



Chemical analyses of selected propolis samples from Latvia

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INTRODUCTION

What is Propolis?

A resinous material collected by honeybees from plant sources, rich in bioactive compounds. Its chemical profile depends on vegetation, climate, geology, and soil

Current Knowledge in Latvia?

- Analysis by GC-MS: Only propolis from Tirza (northeast) [1,2]
- Analysis by HPLC: Phenolic acids in Riga's propolis [3]
- No nationwide chemical profile exists

Why Latvia is Unique?

- 8 geobotanical regions [4]
- Diverse vegetation types
- Influenced by climate, geology, soil and landscape
- Likely to yield region-specific propolis chemistry

Aim of This Study?

- Conduct first comprehensive chemical analysis of Latvian propolis
- Sample multiple regions
- Isolate & identify the most abundant metabolites

Significance

Provides the **first nationwide overview** of Latvian propolis composition, highlighting its chemical diversity and potential applications

Table 1. Propolis collection areas

Sample	Collection area
LV01	Jelgava, Central Latvia
LV02	Riga, North-coastal Latvia
LV03	Daugavpils, Southeast Latvia
LV04	Rujiena, Northern Latvia
LV05	Balvi, Eastern Latvia
LV06	Aizpute, Western Latvia
LV07	Svete, Southern Latvia
LV08	Ragana, North-Central Latvia
LV09	Talsi, Northwest Latvia
LV010	Cesis, Northeastern-Central Latvia



Figure 1. Latvia map

RESULTS

From 10 propolis samples collected from different regions of Latvia **49** compounds were identified. The **main chemical classes of propolis compounds** are listed in Table 2.

Aromatic acids are present in all samples (benzoic, p-coumaric, isoferulic, caffeic acids and derivatives).

Flavonoids & chalcones (pinocembrin, pinobanksin, pinostrobin chalcone) were found only in LV01, LV02 & LV03.

LV03 selected for further study due to high flavonoid content (5.87%) & phenolic acids (61.20%).

LV03 → **12 metabolites isolated** via chromatography and identified by NMR in comparison with literature data: 2',4',6'-trihydroxy-4-methoxy dihydrochalcone, 2',6',4'-trihydroxy-4'-methoxy dihydrochalcone, 2',6'-dihydroxy-4,4'-dimethoxy dihydrochalcone, 2',6'-dihydroxy-4'-methoxy dihydrochalcone, 2',4',6'-trihydroxydihydrochalcone, palmitic acid, benzyl benzoate, cinnamyl cinnamate, pinostrobin, pinostrobin chalcone, pinocembrin and pinobanksin.

CONCLUSIONS

Latvian propolis predominantly reflect the **European-type chemical profile**, rich in **aromatic acids** and phenolic compounds. Two distinct subtypes were identified: **poplar-type** propolis (Jelgava and Daugavpils) containing flavonoids indicative of *Populus nigra*, and **aspen-type** propolis (other regions) lacking flavonoids, but rich in phenolics linked to *Populus tremula* and surrounding flora [5]. These findings emphasize the importance of plant source identification for standardizing propolis quality and reveal regional chemical variability even within well-studied European propolis types.

MATERIALS AND METHODS

Sample Collection

10 propolis samples were collected in July 2022 from different regions of Latvia (Figure 1, Table 1).

Extraction & GC-MS

- Each sample (3 g) was extracted with **70:30 ethanol/water** and the extracts were evaporated to dryness
- Each dried sample (5 mg) was **silylated** and analyzed by **GC-MS**
- Compounds identified using Wiley database, literature, and internal data

Chromatography & NMR

- Sample LV03 purified by column chromatography
- Structure determined by **¹H-NMR**, **¹³C-NMR**, **COSY**, **HSQC**, **HMBC** (Bruker Avance III 400 MHz)

Percentage of main chemical categories

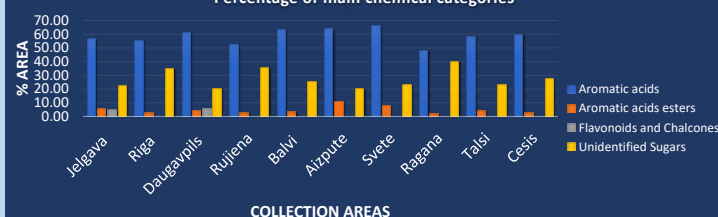


Figure 2. Main chemical category composition (%) of propolis by region.

Table 2. Chemical categories of compounds from various regions of Latvia

	Area %									
Chemical category	LV01	LV02	LV03	LV04	LV05	LV06	LV07	LV08	LV09	LV010
Aliphatic acids	4.75	3.18	3.12	1.31	1.41	3.05	1.46	3.34	1.18	4.98
Aromatic acids	57.09	55.35	61.20	52.39	63.58	63.68	66.33	47.75	58.41	59.74
Aromatic acids esters	5.85	2.91	4.47	3.03	3.57	10.60	7.95	2.05	4.04	2.91
Diterpenes	-	-	-	-	-	0.28	-	-	-	-
Sesquiterpenes	3.36	1.52	2.94	0.48	2.53	-	-	0.31	1.15	-
Flavonoids / Chalcones	4.81	0.17	5.87	-	-	-	-	-	-	-
Sugars	22.73	35.18	20.45	35.40	25.06	20.04	23.48	40.35	22.97	27.86

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PP-267 [Beekeeping Technology and Quality] Chemical analyses of selected propolis samples from Latvia

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Propolis is among the most valuable honey bees' products, a complex resinous mixture produced by bees through the combination of beeswax and plant-derived exudates. Its chemical composition is highly diverse and influenced by geographical and seasonal factors, as well as the botanical sources available to bees. Due to its rich chemical diversity, propolis has been widely studied for its potential pharmacological, antimicrobial, and antioxidant properties. However, Latvia remains a relatively unexplored country in terms of propolis research. The current study aimed to investigate the chemical constituents of selected propolis. The samples collected from ten regions across Latvia, utilizing gas chromatography-mass spectrometry (GC-MS) for comprehensive analysis and comparison. Propolis extracts were prepared using a 70:30 ethanol/water solvent system, followed by silylation of dried extracts prior to GC-MS analysis. The results revealed that Latvian propolis is mostly primarily composed of phenolic acids, their esters, and flavonoids, aligning with the characteristic composition of European propolis, with samples from eight regions classified as aspen-type propolis, while the remaining were identified as poplar-type. The GC-MS analysis has enabled the identification of 49 distinct compounds, among which the presence of 2',4',6'-trihydroxy-4-methoxy dihydrochalcone, 2',6',4-trihydroxy-4'-methoxy dihydrochalcone, 2',6'-dihydroxy-4,4'-dimethoxy dihydrochalcone, 2',6'-dihydroxy-4'-methoxy dihydrochalcone, and 2',4',6'-trihydroxydihydrochalcone, as well as palmitic acid, benzyl benzoate, cinnamyl cinnamate, pinostrobin, pinostrobin chalcone, pinocembrin, and pinobanksin, was confirmed through isolation procedures. Given the limited studies on the chemical profile of Latvian propolis, these findings contribute towards interesting insights into the phytochemical diversity of propolis within this geographic area. The study enhances the understanding of the chemical composition of Latvian propolis and provides a foundation for further research on its bioactive properties, therapeutic potential, and potential applications in pharmacology, biotechnology, and the development of natural health products.