium/Iron	Quality



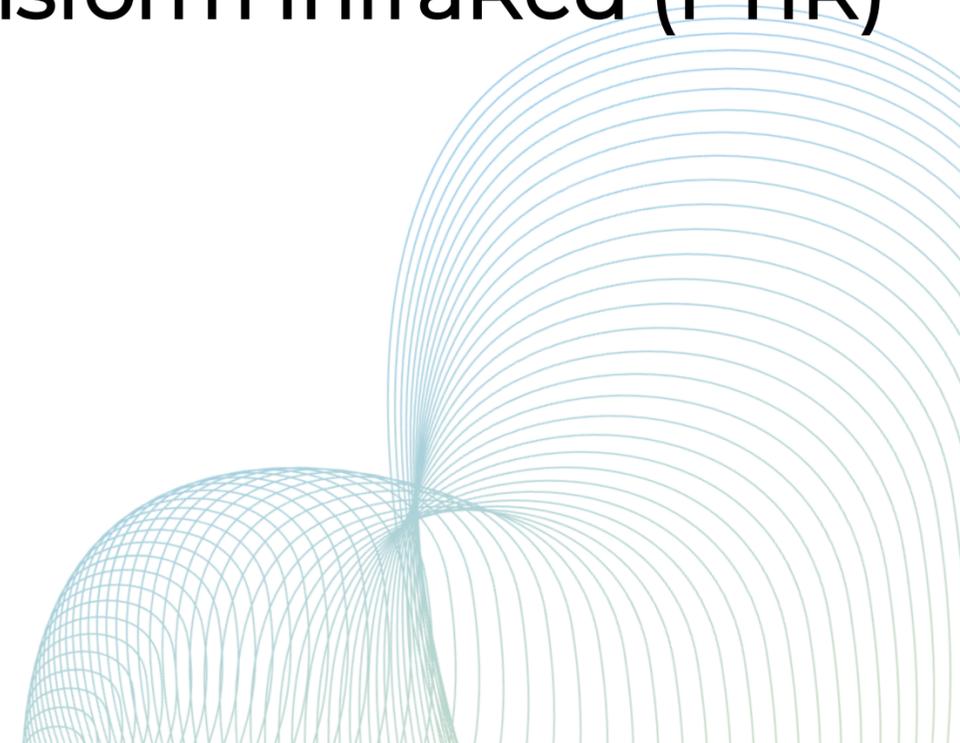


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HONEY RESEARCH

Adulteration

- Use of Spectroscopic techniques
- Nuclear Magnetic Resonance (NMR) and Fourier Transform InfraRed (FTIR)



POLLEN RESEARCH

Bee Pollen in Trinidad and Tobago: An Evaluation of Antioxidant Properties and the Potential for Biomonitoring of Heavy Metals

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Abstract

This study investigated the antioxidant properties of bee pollen from various locations throughout Trinidad and Tobago and evaluated its potential as a bio-indicator of surrounding pollution. Total phenolic content (TPC) ranged from 5.48 to 11.30 mg GAE/g, total flavonoid content (TFC) ranged from 0.12 to 0.50 mg QE/g, while DPPH radical scavenging activity (RSA) varied between 60.10 to 67.49 %. Heavy metal concentrations in bee pollen decreased in the order of Mn > Zn > Fe > Cu > Ni > Pb > Cd, with potential sources apportioned to fertilizers, vehicular emissions, atmospheric transport and from being ubiquitous within the environment.

Introduction

Bee pollen is the product of plant pollen agglutinated by nectar and the bee's salivary enzymes¹. The polyphenolic content is of growing interest to scientists as these compounds have been found to offer antioxidant, anti-inflammatory, and antimicrobial benefits to human health. Bees forage approximately 5-7 km from their hives collecting pollen from a variety of local flora and fruit trees. Pollutants may be absorbed by plants and potentially transferred to pollen, providing feedback on the environmental status within that area².

Methodologies

Antioxidant Properties:

- Total phenolic content evaluated using the Folin-Ciocalteu's method
- Total flavonoid content was determined using the AlCl₃ colorimetric assay
- Radical Scavenging Activity was assessed using the DPPH method

Heavy Metals:

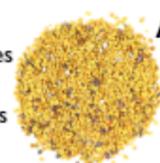
- Pollen dried overnight
- Pre-digested with concentrated Nitric Acid
- Digested at 75 °C for one hour and then at 100 °C for three hours
- Filtered, diluted and analysed for Cd, Cr, Cu, Fe, Mn, Ni, Pb and Zn using Flame Atomic Absorption Spectroscopy

Anti-carcinogenic/Anti-bacterial/Anti-fungal

Flavonoids
Phenolic acids

Anti-oxidative

Antioxidant enzymes
Flavonoids
Phenolic substances
Carotenoids



Anti-inflammatory

Flavonoids
Polyphenols
Fatty Acids
Phytosterols

Anti-allergenic

Flavonoids
Steroids
Volatile oil compounds

Anti-atherosclerotic

Fatty Acids
Omega-3
α-linolenic acid

Results and Discussion

Antioxidant properties

Table I. Antioxidant properties of pollen from Trinidad and Tobago compared to other regions

