



Resin, Rosin or Flower?

An investigation of the aroma profiles of cannabis products

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In the last few years, cannabis products beyond flower have seen a massive increase in popularity. In particular, live resin, an extract obtained from extraction of cannabinoids, terpenes, and other compounds via the use of a solvent such as butane, have become a mainstay due to the rise of vaping devices. More recently, rosin, which is the pressed extract of flower typically under heat, is an up-and-coming form of consumption for cannabis connoisseurs. These different cannabis products can have different aroma and flavor properties depending on method of production and therefore provide the opportunity for users to experience different flavors and aromas for the same cultivar.

To understand the differences between different cannabis products, we conducted a study aimed at determining how the aroma and flavor profiles of the cultivar Tropicaya changes using 2-dimensional gas chromatography coupled with mass spectrometry and a flame-ionization detector (GCxGC-MS/FID). This technique allows us to easily differentiate compounds in 2-dimensional chromatographic space resulting in much greater separation compared to traditional analytical methods and therefore accuracy when quantifying and identifying compounds in the samples.

Tropicaya is a cross between Tropicana Cookies and Papaya. The latter parent is well known for the intense fruity, exotic notes it presents, while the former is citrus heavy with the common notes of Cookies-derived cultivars. We measured the aroma profiles of three different product states: Flower, live resin, and rosin. In general, the aroma profiles appear roughly similar in their presentation – i.e., the top terpenes are similarly distributed. However, we find that the relative amounts of each create uniquely different aromas and flavors for each product. Additionally, we find small differences in key flavorant compounds that also have an impact on the aromas of the products. These results indicate that the various states of cannabis can produce markedly different aromas and therefore effects upon consumption.



Comparison of top terpenes

Our analysis provides a plethora of data. In the 2-Dimensional chromatogram of the flower Tropaya sample, each spot or streak represents a single compound that we can then identify using mass spectrometry, and then quantify using flame ionization. To obtain accurate quantitation we used a 60+ compound analytical standard that contains terpenes, sesquiterpenes, monoterpenoids, sesquiterpenoids, and flavorants with various functionality such as esters, alcohols, and ketones. We will first start with comparing the top terpenes in a flower, rosin, and live resin sample of Tropaya.

The top terpenes generally follow the same trends, with β -Caryophyllene dominating the aroma profile. However, changes are seen when comparing the live resin and rosin with the flower data: In the rosin sample, we see a ~2% decrease in both β -Caryophyllene and β -Myrcene levels, followed by a large ~6% increase of relative concentration of D-Limonene. This large change leads to the rosin sample taking on a more citrusy aroma and flavor, while the flower tends to present a muskier, woodier aroma. This change in D-Limonene concentration is even more pronounced in the live resin product, where it has an approximate 13% increase compared to the flower. When smelled by five flavorists, they ranked the live resin to be most citrus heavy, followed by the rosin, and last the flower, confirming the trends observed in the data.

These changes are important as they may also have slight modifications on the effects of the products, as many of these terpenes are suggested to have beneficial synergistic effects with THC and/or CBD.¹ For instance, β -Myrcene is often considered to possess sedative effects, and is typically the major terpene in cultivars derived from the OG family. As the live resin product has less of this specific terpene, it may have slightly less sedative effects when compared to the others. On the other hand, the slight increase in Linalool (+1.07%) may slightly counter this change, while adding additional floral flavors. Regardless of the changes on effects, the aroma will undoubtedly be modified.

References:

1. Russo, E. B. Taming THC: potential cannabis synergy and phytocannabinoid-terpenoid entourage effects. *Br. J. Pharmacol.* **2011**, 163, 1344-1364.



Lastly, we note that the lower D-Limonene in the flower relative to the other two products tends to result in a softer aroma on the nose, as well fewer top notes for the flavor. The higher β -Caryophyllene and β -Myrcene, which do not have as sharp aromas as D-Limonene, create a more nuanced aroma that allows some of the compounds that create sweet notes to come through more easily. These include the compounds isobutyl hexanoate and isopropyl butyrate. The former is known to possess a sweet, fruity, tropical aroma while the latter is described as ripe pineapple. Isopropyl butyrate is found in numerous fruits, including apple, banana, papaya, and passion fruit. Isobutyl hexanoate is also found in fruits, including apple, banana, and grapes. These two compounds help add the sweet, fruity notes found in Tropaya.

