OP-214 [Beekeeping Technology and Quality]

Determination of dynamic variation characteristics of flavor and aroma volatiles of chaste honey during natural ripening process using electronic nose, electronic tongue and GC-O-MS

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The natural ripening process of honey is accompanied by the generation and transformation of volatile compounds, which affect the sensory quality of honey. It is generally believed that the honey aroma is one of the important factors determining the characteristics and quality of honey. However, there is limited research on the dynamic changes of aroma volatile compounds in honey. In this study, gas chromatography-olfactometry-mass spectrometry (GC-O-MS) combined with electronic nose and electronic tongue technology was used to investigate the evolution of flavor characteristics and aroma volatile profiles in chaste honey at different ripening stages. The results showed that electronic nose and electronic tongue could be used to distinguish chaste honey at different stages of maturity. We identified 206 volatile compounds in chaste honey at different ripening stages using GC-O-MS. Among these, 59 annotated compounds were recognized as aroma-active compounds, with benzeneacetaldehyde, benzaldehyde and benzeneethanol emerging as the three most aromatic compounds throughout all stages. Quantitative analysis of the top 20 compounds revealed that benzeneacetaldehyde was the primary aromatic compound that increased, potentially due to the high phenylalanine content in chaste honey. Although common aromatic compounds in honey, such as linalool, isophorone and 4-oxoisophorone, showed significant increases during ripening, their odor activity values remained below the threshold for aroma activity. Our highlight the aroma characteristics of chaste honey during ripening and offer new insights into honey quality control.

Institute of Apicultural Research
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Investigation of sensory profiling and aroma volatiles changes during chaste honey natural ripening

Dandan Sun

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Background of Honey Aroma

- Honey's aroma is a key indicator of its quality and characteristics.
- Over 600 volatile compounds have been identified in honey.
- The mechanisms of flavor formation during ripening remain poorly understood.

Uniqueness of Chaste Honey

- **Highly Valued** – China's premier monofloral honey for its unique flavor and therapeutic properties.
- **Research Gap** – Aroma development during maturation remains under-researched.

Research objectives

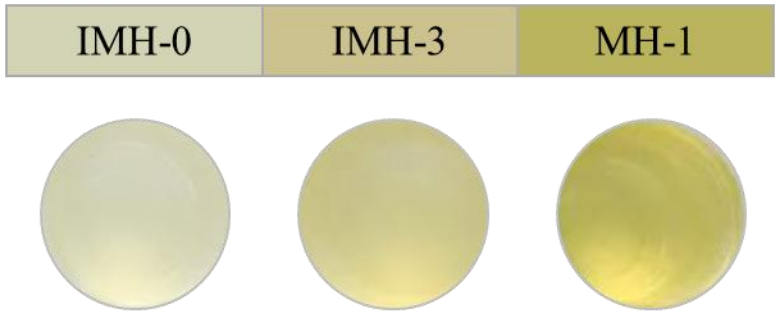
1. Track flavor changes using E-nose and E-tongue for sensory profiling.

