Initial investigation of wildflower honey using headspace solid-phase microextraction coupled with gas chromatography-mass spectrometry for geographical information

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Introduction

Honey has been used as a food, sugar substitute, and flavor enhancer forever. The uses for honey are extremely varied from food to medicine. It is widely touted that you can address seasonal allergies, especially those following a move, by eating local honey. For this to be true the composition of the local honey, including trapped pollen, would allow allergy symptoms to be eliminated. In this project, the volatile and semi-volatile aroma compounds in wild flower honey from several different locations were analyzed. Headspace solid phase microextraction (HS-SPME) coupled with gas chromatography-mass spectrometry (GC-MS) was used to help develop the characteristic flavor and aroma profiles of each honey analyzed. Then in combination with statistical analysis, such as principle component or cluster analysis, the data allowed for the characterizing of these honeys based on location. The goal of this project is to detect regional variations in honey to begin to establish the idea of terroir for honey.

Methods

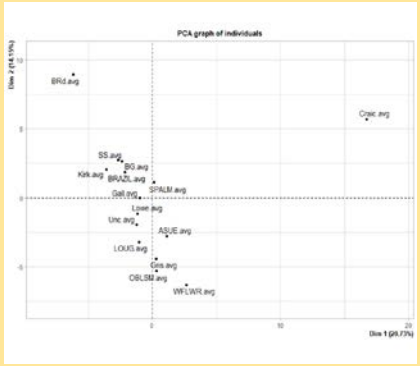
Samples were made using 5g of each honey sample along with 1g of NaCl, 5uL of water, and 50 uL of standard solution of 2-heptanol and guiacol in a 20 mL headspace vial. This mixture was heated with stirring at 45°C for 15 minutes. A divinylbenzene-carboxen-polydimethylsiloxane 50/30 µm (DVB-CAR-PDMS) SPME fiber was injected into the honey headspace for 40 minutes while the sample continues stirring at 45°C. The fiber is removed from the headspace and injected into the gas chromatography injector for two minutes. Each sample was analyzed three times. Seventeen honeys were analyzed.

Sample	ID	Identity	Locale
A	SS	Silver Spoon	Wilmington, NC
B	Beach	Beach Road	Southport, NC
C	Lowe	Lowe Honey	Southport, NC
D	GALL	Hive-Gallberry	Calabash, NC
E	SPALM	Hive-Gallberry	Southern, GA
F	BG	Bee Gee	Calabash, NC
G	SER	Kirkland	Mix
H	UNC	Uncle Jim's	Latta, SC
I	GRIS	David Grissett	Ocean Isle, NC
J	LOUG	Louisiana Gold	New Orleans, LA
K	Craic	Craic Honey Co.	Naches, WA
L	WFLWR	Wildflower Honey	Roseville, MN
M	OBLOSM	Orange Blossom	Hamptonville, NC
N	ASUE	Aunt Sue's	Sioux City, IA
O	BRAZIL	Wildflower Brazil	Brazil
P	UNC2	Uncle Jim's #2	Latta, SC
Q	Mnt2	Mountain Man #2	Conway, SC

Results

A principle component analysis (PCA) conducted on the scaled data using prcomp() in R. The compounds present in most abundance are used in this analysis by using average gas chromatogram peak height. This plot produced clustering as show in the following graph.

34.89% of variation can be explained by the first two principle components and 8 principle components are needed to explain at least 80% of the variation.



Compounds shown in 100% of the honey samples are shown in table 2.

Comparison between local honeys and non local honeys are recorded in table 2 to show differences in chemical composition in different regions.

Compound	Average Relative Area Local	Average Relative Area Non-Local
Fufural	0.266672445	0.104050961
Benzaldehyde	0.43799481	0.236560287
Octanal	0.012994086	0.008704491
2-methyl-butanal	0.02027435	0.002454768
Pentadecane	0.005327285	0.00251134

Conclusions

GC-MS was able to determine several different chemical compounds found in the wildflower honey headspace. PCA cluster analysis was helpful in differentiating the honeys from one another. The PCA however was not able to cluster the honeys by geographical location. This work however does prove the use and the potential of using HS-SPME coupled with GC-MS to find regional markers that establish the geographic location of honeys. In the future, additional honey samples regionally and nationally could show potential for geographical clustering. NMR information will also be used to further aide in cluster analysis.

References

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