The Signature Series

THE ORIGINAL

JACK HERER®

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INTRODUCTION

The cannabis industry has a serious problem...

Imagine you try Coca-Cola for the first time. Then you walk across the street and buy it again, but now it tastes *completely different*. The first one was great, the other was horrible. Would you gamble and buy that soda again not knowing which experience you're going to get? Do you know which one is authentic?

This is the state of cannabis in 2022.

For a whole host of reasons, the cannabis industry is still in its infancy. The scenario outlined is silly for most of us. If we buy a Coke in Texas, we all expect it to taste the same as a Coke in California - *that's just how it works.* But if you buy Jack Herer in one dispensary and then again in another dispensary, you're probably going to wind up with two very different products.

The industry is flooded with knockoffs.

Just because a product has a strain name on it does not mean that it's representative of the actual strain itself. There are no regulatory bodies or labs testing to ensure that the product in your hand matches the strain it's supposed to represent.

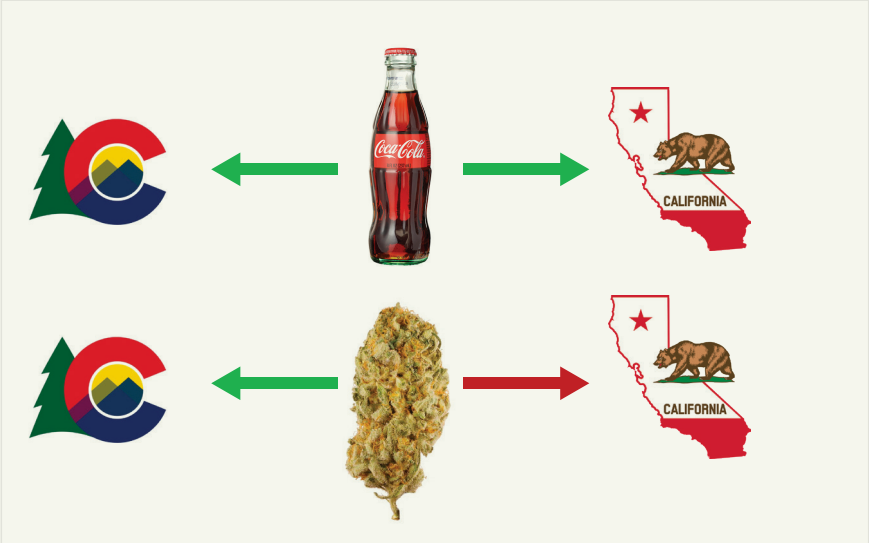


Figure 1. Coke has the same great taste in both Colorado and California, but do cannabis products produced in these two states have the same flavors, aromas, and effects?

This is an all-around loss for everyone involved. For cultivators, having somebody else sell products with your name on it is completely diminishing your brand. It doesn't represent the love, money, and time that you've invested into creating a product that others are then poorly copying and profiting from. Consumers have no easy way of knowing if their experience is authentic or repeatable. They could buy a product with your name on it and have an awful experience which tarnishes your reputation even though they've never actually tried the real thing. Some two-bit knockoff has ruined your brand and your reputation with just one sale.

Even worse, it's not just the cheap counterfeits that are filling dispensary shelves. There is only *one* terpene company in the United States who is licensed to study, extract, and formulate terpene profiles completely in-house. **Every other terpene company** is relying on a third-party lab to perform analytics with questionable and varying degrees of quality. And, unless they're working directly with the original cultivator themselves, all of those third-party labs are analyzing a knockoff so that they can create a knockoff of a knockoff. It's all just a cheap joke and it hurts the cannabis industry as a whole.

Consumers have no easy way of knowing if their experience is authentic or repeatable.

We need a monumental shift.

A change that cements the future for both brands and consumers alike. People need to be able to have consistent and repeatable experiences regardless of where they shop. Cultivators need to take control of their brand and reputation without suing everyone into oblivion, wasting more time and money in the process. It all changes today.

INTRODUCING

ABSTRAX Signature SERIES

The Signature Series represents a new age of cannabis.

We set out to accomplish four things:

1. Work directly with the best cultivators to create the signature version of their flower's terpene profile based off of our industry-leading analytics and the cultivar's (strain's) unique metabolite fingerprint.

2. Give cultivators the opportunity to capture lost revenue and grow their brand by licensing their own signature profile to other companies looking to sell their infamous products.

3. Give consumers the opportunity to experience legendary cannabis strains as they were intended regardless of where they choose to shop.

