



DETERMINATION OF MINERAL CONTENT IN COLOMBIAN PROPOLIS SAMPLES FROM THREE REGIONS: BOYACÁ, CAUCA AND SAN ANDRÉS INSULAR

Kevin Fernando Romero Acosta¹, Sandra Marcela Muñoz¹, Jose Libardo Tapiero Cuellar¹

¹ SENA – Centro Agropecuario de Buga – Laboratorio LAMFA. E-mail: jtapiero@sena.edu.co

Abs Ref: 0440



INTRODUCTION

Bees of the *Apis mellifera* genus play a crucial role in forest ecosystems through pollination and the maintenance of biodiversity [1]. Among the products derived from bees is propolis, which is produced by mixing their saliva with resins from various plant sources, such as plant tissues, buds, and exudates, for the purpose of hive construction and environmental protection [2]. Propolis has been reported to exhibit multiple biological activities, including antioxidant, antibacterial, anti-inflammatory, and potential anticancer effects [2a, 3]. These activities are associated with its diverse phytochemical composition, comprising more than 180 constituents, such as flavonoids, phenolic acids, diterpenes, aromatic compounds, vitamins, essential fatty acids, minerals, among others [3b, 4]. This composition is influenced by several factors, including bee species, geographic region, environmental conditions, and local flora [4]. In the case of propolis extracts, their composition may vary depending on the extraction method, solvent, temperature, and duration [5].

MATERIALS AND METHODS

Study area:

Samples were collected from apiaries located in three regions of the country: San Andrés Island, Boyacá, and Cauca.

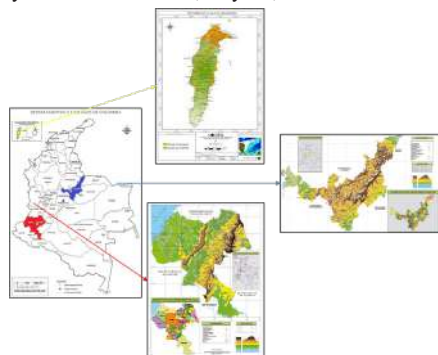


Figure 1. San Andres Island, Boyacá and Cauca Colombia.

1. Extract preparation

Soxhlet extraction

Twenty grams of sample were weighed into cellulose thimbles and subjected to Soxhlet extraction (500 mL flask, 250 mL chamber) using 96% food-grade ethanol as solvent for 3 h. Extracts were designated as ESoxS, ESoxB, and ESoxC (ESox: Soxhlet Extraction; S: San Andrés; B: Boyacá; C: Cauca).

Static maceration

Ethanolic extracts at 20% (w/w) were prepared using 96% food-grade ethanol as solvent. Samples were maintained under static maceration for 3 weeks. Extracts were labeled as EMS, EMB, and EMC (EM: Maceration Extraction; S: San Andrés; B: Boyacá; C: Cauca).

2. Sample preparation for mineral analysis

Raw propolis were weighed into crucibles and subjected to calcination in a muffle furnace: 12 h at 100 °C, followed by 525 °C until white ash was obtained (5 h). The resulting ash was dissolved in 1 M HNO₃ and diluted to 50 mL, with 1% LiCl₃ solution added for Ca and Mg quantification.

3. Mineral quantification

Calcium and magnesium were determined by atomic absorption spectrometry (ICE 3000, Thermo Scientific) in air/acetylene flame mode, according to AOAC 985.35 (22nd edition, 2023), using element-specific hollow cathode lamps.

RESULTS AND DISCUSSION

The concentrations of the minerals analyzed in different regions of Colombia are presented in Table 1.

Sample	Concentration (µg/g)						
	Mg	Fe	Zn	Ca	Se	Mn	Cu
Raw propolis San Andrés	59.27	86.11	26.64	115.00	66.91	5.46	1.08
Raw propolis Boyacá	12.15	64.60	22.78	61.61	<LOQ	53.30	<LOQ
Raw propolis Cauca	15.04	40.86	10.86	57.74	<LOQ	4.86	<LOQ
Soxhlet extract San Andrés	14.02	<LOQ	6.40	21.84	<LOQ	<LOQ	<LOQ
Soxhlet extract Boyacá	2.63	<LOQ	6.84	10.89	<LOQ	<LOQ	<LOQ
Soxhlet extract Cauca	1.65	<LOQ	6.33	4.28	<LOQ	<LOQ	<LOQ
Maceration extract San Andrés	6.00	3.70	7.32	10.11	<LOQ	<LOQ	<LOQ
Maceration extract Boyacá	1.51	<LOQ	6.56	3.09	<LOQ	<LOQ	<LOQ
Maceration extract Cauca	3.31	<LOQ	7.21	8.36	<LOQ	<LOQ	<LOQ

Note: <LOQ = below the Limit of Quantification.