2. Identify and quantify volatile compounds via GC-O-MS.

3. Pinpoint key aroma-active compounds contributing to ripening.

Sample analysis

Chaste honey ripening process



IMH-0: nectar collected from honeycomb

IMH-3: from uncapped honeycomb cells for 72 h

MH-1: from capped cells with beeswax for 24 h

Sensory analysis

Electronic nose

Electronic tongue

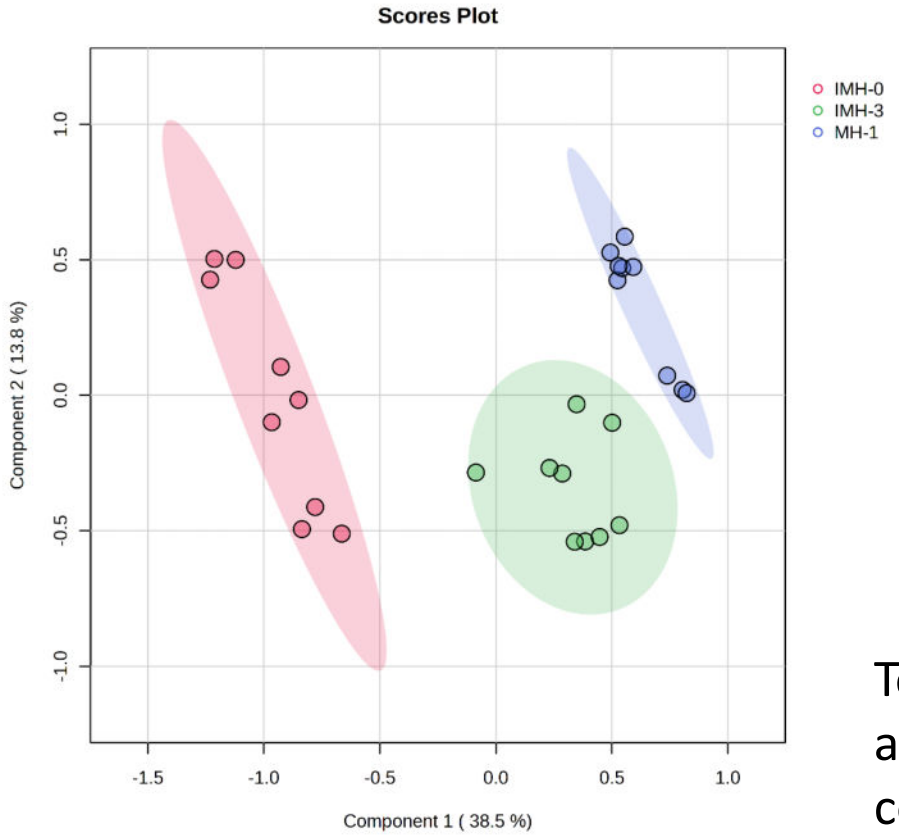
GC-O-MS

Qualitative & Quantitative analysis

olfactory test

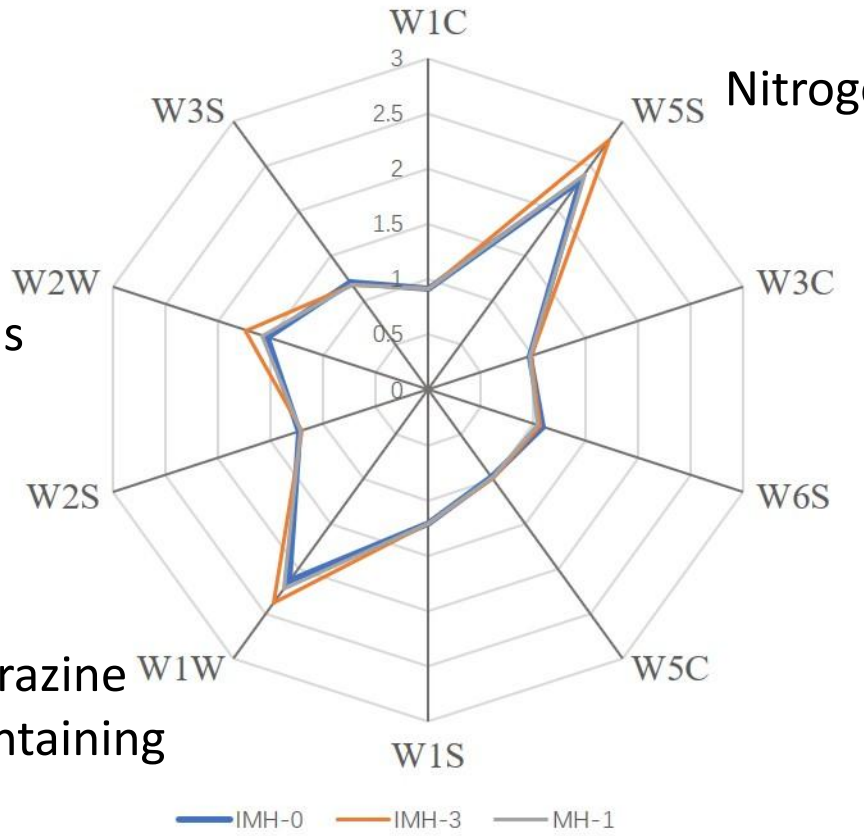
Results

Sensory Analysis — E-nose



Aromatic compounds

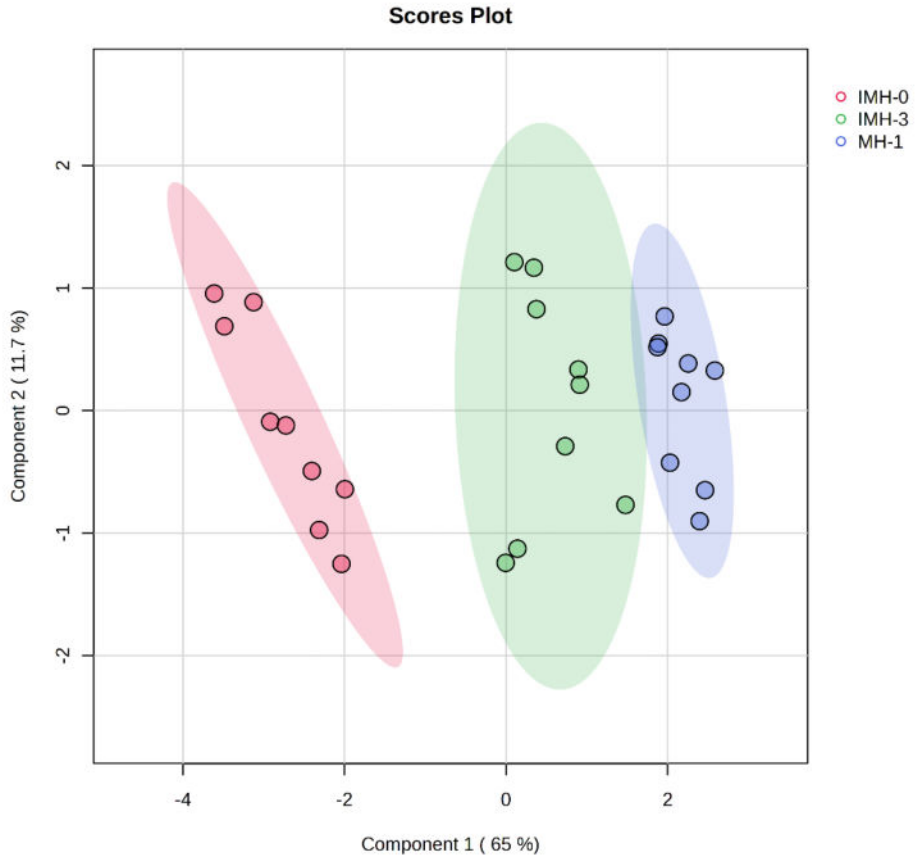
Terpenes, pyrazine and sulfurcontaining compounds

