

# Analysis Report Honey-Profiling™

## Sample Declaration

Sample ID: Altay  
 Customer: **KillerBee**  
 Customer Sample ID: Altay  
 Type of Sample: Honey  
 Type of Honey: Blossom  
 Botanical Variety: Sour Wood  
 Geographical Origin: USA  
  
 Measuring Date: 21-Oct-2019 02:36:37  
 Reporting Date: 21-Oct-2019 09:47:00, 9 page, Version 2.0.3

## Results Summary

Type of Analysis	Result	Status
<b>Detection of Sugar Syrups</b>	No	●
<b>Codex Alimentarius and EU-Directive 2001/110/EC</b>	Compliant	●
<b>Quantitative Analysis</b>	Typical concentrations	●
<b>Non-Targeted Analysis</b>		
Univariate Verification	Consistent	●
Multivariate Verification	Consistent	●

The data analysis is performed at Bruker BioSpin GmbH (Rheinstetten, Germany) according to testing method AA-54-03 (DIN EN ISO/IEC 17025:2005 Accreditation Certificate D-PL-19229-01-00).

## Detection of Sugar Syrups

(Analysis-ID: HO-2000-02/0167)

Following tests have been applied in order to detect sugar syrups:

Nr	Type	Description	Result	Value	Limit	Out
1	Intensity/Ratio	3.263 (absolute quantitative)	passed	542	<1279	-
2	Intensity/Ratio	5.077 (absolute quantitative)	passed	141	>39	-
3	Intensity/Ratio	3.636 (absolute quantitative)	passed	2506	<4674	-
4	Intensity/Ratio	4.262 (absolute quantitative)	passed	118	>29	-
5	Intensity/Ratio	4.195 (absolute quantitative)	passed	379	<1200	-
6	Intensity/Ratio	5.271 (absolute quantitative)	passed	33.9	>5.6	-
7	Intensity/Ratio	4.280 (absolute quantitative)	passed	69	>20	-
8	Intensity/Ratio	5.113/(3.270-3.310)	passed	0.003	<0.036	-
9	Intensity/Ratio	4.496/(3.270-3.310)	passed	0.097	>0.012	-
10	Intensity/Ratio	5.334/(5.270-5.300)	passed	0.06	<0.13	-
11	Intensity/Ratio	3.546/(5.270-5.300)	passed	0.86	>0.62	-
12	Intensity/Ratio	3.740/(5.270-5.300)	passed	1.9	>1.2	-
13	Intensity/Ratio	3.857/(5.200-5.260)	passed	0.0109	>0.0037	-
14	Intensity/Ratio	4.150 (absolute quantitative)	passed	312	>115	-
15	Intensity/Ratio	5.181 (absolute quantitative)	passed	46	>24	-
16	Intensity/Ratio	4.055/(5.030-5.070)	passed	9	<46	-
17	Intensity/Ratio	1.809/(5.030-5.070)	passed	0.1	<1.0	-
18	Intensity/Ratio	3.708/(5.030-5.070)	passed	386	<872	-
19	Intensity/Ratio	6.765/(5.250-5.270)	passed	0.012	<0.046	-
20	Intensity/Ratio	2.200/(5.305-5.315)	passed	0.314	>0.019	-
21	Intensity/Ratio	3.326/(3.270-3.310)	passed	0.177	>0.034	-
22	Intensity/Ratio	4.037/(3.270-3.310)	passed	2.06	>0.73	-
23	Intensity/Ratio	4.006/(5.270-5.300)	passed	0.87	>0.70	-
24	Intensity/Ratio	3.564/(5.270-5.300)	passed	17.4	>10.0	-
25	Intensity/Ratio	5.388/(5.370-5.400)	passed	0.24	>0.13	-
26	Intensity/Ratio	3.524/(4.075-4.110)	passed	0.062	<0.070	-
27	Intensity/Ratio	3.182/(4.075-4.110)	passed	0.0014	<0.0045	-
28	Intensity/Ratio	3.785/(4.075-4.110)	passed	0.047	>0.036	-
29	Intensity/Ratio	3.857/(4.075-4.110)	passed	0.0055	>0.0021	-
30	Intensity/Ratio	4.267/(4.970-4.990)	passed	1.4	<4.7	-
31	Intensity/Ratio	4.276/(4.970-4.990)	passed	0.3	<5.4	-
32	Intensity/Ratio	4.204/(5.090-5.110)	passed	1.6	<5.7	-
33	Intensity/Ratio	4.249 (absolute quantitative)	passed	167	<380	-
34	Intensity/Ratio	4.460/(5.030-5.070)	passed	0.02	<0.77	-
35	Intensity/Ratio	3.524/(5.250-5.270)	passed	42	<97	-
36	Intensity/Ratio	5.113/(5.250-5.270)	passed	0.02	<0.19	-
37	Intensity/Ratio	5.091/(5.090-5.110)	passed	0.33	<0.48	-
49	Quantification	Fructose/Glucose	passed	1.46	>0.85 and <1.95	-
50	Quantification	Fructose+Glucose	passed	69.3	>40	-
51	Quantification	Turanose	passed	2.00	>0.3	-
52	Quantification	DHA(D) and Mannose(M)	passed	1 / 0.012	D<30 or M<0.05	-