4. Give 3rd-party companies the opportunity to sell 100% authentic products through a limited licensing agreement without expensive, complicated, and drawn out legal battles.

For cultivators, it doesn't cost a dime to engage with us and develop your own signature profile. This is your opportunity to define exactly what your product *is* and then capitalize upon it. For brands looking to sell these strains, you're supporting the community just by purchasing these products. You're allowed to use the strain name through a limited licensing agreement simply by purchasing the product from us. No complicated paperwork, no legal headaches. And, by purchasing, you've opened a downstream opportunity for broader collaborations between your brands - further strengthening the ties between our industry.

BRANDS HAVE EXISTED. TERPENES HAVE EXISTED.

Why is this new?

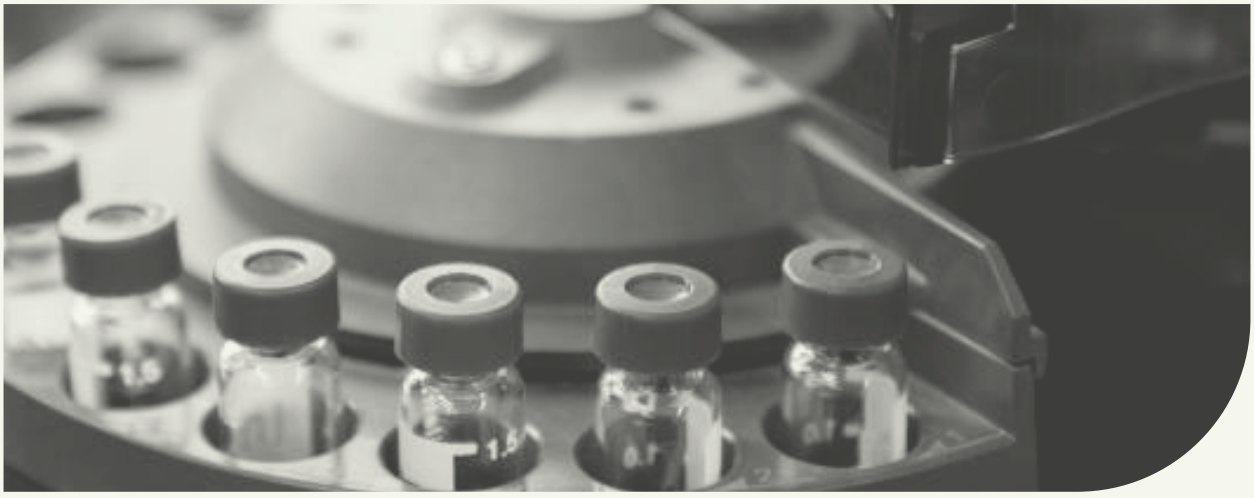
Abstrax TECH

These are the *next-generation* of terpene profiles.

To get specific: the Signature Series features *advanced terpene profiles* built upon the most detailed cannabis analytics in the world. In fact, they go way beyond terpenes with the inclusion of the "gas compounds" (cannasulfur compounds, CSCs) that Abstrax recently discovered and published in a breakthrough discovery.[1] Meaning that if the flower sample contains CSCs, then our Signature Series products will also contain CSCs to impart that gassy, skunky flavor and aroma that matches exactly with the flower's fingerprint.

Abstrax is the only terpene company on the planet capable of deciphering the complexity of cannabis. Using 2-dimensional gas chromatography, GC×GC, combined with our proprietary technology, allows us to test for well over 400 compounds found in cannabis. Other labs test for 40-50 compounds at most. Even then, how do we know the compounds they are testing for are relevant to cannabis? It's like using an electron microscope versus a magnifying glass. As a result, we can study *and* recreate cannabis with greater precision and more accuracy than anyone else in the world.

This opportunity just wasn't possible until now. The technology simply didn't exist.



So not only are we imparting terpene profiles with CSCs in the same ratios found in cannabis, but we are able to analyze the flower at a degree that's been unheard of until now. The result is an *advanced terpene profile* that is identical to the source material and then refined through collaboration between Abstrax and the original cultivator themselves. As you'll see later in the paper, we analyzed Jack Herer terpene profiles from our top 3 competitors to see just how close their formulations are to the real thing. The results are, well...

WITH GREAT POWER COMES...

Abstrax TECH

When it comes to cannabis, there aren't many people who haven't heard the name Jack Herer.

Figure 2. Jack Herer inflorescence.