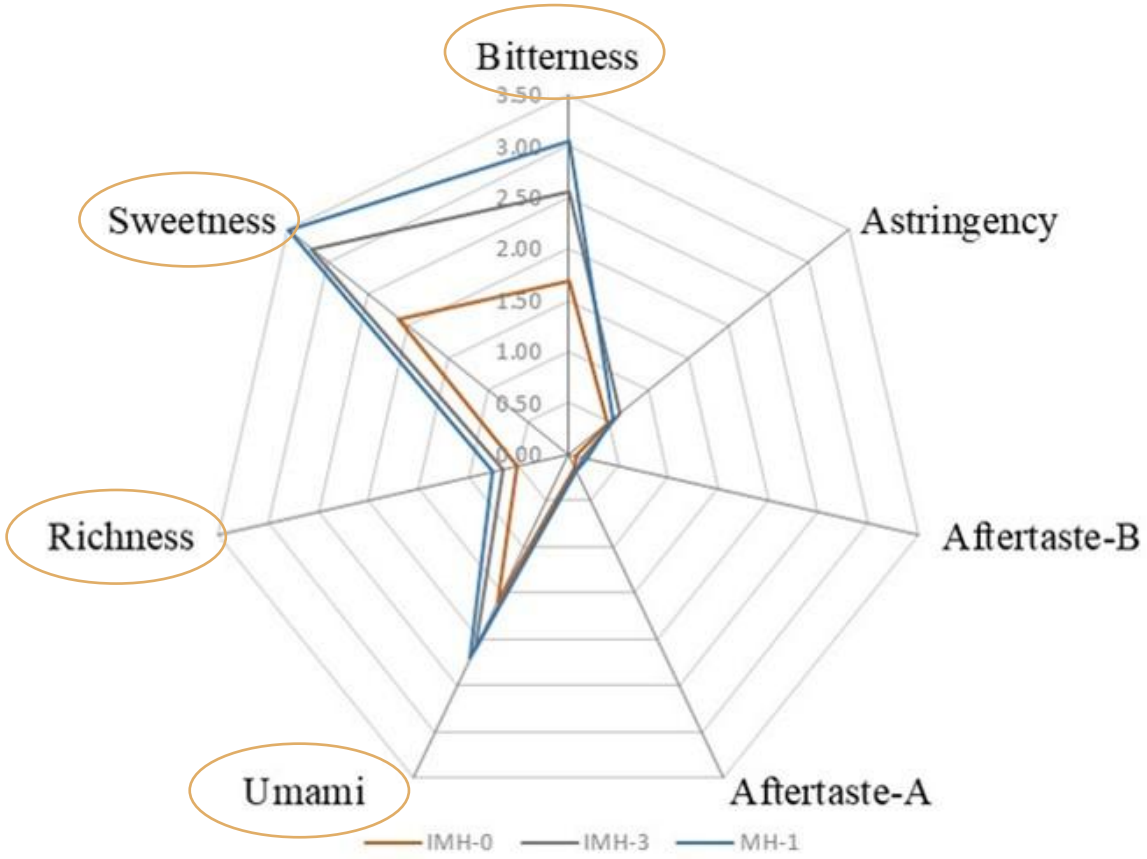


Nitrogen oxides

Results

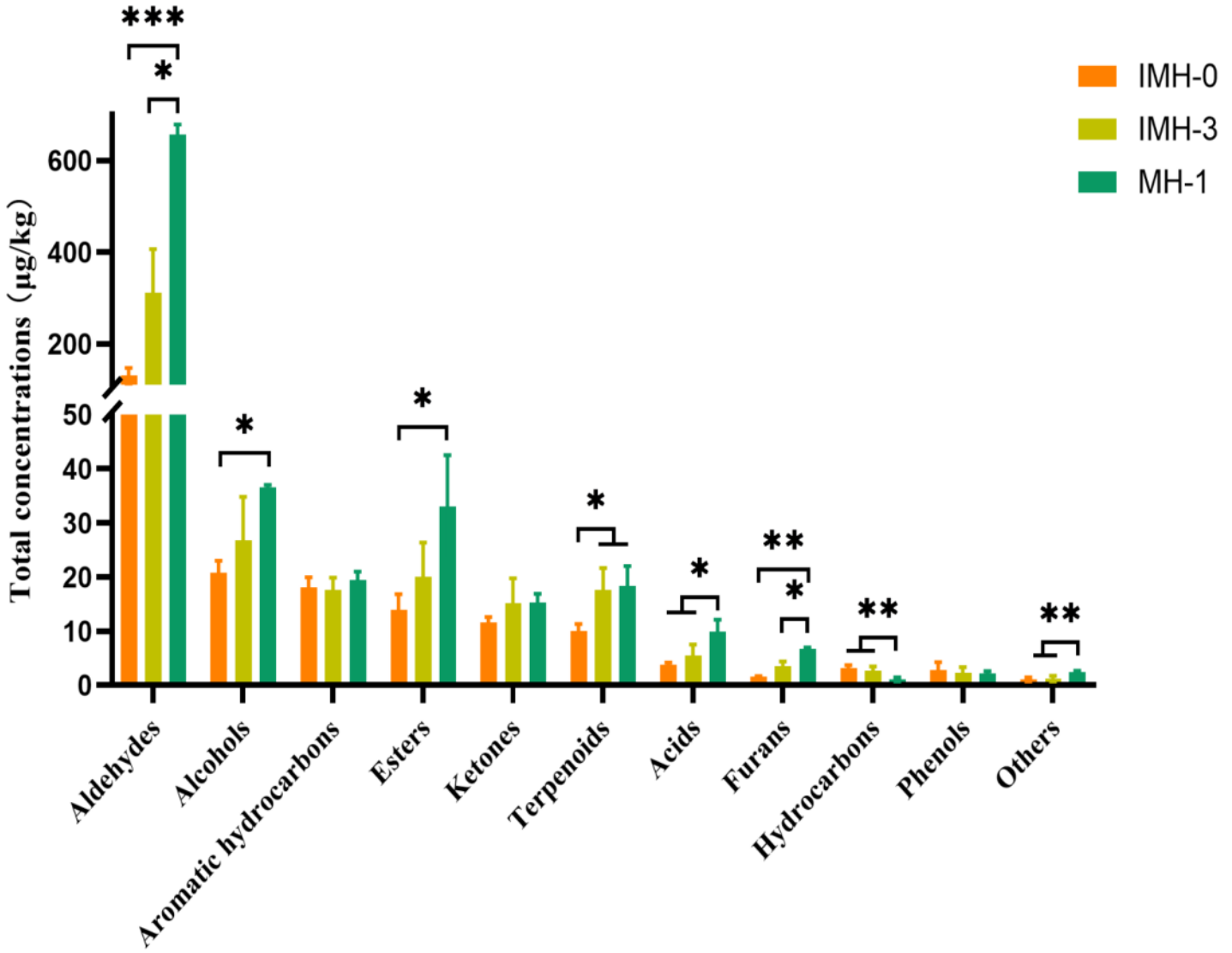
Sensory Analysis— E-tongue





E-nose and e-tongue effectively differentiate ripening stages