Nr	Type	Description	Result	Value	Limit	Out
53	Quantification	Sucrose	passed	1.7	<15	-

**Result:** There are no indications for the presence of sugar syrups.

## Codex Alimentarius and EU-Directive 2001/110/EC:

Following parameters are required according to Codex Alimentarius and EU-Directive 2001/110/EC. The concentrations are obtained by direct quantification. Parameters labelled with \* are calculated parameters.

Compound	Value	Unit	LOQ	Official Reference		
				min	max	Flag
glucose + fructose *	69.3	g/100g	20.0	60	-	●
sucrose	1.7	g/100g	0.5	-	15	●
5-hydroxymethylfurfural (HMF)	<LOQ	mg/kg	5	-	80	●

Following flags are used according to Codex Alimentarius and EU-Directive 2001/110/EC:

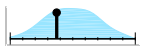
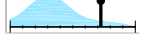



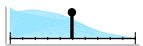
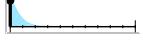
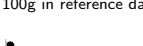



Compound	Flag	Concentration	Declaration	Interpretation
glucose + fructose	●	< 45 g/100g	All	Not compliant
		< 60 g/100g	Blossom	Not compliant for blossom honey
	●	≥ 60 g/100g	All	Compliant
	●	≥ 45 g/100g	Honeydew	Compliant for honeydew honey
sucrose	●	≥ 45 g/100g, < 60 g/100g	Unknown	Compliant for honeydew honey and blends of honeydew honey with blossom honey. Not compliant for blossom honey.
	●	> 15 g/100g	All	Not compliant
		10-15 g/100g	Acacia, Eucalyptus	Not compliant for false acacia ( <i>Robinia pseudoacacia</i> ), and red gum ( <i>Eucalyptus camadulensis</i> )
	●	≤ 5 g/100g ≤ 10 g/100g	All Acacia, Eucalyptus	Compliant Compliant for false acacia ( <i>Robinia pseudoacacia</i> ), and red gum ( <i>Eucalyptus camadulensis</i> )
HMF	●	≤ 15 g/100g 5-10 g/100g	Lavender All, except Acacia, Eucalyptus, Lavender	Compliant for <i>Lavandula</i> spp. If ≤ 15g/100g: compliant for lavender ( <i>Lavandula</i> spp.) and borage ( <i>Borago officinalis</i> ). If ≤ 10g/100g: compliant for false acacia ( <i>Robinia pseudoacacia</i> ), alfalfa ( <i>Medicago sativa</i> ), Menzies Banksia ( <i>Banksia menziesii</i> ), French honeysuckle ( <i>Hedysarum</i> ), red gum ( <i>Eucalyptus camadulensis</i> ), leatherwood ( <i>Eucryphia lucida</i> , <i>Eucryphia milliganii</i> ) and <i>Citrus</i> spp
	●	> 80 mg/kg	All, except Industrial honey	Not compliant, except for baker's honey
HMF	●	≤ 40 mg/kg	All	Compliant
		> 80 mg/kg	Industrial honey	Compliant for baker's honey
	●	40-80 mg/kg	All	Not compliant, except for baker's honey and honeys of declared origin from regions with tropical climate and blends of these honeys

## Quantitative Analysis

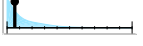

(Analysis-ID: HO-Q/1363)

In the following table the results of the quantitative analysis are given. The concentrations are obtained by direct quantification. Parameters labelled with \* are calculated parameters. The reference range is derived from the *Blossom* samples in the Honey-Profiling Database. The reference range bases on 13212 samples.