We find that the Tropaya flower has the highest relative concentration of isobutyl hexanoate at ~0.96%, whereas the rosin and live resin samples have ~0.46% and ~0.49%, respectively. Additionally, isopropyl butyrate also sees decreases in relative concentrations for both rosin and live resin relative to the flower sample. These results show that although rosin and live resin still retain the compounds found in the native flower, they tend to have decreased concentrations. These lower concentrations for the rosin and live resin result in slightly different fruity undertones in their flavors and aromas.

As the flower sample has higher amounts of these flavor compounds as well as a more well rounded nose compared to the live resin and rosin, these fruity notes may be more distinguishable. Nonetheless, this is not indicative of lower quality; rather, it is simply a preference towards a given aroma profile. These data show that different cannabis products can have different aromas, even for the same cultivar. This difference provides options for consumers when searching for their preferred flavors and aromas of their different consumable products.



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Introduction

In the last few years, cannabis products beyond flower have seen a massive increase in popularity. In particular, live resin, an extract obtained from extraction of cannabinoids, terpenes, and other compounds via the use of a solvent such as butane, have become a mainstay due to the rise of vaping devices. More recently, rosin, which is the pressed extract of flower typically under heat, is an up-and-coming form of consumption for cannabis connoisseurs. These different cannabis products can have different aroma and flavor properties depending on method of production and therefore provide the opportunity for users to experience different flavors and aromas for the same cultivar.

To understand the differences between different cannabis products, we conducted a study aimed at determining how the aroma and flavor profiles of the cultivar Tropicana changes using 2-dimensional gas chromatography coupled with mass spectrometry and a flame-ionization detector (GCxGC-MS/FID). This technique allows us to easily differentiate compounds in 2-dimensional chromatographic space resulting in much greater separation compared to traditional analytical methods and therefore accuracy when quantifying and identifying compounds in the samples.

Tropicana is a cross between Tropicana Cookies and Papaya. The latter parent is well known for the intense fruity, exotic notes it presents, while the former is citrus heavy with the common notes of Cookies-derived cultivars. We measured the aroma profiles of three different product states: Flower, live resin, and rosin. In general, the aroma profiles appear roughly similar in their presentation – i.e., the top terpenes are similarly distributed. However, we find that the relative amounts of each create uniquely different aromas and flavors for each product. Additionally, we find small differences in key flavorant compounds that also have an impact on the aromas of the products. These results indicate that the various states of cannabis can produce markedly different aromas and therefore effects upon consumption.

Cultivar Overview

Cultivar **TROPAYA**

Flavors



Image Source: Fresh Baked Boulder; <https://www.freshbakedboulder.com/product/tropaya-p/>

Tropaya is a cross between **Tropicana Cookies** and **Papaya**. The latter parent is well known for the intense fruity, exotic notes it presents, while the former is citrus heavy with the common notes of Cookies-derived cultivars. We measured the aroma profiles of three different product states: **Flower, live resin, and rosin**. In general,

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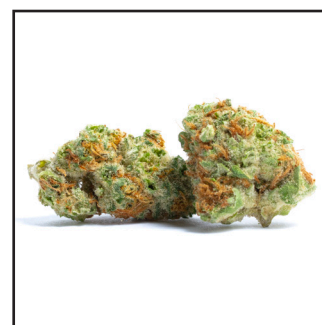


Cultivar **TROPICANA COOKIES**

Flavors



+



Cultivar **PAPAYA**

Flavors



Types of Cannabis Products Analyzed

FLOWER



- Most common form of consumption
- Intrinsically possesses Full Spectrum aroma, effects, and flavors
- Can lose aroma over time more quickly than other products

LIVE RESIN



- Popular form in vaping applications
- Can have different aroma profiles from flower due to extraction methodologies
- Preserves aroma well over time