Jack Herer **(Figure 2)** is a famous and ubiquitous cannabis sativa cultivar. It was named eponymously to honor the late Jack Herer, the godfather of modern hemp and one of the most important activists in promoting cannabis deregulation.

This variety produces immense buds that are infamous for the energetic and focused effects they produce. Sensei Seeds first bred Jack Herer in the 90's by combining a Haze cultivar with Northern Lights #5 and Shiva Skunk. Although technically only 55% sativa by the phenotypic classification of its lineage, it is known to produce tried and true euphoric, cerebral, and uplifting effects which easily classify it as a sativa.

In addition to predictable effects, Jack Herer is also legendary for its aroma. The scent is described as bright, woody, and citrusy, but what is it that makes Jack so unique? Below we describe some of the attributes of the chemical profile of Jack Herer flower and what makes it so distinctive. We then compare and contrast how our sophisticated data-driven blend development outperforms other terpene company's attempts when replicating the aroma and flavor of this cultivar.

THE MOTH AND THE FLAME

Abstrax TECH

The ubiquity of Jack Herer in the cannabis community has led many cannabis flavor development companies to try and replicate its unique scent and flavor. Nearly every institution developing terpene profiles will have a Jack, or Jack-like product. But how similar are they to the real thing, and how does the Signature Series shape up next to them? Further, are they even sourcing authentic samples of Jack Herer, if they are measuring actual cannabis samples in the first place?

In an industry plagued with knockoffs that are renamed for more marketability to help commercial appeal, it is vital to ensure the flower or extract we are basing our blends upon is an authentic sample from a reliable source.

Figure 3. Schematic showing the workflow of replicating blends as closely as possible to the original genetic source.

To answer this question, we procured three samples of Jack Herer botanical terpene blends from three separate terpene companies, as well as the original Jack Herer flower from the Jack Herer Group. We then developed our own Signature Series blend in-house using the data acquired from our GC×GC experiments on the original flower. This process was very iterative, as are all projects we undertake to attain biomimicry of the flavor and aroma as closely as possible. Our process is shown schematically in **Figure 3.**

Figure 4. The final Signature Series blend is, by far, the closest representation of the original flower sample.

This process begins with procuring genetics that are truly representative of their name. We work diligently with those who are close to the original genetic source as possible, ensuring that the samples we measure are representative of the original cut and were properly grown and cured. We also screen the samples by age, ensuring that the samples we measure are as fresh from cure as possible. From here, we measure the aroma and flavor properties of the sample on our GC×GC instrumentation. After analyzing the data, we then create an initial blend formulation. This blend formulation is then run on our GC×GC instrumentation and compared with the original data of the flower. From here, we adjust the blend as necessary to minimize differences between the flower sample and the blend formulation as much as possible. After several iterations, the samples are tested by our expert sensory panel to determine how closely the aroma and flavor matches the flower. Once a formulation passes these strict criteria, it is approved as a finalized Signature Series blend – the closest to the original flower sample on the market.

THE ONE TRUE JACK

Comparing the Signature Series against three competitor "Jack Herer" Blends

Abstrax TECH

As mentioned previously, we procured three other competitor "Jack" blends to compare against our Signature Series *and* the original Jack Herer flower itself. We measured their blends – in the exact same way we did ours – as well as the original flower. The results were astounding, if not enlightening.

We've discovered that there are four key terpenes that are largely responsible for the distinctive flavor and aroma of Jack Herer. Of those four critical terpenes, all three of our top competitors are completely missing at least half of them **(Table 1.)** To compensate for this shortcoming, each competitor has overcorrected by drastically spiking their percentage of Terpinolene and d-Limonene.

SAMPLE / BLEND	TERPINOLENE	D-LIMONENE	ß-PHELLANDRENE	TRANS-ß-OCIMENE
Jack Herer Flower	34%	2%	9%	9%
Signature Series	36%	2%	7%	8%
Competitor 1 Blend	40%	11%	0%	0%
Competitor 2 Blend	53%	14%	0%	0%
Competitor 3 Blend	52%	8%	0%	0%

Table 1. Jack Flower & Blend Data for Key Terpene Concentrations.

To go even further, when we analyze the top 10 most dominant terpenes found within the authentic Jack Herer flower sample:

Competitor 1
missing 4 out of 10.