Identification of Volatiles



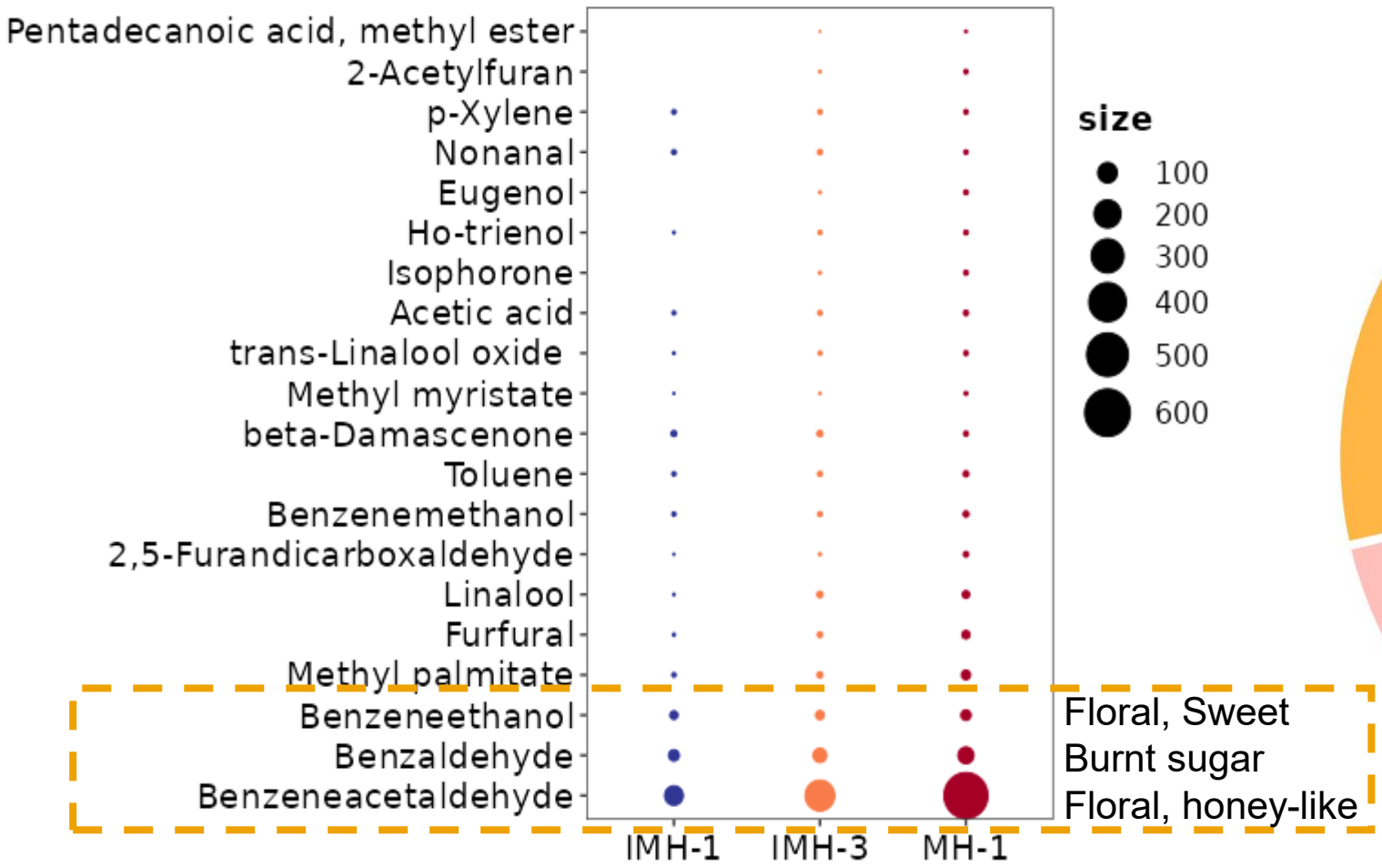
Volatile Compounds Identified

A total of **206** volatile compounds were identified, classified into 11 categories.