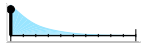



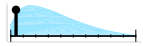



### Sugars:

Compound	Value	Unit	LOQ	Reference Range	Flag
glucose + fructose *	69.3	g/100g	20.0	60.9  83.5	●
fructose / glucose *	1.46	-	-	0.93  1.66	●
fructose	41.1	g/100g	10.0	33.5  47.6	●
glucose	28.1	g/100g	10.0	24.9  40.7	●
sucrose	1.7	g/100g	0.5	<0.5  5.6	●
turanose	2.0	g/100g	0.2	0.4  2.9	●
maltose	2.1	g/100g	0.5	<0.5  3.8	●
melezitose	<LOQ	g/100g	1.0	<1.0  1.7	●
maltotriose	<LOQ	g/100g	1.0	<1.0 g/100g in reference dataset	●
gentiobiose	<LOQ	g/100g	0.3	<0.3  0.4	●
raffinose	0.2	g/100g	0.1	0.1  0.6	●
mannose	<LOQ	g/100g	0.05	<0.05  0.07	●



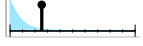


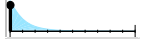


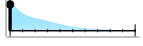
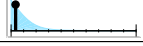
### Acids:

Compound	Value	Unit	LOQ	Reference Range	Flag
citric acid	83	mg/kg	50	<50  579	●
malic acid	<LOQ	mg/kg	100	<100  569	●
quinic acid	<LOQ	mg/kg	300	<300 mg/kg in reference dataset	●






**Amino Acids:**

Compound	Value	Unit	LOQ	Reference Range	Flag
alanine	<LOQ	mg/kg	5	<5  73	●
aspartic acid	<LOQ	mg/kg	150	<150  216	●
glutamine	<LOQ	mg/kg	200	<200  293	●
leucine	<LOQ	mg/kg	40	<40  132	●
proline	229	mg/kg	150	192  1059	●
valine	<LOQ	mg/kg	10	<10  51	●
tyrosine	<LOQ	mg/kg	50	<50  841	●
phenylalanine	<LOQ	mg/kg	100	<100  1483	●

**Indicators for Fermentation, Processing and Origin:**

Compound	Value	Unit	LOQ	Reference Range	Flag
2,3-butanediol	<LOQ	mg/kg	20	<20  122	●
5-hydroxymethylfurfural (HMF)	<LOQ	mg/kg	5	<5  59	●
acetic acid	29	mg/kg	10	<10  86	●
acetoin	<LOQ	mg/kg	20	<20  68	●
ethanol	<LOQ	mg/kg	5	<5  295	●
lactic acid	11	mg/kg	10	<10  357	●
formic acid	191	mg/kg	5	<5  369	●
fumaric acid	<LOQ	mg/kg	5	<5  13	●
pyruvic acid	<LOQ	mg/kg	10	<10  38	●
succinic acid	13	mg/kg	5	<5  214	●

## Markers:

Compound	Value	Unit	LOQ	Reference Range	Flag
3-phenyllactic acid	<LOQ	mg/kg	300	<300  791	●
dihydroxyacetone (DHA)	<LOQ	mg/kg	20	<20  633	●
methylglyoxal (MGO)	<LOQ	mg/kg	30	<30  309	●
kynurenic acid	<LOQ	mg/kg	60	<60  122	●
shikimic acid	<LOQ	mg/kg	80	<80  261	●