– 40% –

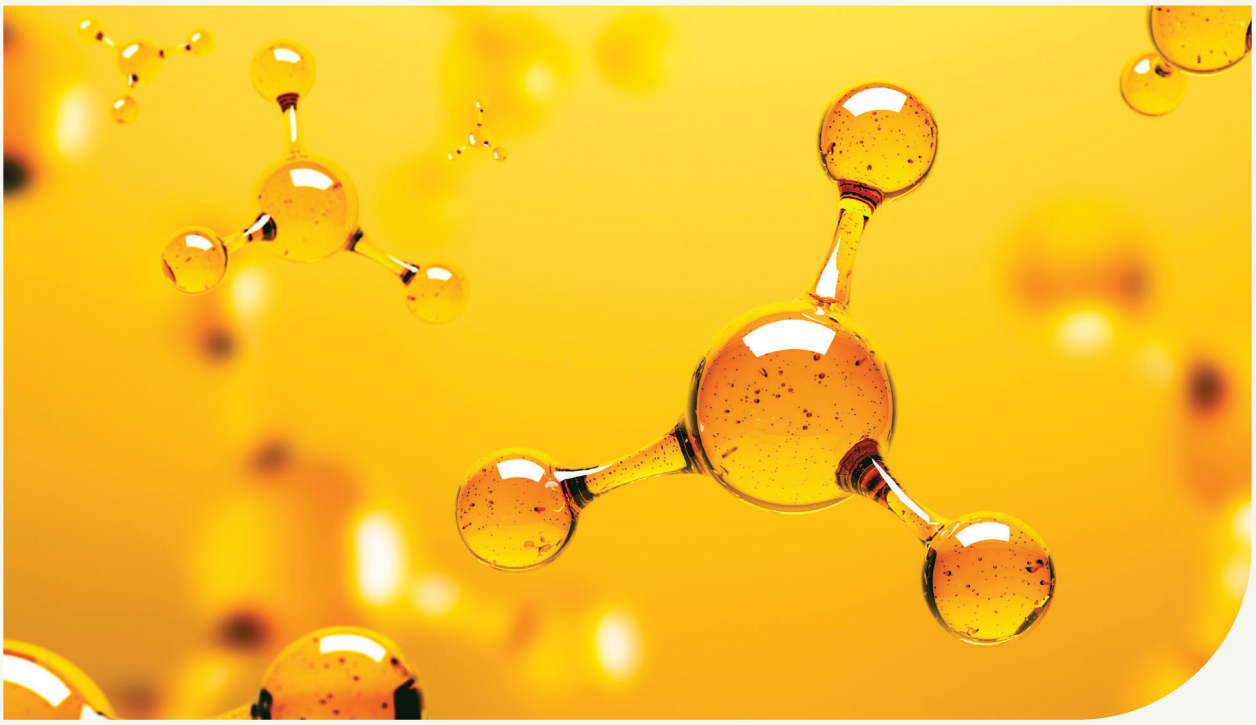
Competitor 2
missing 5 out of 10.

– 50% –

Competitor 3
missing 3 out of 10.

– 30% –

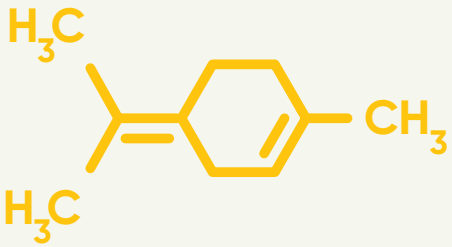
If you're buying a Jack Herer terpene profile from somewhere else, there's a likely chance that your formulation is missing *half* of the key ingredients. We can appreciate some fluctuations between different samples of Jack, but to completely omit half of the terpenes and still call it Jack is a disservice to customers who want to experience Jack Herer.



Key Attribute 1: Terpinolene content

Terpinolene is, by far, the most dominant terpene found in Jack. This is perhaps the one major attribute of this cultivar that the other terpene companies got right – this compound is found in the highest concentration in all of their Jack blends. However, the actual amount of it is quite variable, as shown in **Table 1**, and significantly affects the overall flavor profile **(Figure 5.)**

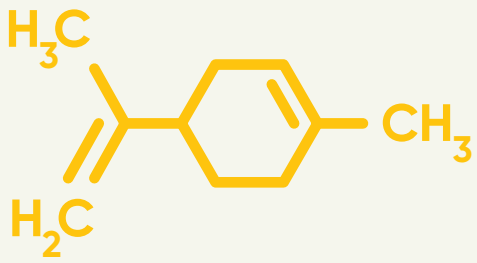
In some cases, over 50% of their aroma is contributed from this single compound. This high concentration easily leads to oversaturated citrus and terpentine overtones from Terpinolene. Indeed, our sensory panel ranked the two blends with the highest Terpinolene concentrations as "pinesol-like", further confirming the data. On the other hand, our Signature Series blend is very close to the expected Terpinolene concentration of ~36%. This was the first key difference between the original flower, our blend, and our competitors.



