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PP-352 [Apitherapy]

Antimicrobial Potential of Stingless Bee Honey: Physicochemical Characterization and ActivityAgainst Pathogenic Bacteria

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LABBEES

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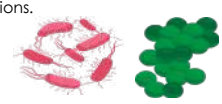
Background/Purpose

Stingless bee honey is a complex natural product composed of sugars, organic acids, proteins, minerals, vitamins, phenoliccompounds, and flavonoids. Due to its bioactive properties, it has been traditionally used in phytotherapy and homemade remedies. The growing demand for natural therapeutic alternatives is driven by concerns over the side effects of syntheticdrugs and the rise in antibiotic resistance.

This study aimed to characterize the physicochemical properties and antimicrobialactivity of stingless bee honey from different species and assess its effectiveness against pathogenic bacteria.

Problem Description

Escherichia coli and *Staphylococcus aureus* are major bacterial pathogens responsible for various infections. Their increasing resistance to conventional antibiotics highlights the urgent need for alternative antimicrobial agents. Stingless bee honey hasdemonstrated antibacterial potential, but its variability among species remains poorly understood. This study sought to evaluatehoney samples from multiple stingless bee species to determine their antimicrobial properties and potential therapeutic applications.



Methodology

Honey samples from 15 stingless bee species across different Brazilian regions were analyzed. Physico-chemical characterization was conducted, and antimicrobial activity was assessed using the broth microdilution method. The Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) were determined for each sample to evaluatetheir effectiveness against *E. coli* and *S. aureus*.

Table 1. List of 14 Analyzed Samples with Species, Popular Name, Origin, and Geographical Position

Scientific name	Popular name	Origin	Geographical position
Melipona bicolor	Guaraipo	Guaraqueçaba-PR	25° 18' 24" S, 48° 19' 44" W
Melipona interrupta	Jupara	Parintis-AM	2° 37' 42" S, 56° 44' 11" W
Melipona mondury	Uruça amarela	Aracruz-ES	19° 49' 11" S, 40° 16' 27" W
Melipona obscurior	Manduri	Seara-SC	27° 08' 58" S, 52° 18' 38" W
Melipona quadrifasciata	Mandaçaia	Irecê - BA	11° 17' 60" S, 41° 51' 24" W
Melipona rufiventris	Tiúba	Goiás-GO	15° 55' 21" S, 50° 8' 16" W
Melipona seminigra	Uruça boca-de-renda	Belém-PA	1° 27' 18" S, 48° 30' 9" W
Melipona subnitida	Jandaíra	Jandaíra-BA	1° 33' 32" S, 37° 47' 7" W
Plebeia emerina	Emerina	Seara-SC	27° 08' 58" S, 52° 18' 38" W
Scaptotrigona tubiba	Tubi	Barra do Corda-MA	5° 30' 2" S, 45° 14' 34" W
Tetragona elongata	Borá	Seara-SC	27° 08' 58" S, 52° 18' 38" W
Tetragona elongata	Borá	Atibaia-SP	23° 7' 2" S, 46° 33' 1" W
Tetragonisca angustula	Jataí	Jundiaí - SP	23° 11' 11" S, 46° 53' 03" W
Tetragonisca angustula	Jataí	Seara-SC	27° 08' 58" S, 52° 18' 38" W

Results and Conclusion

A high variability in physicochemical properties was observed among honey samples, but no directcorrelation with antimicrobial activity was found. However, honey from *Melipona rufiventris* and *Scaptotrigona tubiba* exhibitedthe highest antibacterial activity, comparable to propolis. These findings reinforce the potential of stingless bee honey as anatural antimicrobial agent and suggest its application in developing alternative treatments for bacterial infections.

Table 2. Relationship of Minimum Inhibitory Concentration and Minimum Bactericidal Concentration for the Strains of Staphylococcus aureus ATCC 6538 and Escherichia coli ATCC 8739 in the 15 Analyzed Samples of Stingless Bee Honey

Scientific name	MIC S. aureus (µL/well)	MIC E. coli (µL/well)	MBC S. aureus (µL/well)	MBC E. coli (µL/well)
Duckeola ghiliani	125	125	X	X
Melipona bicolor	X	X	X	X
Melipona interrupta	125	125	500	X
Melipona mondury	250	250	X	X
Melipona obscurior	X	X	X	X
Melipona quadrifasciata	250	250	250	500
Melipona rufiventris	15.62	62.5	31.25	62.50
Melipona seminigra	125	250	X	X
Melipona subnitida	62.50	125	250	125
Plebeia emerina	62.50	62.50	500	500
Scaptotrigona tubiba	62.50	62.50	31.25	62.50
Tetragona elongata SC	31.25	62.50	125	62.50
Tetragona elongata SP	62.5	125	125	125
Tetragonisca angustula SP	125	125	125	125
Tetragonisca angustula SC	125	125	125	125

X means that the honey had no antimicrobial activity.
MBC, minimum inhibitory concentration; MIC, minimum bactericidal concentration.

Table 3. Relationship of pH, Acidity, and Moisture in the 15 Analyzed Samples of Stingless Bee Honey

Scientific name	Density (g/mL)	Moisture	Acidity (mEq/kg)	Reducer sugar (g/100g)	HMF (mg/kg)	pH
Duckeola ghiliani	1.36	>25	117.09	49.40	40.77	3.1
Melipona bicolor	1.30	>25	33.75	57.60	114.06	3.2
Melipona interrupta	1.36	>25	83.06	47.70	54.95	3.1
Melipona mondury	1.36	>25	45.20	46.21	22.40	3.9
Melipona obscurior	1.35	>25	58.87	37.79	0.50	3.8
Melipona quadrifasciata	1.30	>25	101.50	37.34	0.89	3.1
Melipona rufiventris	1.37	23.60	41.64	72.88	0.80	3.4
Melipona seminigra	1.37	24	22.55	64.39	9.69	3.3
Melipona subnitida	1.35	>25	78.39	33.37	12.86	3.1
Plebeia emerina	1.37	25	79.32	44.26	28.61	3.6
Scaptotrigona tubiba	1.35	>25	67.21	39.37	191	3.2
Tetragona elongata SC	1.36	>25	49.12	35.86	15.71	3.7
Tetragona elongata SP	1.35	22.60	40.58	72.81	0.40	4.5
Tetragonisca angustula SP	1.37	23.40	48.25	56.77	0.88	3.7
Tetragonisca angustula SC	1.37	>25	72.81	38.24	4.71	3.5

HMF, hydroxymethylfurfural.

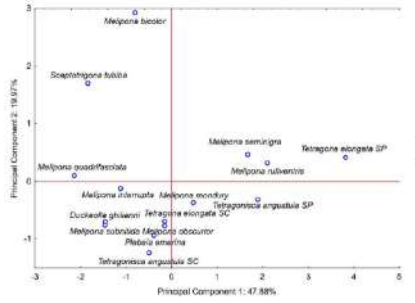


FIG. 1. Principal components analysis scatterplot showing the distribution of honey samples based on their physicochemical features.

Practical Implications

The identification of highly bioactive honeys provides an opportunity for beekeepers to promote specific species for medicinaluse, increasing the market value of their products. Understanding the antibacterial potential of different honey types may alsoencourage sustainable beekeeping practices and the development of functional honey-based products with health benefits.

KEYWORDS Apitherapy, stingless bees honey, physicochemical properties, antimicrobial activity

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