Table 1. Concentrations (µg/g) of Mg, Fe, Zn, Ca, Se, Mn, Cu, together with the total mineral content assessed.

The mineral results in raw propolis of *Apis mellifera* (see Table 3) differ from those reported by Matuszewska et al. (2021), who found calcium contents ranging from 220 to 560 µg/g, magnesium from 64 to 140 µg/g, iron from 76 to 160 µg/g, zinc from 11 to 19 µg/g, manganese from 5.00 to 9.70 µg/g, and copper from 0.98 to 3.00 µg/g in raw propolis of *Apis mellifera*.

The predominant mineral in the three regions is calcium, followed by iron and zinc. Notably, only in the propolis from San Andrés were copper (1.08 µg/g) and selenium (66.91 µg/g) detected.

The Tukey test (see Table 2) revealed that the mineral content of raw propolis is significantly higher compared to ethanolic extracts. Furthermore, no significant differences were observed between the two extraction methods (see Figure 2).

Method	N	Mean	Grouping
Raw	6	232.6	A
Soxhlet	6	24.96	B
Maceration	6	19.06	B

Table 1. Concentrations (µg/g) of Mg, Fe, Zn, Ca, Se, Mn, Cu, together with the total mineral content assessed.



Figure 2. Interval plot for total mineral content by method.

Mineral content in propolis varied among San Andrés, Boyacá, and Cauca, likely reflecting regional environmental conditions and flora. The high selenium levels in San Andrés samples may be linked to *Cocos nucifera* and *Rhizophora mangle*, identified as relevant sources of this trace element.

REFERENCES

- Adler, L. Escobar-Márquez, M. T. Solis-Soto, C. F. Pinto, *Journal of Ethnobiology and Ethnomedicine* 2023, 19, 5. [2] aM. Y. Abduh, T. R. Shafitri, E. Elfahmi, *Heliyon* 2024, 10, e38736; bV. D. Wagh, *Adv Pharmacol Sci* 2013, 2013, 308249. [3] aK. Maroof, K. F. Chen, R. F. S. Lee, B. H. Goh, C. K. Mahendra, L. F. Siow, S. H. Gan, *Food Chemistry Advances* 2023, 2, 100255; bD. K. Pratami, A. Mun'im, M. Sahlan, S. Kumazawa, I. Jantan, S. I. Rahmawati, M. Y. Putra, A. Bayu, *Journal of Functional Foods* 2024, 123, 106602. [4] K. Pant, M. Thakur, H. K. Chopra, B. N. Dar, V. Nanda, *Journal of Food Composition and Analysis* 2022, 111, 104624. [5] F. Galeotti, F. Maccari, A. Fachini, N. Volpi, *Foods* 2018, 7, 41.

DETERMINATION OF MINERAL CONTENT IN COLOMBIAN PROPOLIS SAMPLES FROM THREE REGIONS: BOYACÁ, CAUCA AND SAN ANDRÉS INSULAR

Jose Libardo Tapiero-cuellar¹, Kevin Fernando Romero Acosta², Sandra Marcela Muñoz Burbano³

¹Jose Libardo Tapiero Cuellar

²Kevin Fernando Romero Acosta

³Sandra Marcela Muñoz Burbano

Propolis is a resinous mixture made by bees from tree buds, sap exudates or other plant sources, which they then process in the hive for protection. More than 100 biological compounds with active principles have been detected in some propolis. It has antioxidant, antifungal and antimicrobial properties depending on the botanical species associated with its collection. Its composition is determined by several factors such as geographical location, botanical sources, collection season and bee breed, among others. Its form of commercialization is represented in droppers, liquid and capsules: Pure Propolis, Natural Propolis Extract, among others. In this research the minerals Magnesium (Mg), Iron (Fe), Zinc (Zn), Calcium (Ca), Selenium (Se), Manganese (Mn) and Copper (Cu) were analyzed in propolis from different regions of the country (San Andrés, Boyacá and Cauca), in order to determine if the geographical origin influences the mineral composition. Quantification was performed by flame mode atomic absorption spectrophotometry using Thermo 3000 equipment. According to the results it can be concluded that the mineral content in propolis is very variable and depends on many factors that determine its presence and concentration, so propolis can be differentiated according to its mineral content. As significant results, the content of Selenium in the propolis of San Andres stands out, which may be associated to botanical species of coconut and mangrove that are present in the area, being a significant source of this oligoelement.