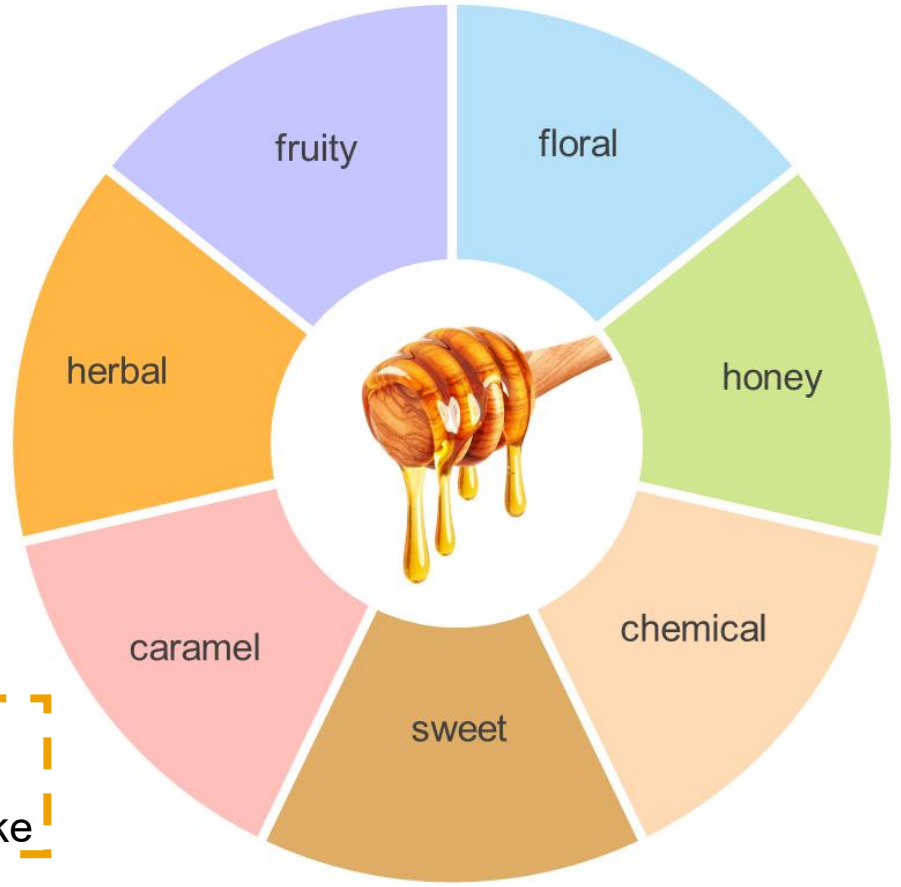
Aldehydes, alcohols, esters, terpenoids, acids, furans, and other compounds increased.

Hydrocarbons decreased.