## Guidelines for Interpretation

- Mannose is a mono saccharide not typical for honey but that is regularly found in industrial syrups. In rare cases, however, the presence of mannose cannot be excluded for certain geographic and/or botanical origins, e.g. for honey containing also honeydew. For blossom honey, a concentration of mannose exceeding 0.05 g/100g could indicate addition of syrup or types of industrial processing which are not suitable for honey. Expert interpretation is suggested in case the presence of mannose.
- Dihydroxyacetone and/or methylglyoxal are only typical for Manuka honeys from Ozeania. Occurrence exceeding 30 mg/kg in other types of honey is not typical and could indicate addition of syrup or types of industrial processing which are not suitable for honey; expert interpretation is needed in such cases.
- For monofloral Manuka honey, the concentration of 3-phenyllactic acid should exceed 400 mg/kg.
- Low concentration values of proline (less than 180 mg/kg) could indicate addition of syrup or usage of unripe honey.
- Concentration of ethanol exceeding 400 mg/kg indicates fermentation.
- The presence of kynurenic acid is common for chestnut honey.
- The presence of gentiobiose is common for Linden Tree honey.
- The presence of shikimic acid is common for honeydew.
- The presence of quinic acid is common for honeydew.

## Non-Targeted Verification Analysis

### Univariate Verification

(Analysis-ID: HO-2102-01/0031)

**Applied Model:** Blossom

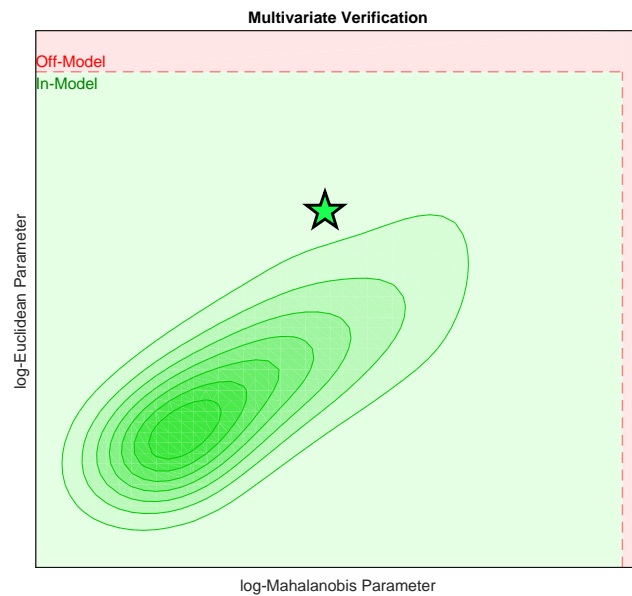
**Result:** No deviation was detected in univariate verification (In-Model).

### Multivariate Verification

(Analysis-ID: HO-2102-01/0031)

**Applied Model:** Blossom

**Result:** No deviation was detected in multivariate verification (In-Model).





## General Remarks

### Analysis of declared Information

The test applied is a classification analysis with the aim to check the consistency of the declared meta-information of the sample (geographical origin or botanical variety). The consistency with a group is expressed as posterior probability in the range from 0% to 100%. A posterior probability exceeding 50% is being regarded as consistent with the respective group. The underlying statistical models are based on Linear Discriminant Analysis for dimension reduction followed by a Linear (or Quadratic) Discriminant Analysis for final classification.

Within the discrimination space figure, the ellipsoids are representing the modeling samples and the star represents the actual sample under investigation.

Expert interpretation is necessary before deducing any conclusions.

### Quantitative Analysis

Quantitative values are compared to the reference honey database (visualised by distribution). Deviations to the reference distributions do not necessarily indicate an adulteration. Fermentation or specific botanical varieties can also create deviations. Therefore, expert interpretation is necessary before deducing any conclusions.

### Non-Targeted Verification Analysis

Verification models are non-targeted analyses comparing the whole NMR-Profile of a specific sample with one corresponding group of reference spectra (database). All spectra data points are taken into account irrespective of whether the signals are caused by already identified molecules or not.

There are different possible reasons for any deviation from the group of reference spectra. If there are detected deviations, this does not automatically mean, that the sample is adulterated. Expert interpretation is necessary before deducing any conclusions.

In the univariate analysis, the NMR spectrum is checked for any unusual low or high signal intensities for a given sample, while taking into account the natural variability of a respective reference group. Multivariate models also take into account the relation between different signals in the NMR spectrum.