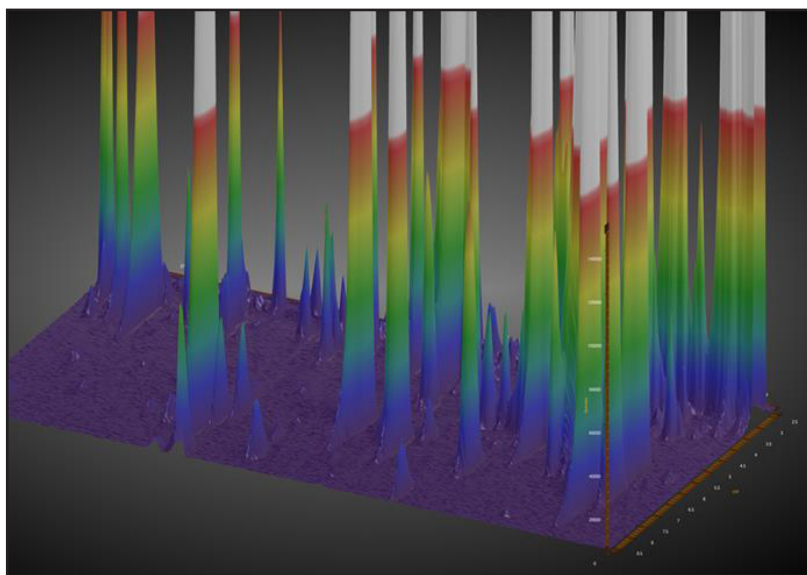
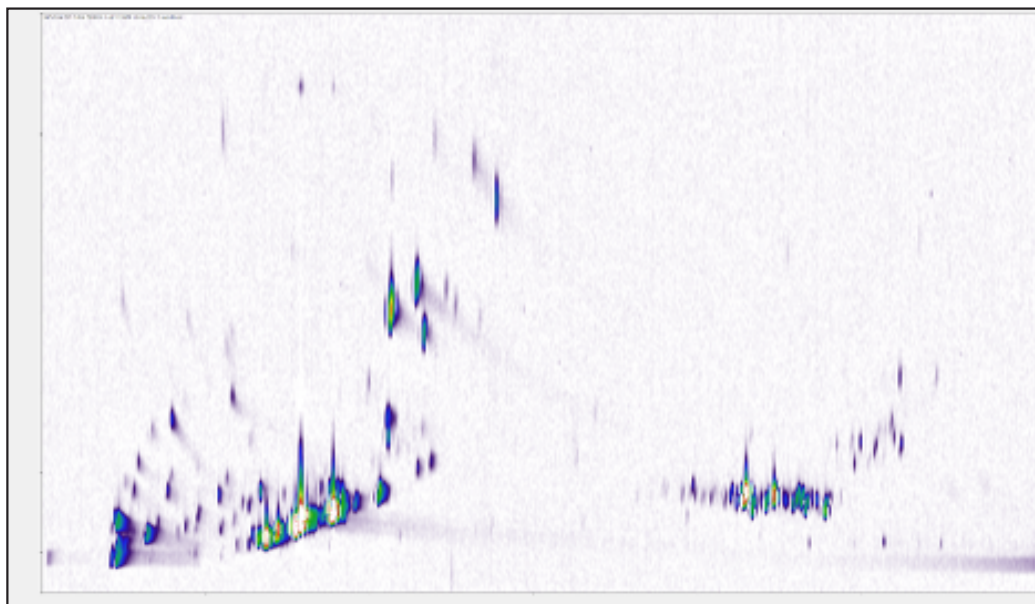
ICE HASH ROSIN



- Up-and-coming form of consumption for connoisseurs
- Can have unique aroma profiles relative to flower depending on method production
- Preserves aroma well over time