Identification of Volatiles

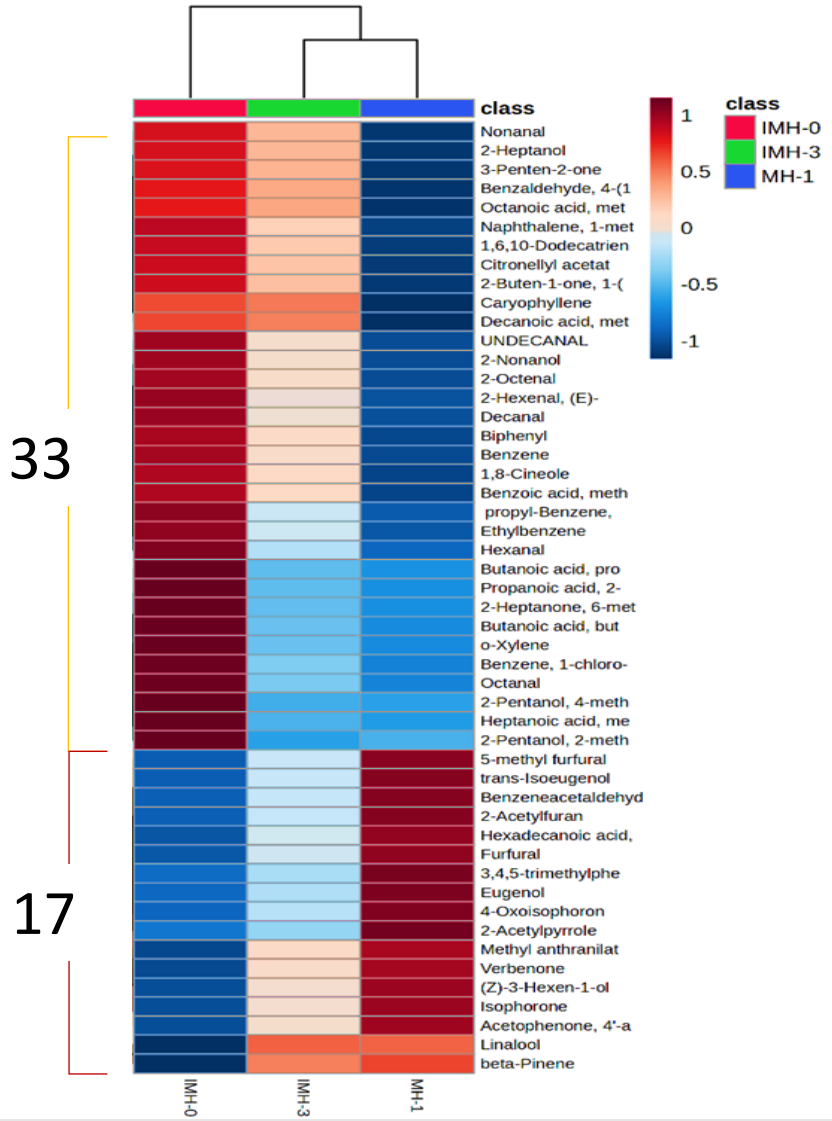


Volatile compounds abundance bubble chart



Odor

Odor-active compounds



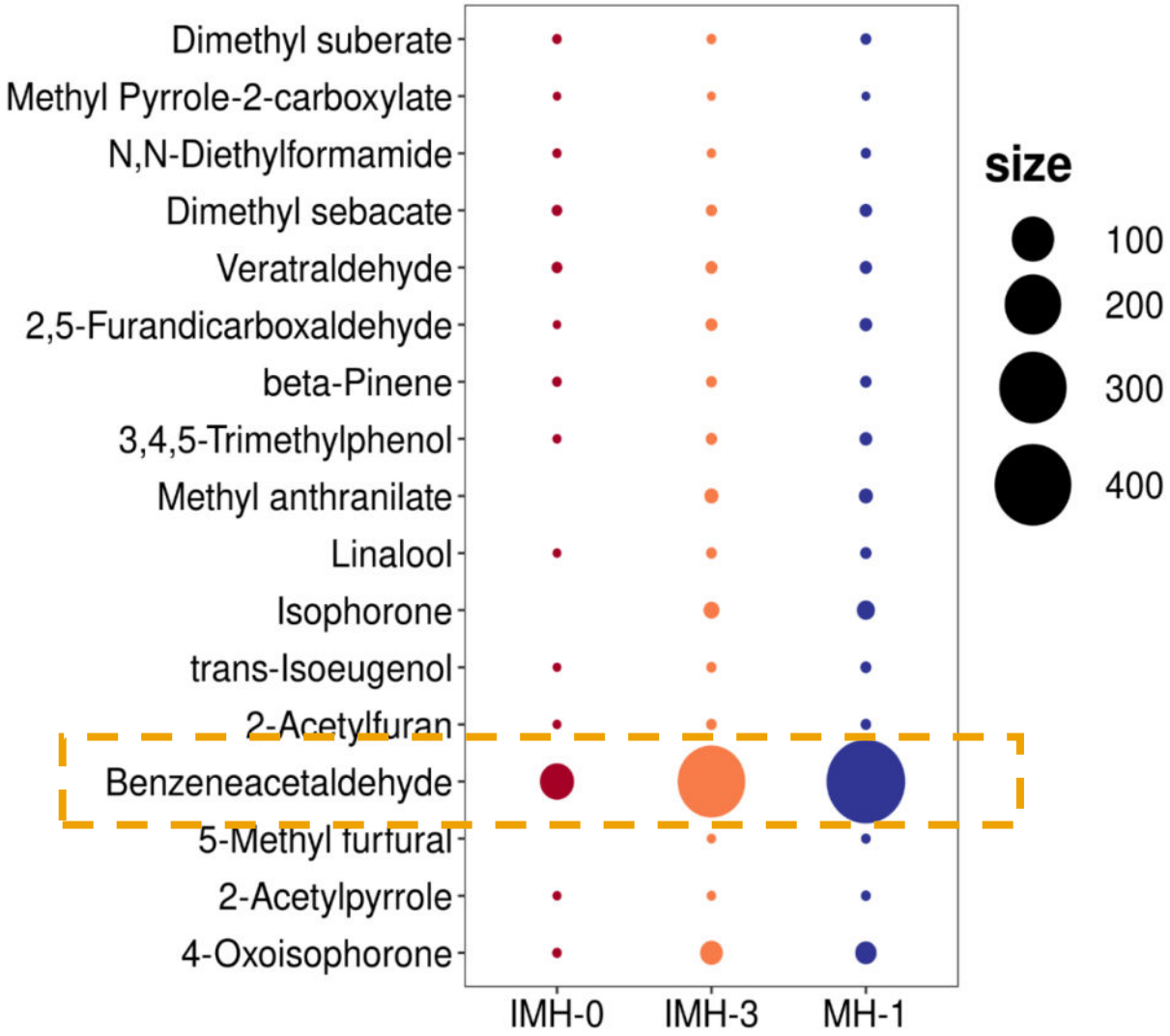
Compound OAVs (Odor Activity Value) heatmap