Location	TPC (mg GAE/g)	TFC (mg QE/g)	RSA (%)
Trinidad & Tobago	5.48 – 11.30	0.12 – 0.50	60.10 – 67.49
Brazil ³	30.55 – 48.76	8.55 – 28.43	14.91 – 40.81
USA ⁴	15.91 – 34.85	2.66 – 5.48	0.90 – 90.45
Spain ⁵	7.72 – 26.39	0.91 – 6.39	17.00 – 88.2
Turkey ⁶	3.87 – 7.44	1.18 – 1.42	60.35 – 81.41

Heavy Metals

Metal Pollution Index

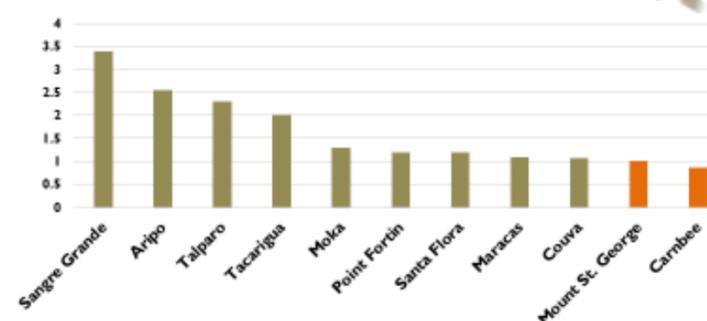


Figure 1. Metal Pollution Index values for heavy metals in pollen

Conclusions

- TPC and TFC values in pollen samples were lower when compared to other locations
- % RSA was comparable to those obtained at other geographical areas
- Consideration of pollen type (*monoflora* vs. *multiflora*) for the different regions investigated
- Variety in floral sources significantly affect phenolic and flavonoid content and overall antioxidant activities.
- Heavy metal concentrations in bee pollen decreased accordingly (Cr not detected): **Mn > Zn > Fe > Cu > Pb > Ni > Cd**
- Potential sources of heavy metal pollution: * Natural * Agricultural processes * Vehicular emissions * NE trade winds
- Metal content generally decreased along the NE trade wind transect
- Bee pollen can be successfully used as a bio-indicator of heavy metal pollution

References

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Tests

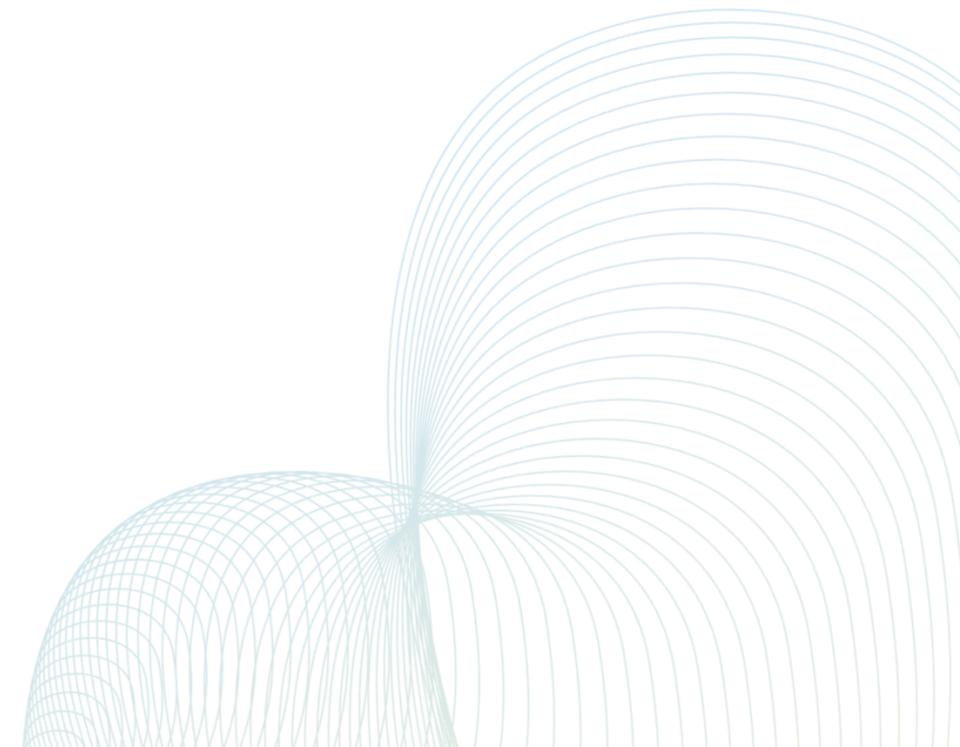
Heavy metals

Antioxidant properties

Pollen identification

COST

- Operational costs/Instrument wear and tear (consumables)
- Solvents
- Standards (for quantification)/Reference Materials
- Sample preparation
- Method development
- Analysis time



COST

Parameter	Approximate cost (\$)		
	TTD	XCD	USD
Moisture	150	60	22
Ash	300	120	44
pH	150	60	22
Electrical Conductivity	150	60	22
Sucrose/Glucose/Fructose	500	200	74
Total Soluble Solids	150	60	22
Insoluble Matter	300	120	44
Optical Density	150	60	22
Specific Rotation	325	130	48
Proline	325	130	48
Antioxidant properties (per test)	500	200	74
Elemental analysis	Based on number of elements requested		

TURNAROUND TIME FOR RESULTS

- Vary based on analysis
- Sample preparation, cleanup and analysis steps
- Replicate samples

ACCREDITATION

- Steps to achieve
- Challenges
- Method validation/Quality Assurance & Quality Control measures





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THANK YOU!