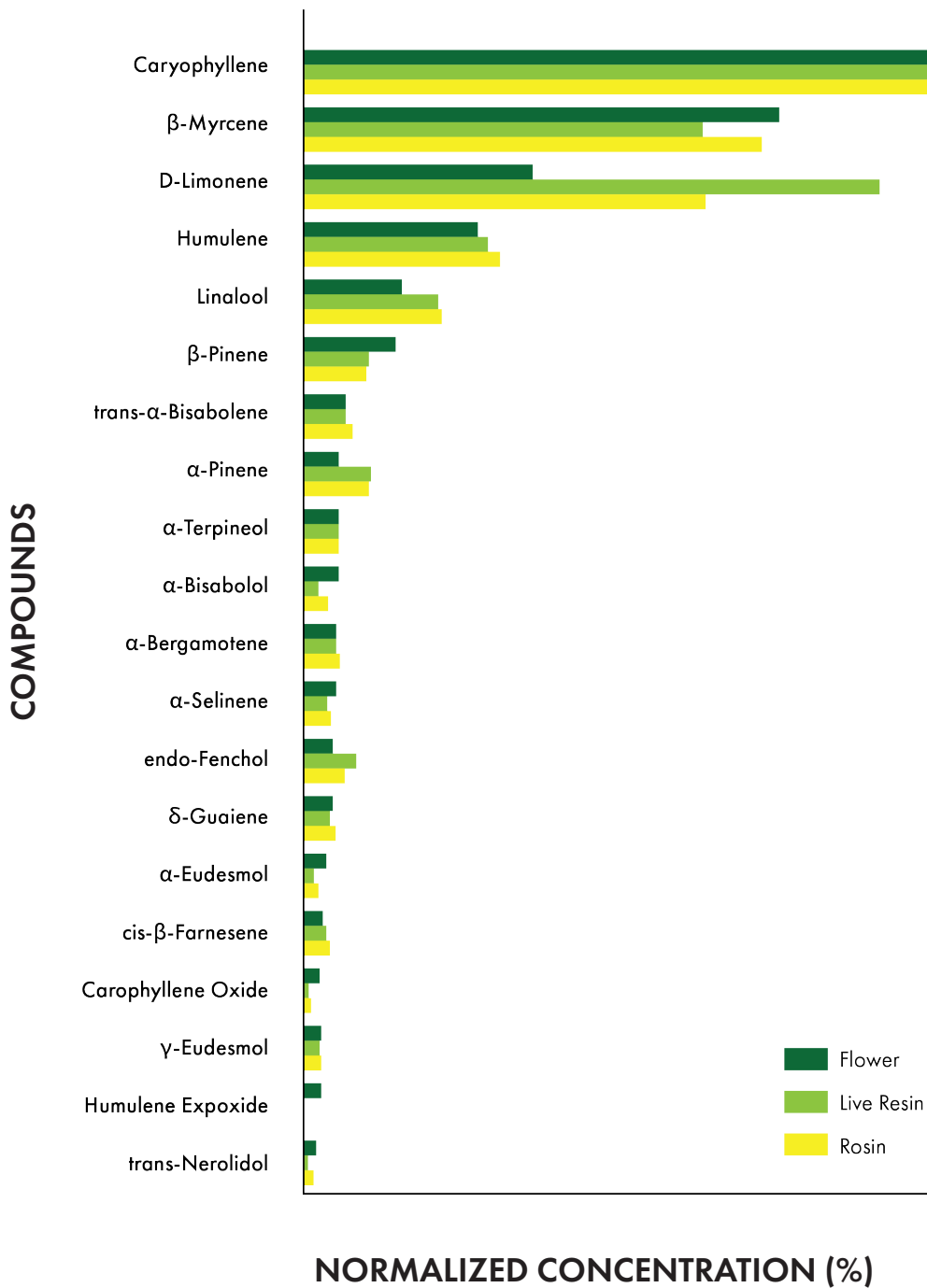
Technical Process: GCxGC—MS/FID

2-Dimensional gas chromatogram of Tropaya flower sample. Each spot or streak represents a single compound that can be identified using mass spectrometry, and then quantify using flame ionization (GCxGC—MS/FID).



Using 3-dimensional models, we can discriminate between many similar compounds and accurately quantify them. Shown to the left is a 3D view of a section of the GC chromatogram of Tropaya. The terpene region reigns over the others with domineering intensity, yet with this 3D view we are able to accurately identify low concentration compounds that are difficult, if not impossible, to identify via 1DGC systems.