Odor-Active Compounds

113 compounds with odor threshold annotations

Heatmap showed top 50 differential volatile compounds in honey during the three ripening stages

Quantitative of Volatiles



Compounds content bubble chart

Concentration Changes

Quantitative analysis of the top 20 compounds with differences showed that **benzeneacetaldehyde** (BA) was the primary aromatic compound that increased during ripening.

Sources of BA in Chaste Honey

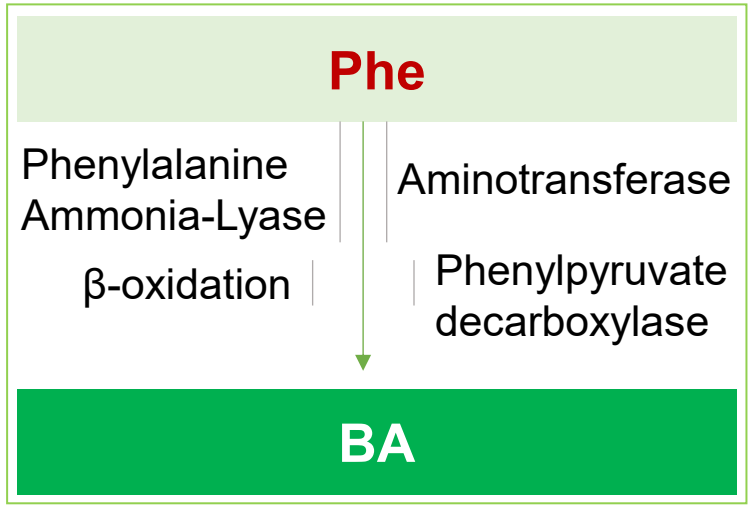
Primary Source

Enzymatic conversion of phenylalanine (Phe) from nectar in bee saliva/honey.

Directly produces honey's characteristic sweet aroma.

Enzyme-Catalyzed Biosynthesis

（enzymatic）

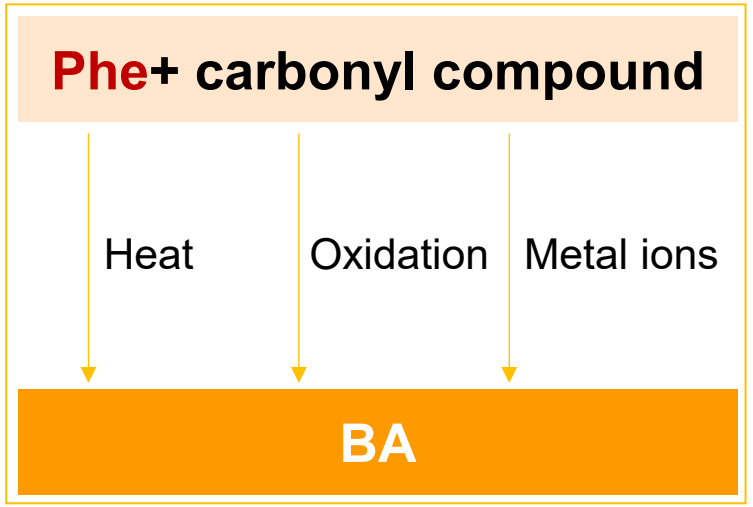


Secondary Source

Especially occurs during storage or heating.

Strecker Degradation

（Non enzymatic）



Summary of Findings

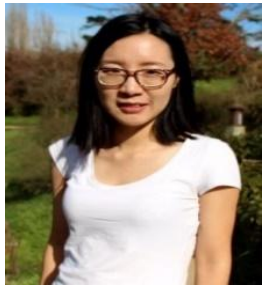
- E-nose and e-tongue were used to distinguish chaste honey at three maturity stages.
- The key volatile aromatic compounds were identified in chaste honey.
- Benzeneacetaldehyde increased most markedly during chaste honey ripening.

ACKNOWLEDGEMENT

Our lab

State Key Laboratory of Resource Insects

Quality and Risk Assessment of Bee Products



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THANKS