Top 20 Compounds: Flower, Resin, Rosin



Top 5 Compounds: A Closer Look

COMPOUND	FLOWER AROMA-%	LIVE RESIN AROMA-% (Δ)	ROSIN AROMA-% (Δ)
β-Caryophyllene	26.32	24.35 (-1.97)	24.77 (-1.55)
β-Myrcene	20.06	15.48 (-4.59)	18.07 (-1.99)
D-Limonene	9.51	22.42 (+12.91)	15.85 (+6.34)
Humulene	7.39	7.12 (-0.26)	7.73 (+0.34)
Linalool	4.12	5.19 (+1.07)	5.41 (+1.29)

FLOWER

Muskier,
woodier aroma 


LIVE RESIN

~13%↑ D-Limonene

Citrus heavy 

ROSIN

~2%↓ Carophyllene
~2%↓ β-Myrcene
~6%↑ D-Limonene

More citrusy 

These changes are important as they may also have slight modifications on the effects of the products, as many of these terpenes are suggested to have beneficial synergistic effects with THC and/or CBD.¹ For instance, β-Myrcene is often considered a sedating terpene, and is typically the major terpene in cultivars derived from the OG family. As the live resin product has less of this specific terpene, it may have slightly less sedating effects when compared to the others. On the other hand, the slight increase in Linalool (+1.07%) may slightly counter this change, while adding additional floral flavors. **Regardless of the changes on effects, the aroma will undoubtedly be modified.**

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Sweet Factor

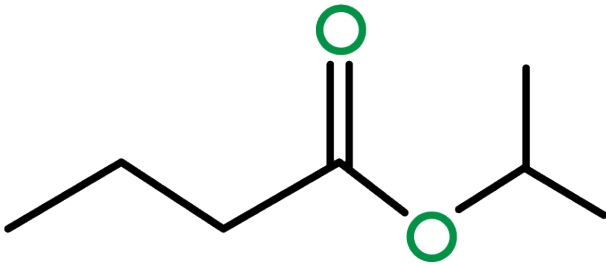
FLOWER



Lower amounts of Limonene, which has a sharp aroma, and higher amounts of β -Caryophyllene and β -Myrcene create a more nuanced aroma. It allows the sweet notes to come through more easily, creating a softer aroma.

↓ Limonene
↑ β -Caryophyllene
↑ β -Myrcene =  **Sweeter and softer aroma**

These two compounds that help add the sweet, fruity notes found in Tropaya.



ISOPROPYL BUTYRATE

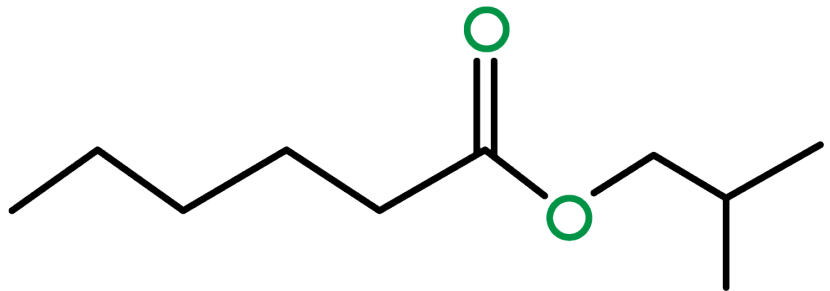
Flavor
Sweet
Fruity
Ripe

Found In
Apple
Apricot
Banana
Papaya

ISOBUTYL HEXANOATE

Flavor
Sweet
Fruity
Pineapple
Tropical

Found In
Apple
Banana
Grape



Conclusion

As the flower sample has higher amounts of these flavor compounds as well as a more well rounded nose compared to the live resin and rosin, these fruity notes may be more distinguishable. Nonetheless, this is not indicative of lower quality; rather, it is simply a preference towards a given aroma profile. **These data show that different cannabis products can have different aromas, even for the same cultivar.** This difference provides options for consumers when searching for their preferred flavors and aromas of their different consumable products.



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