Key Attribute 2: d-Limonene content

D-Limonene is another major difference between the Signature Series and our competitors when compared to the original Jack Herer flower. In general, d-Limonene is a ubiquitous terpene found in cannabis, but not in Jack Herer. This is evident by the 2% concentration measured in the flower sample. While our blend contains a similar concentration, the other blends have *significantly* higher amounts. This discontinuity further skews the blends to lean into the overly citrusy and terpenic aroma. In particular, **Competitor 2** has 14% of their blend composed of d-Limonene, a whopping seven times higher than the percentage of d-Limonene actually found in the Jack Herer flower.

Along with the high Terpinolene content, this leads to even more unnecessary citrus notes that are not present in the flower sample. **Competitors 1** and **3** likewise have significantly greater d-Limonene contents leading to similar issues. The aroma map shown in **Figure 5** exemplifies why excess d-Limonene leads to less of a "Jack Herer" aroma, and more of a citrus one.

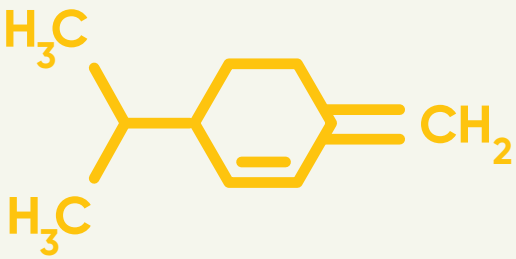


Key Attribute 3: ß-Phellandrene, a missing component

While Terpinolene and d-Limonene both contribute strong citrus overtones, ß-Phellandrene provides a unique scent that, if missing, will drastically change the overall flavor.

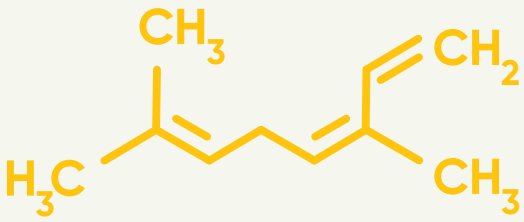
In the Jack flower, we measured a 9% concentration of this rare terpene. While we were able to account for this hidden gem using our instrumentation, the other blends *completely omit* this compound altogether. All three competitor blends are lacking this crucial, distinctive terpene found naturally in Jack Herer flower.

This compound enhances the woodiness of the flavor and aroma while rounding out the highly terpenic scent of Terpinolene. As this compound is missing in the competitors, this key flavor note cannot balance out the flavor of the other dominant compounds.



Key Attribute 4: trans-ß-Ocimene, the equalizer terpene

Thus far, the terpenes mentioned have added citrus, woodiness, and terpenic notes. When balanced correctly, it helps to guide the aroma toward the quintessential Jack scent that has helped to make it infamous over almost three decades. However, even then, the scent will lack a certain floral and semi-sweet note.



The Jack Herer flower sample has a high concentration of trans-ß-Ocimene (9%). This compound, when isolated by itself, is incredibly sweet. Trans-ß-Ocimene cuts through the citrus and woodiness of the other major compounds and, thus, it is a key component in rounding out the overall aroma of Jack both in flower form and in blends.

Mapping the aromas of terpene blends to Jack

In **Figure 5,** we see a significant floral component in the aroma and flavor map in the flower sample that arises precisely from trans-ß-Ocimene.

Our Signature Series blend has a concentration at 8%, leading to an extremely similar aroma profile. However, all of the competitor blends severely lack this compound in any significant amount.

We note that Ocimene has many different isomers that can possess many different aromas. In fact, we detected significant amounts of cis-ß-Ocimene in all of the competitor blends, indicating that the Ocimene source used may either be:

(1) Impure, with a low percentage of trans-ß-Ocimene present.

(2) The competitors were unaware that the cis- and trans- isomers of ocimene can have substantially different aromas when obtained in near pure form.

(3) Did not know that trans-ß-Ocimene is the correct isomer.

By analyzing analytical standards of both trans-ß-Ocimene and cis-ß-Ocimene, we were able to definitely confirm that trans-ß-Ocimene is indeed the correctly identified compound. This compound is the final key that *only* the Abstrax Signature Series replicates accurately.

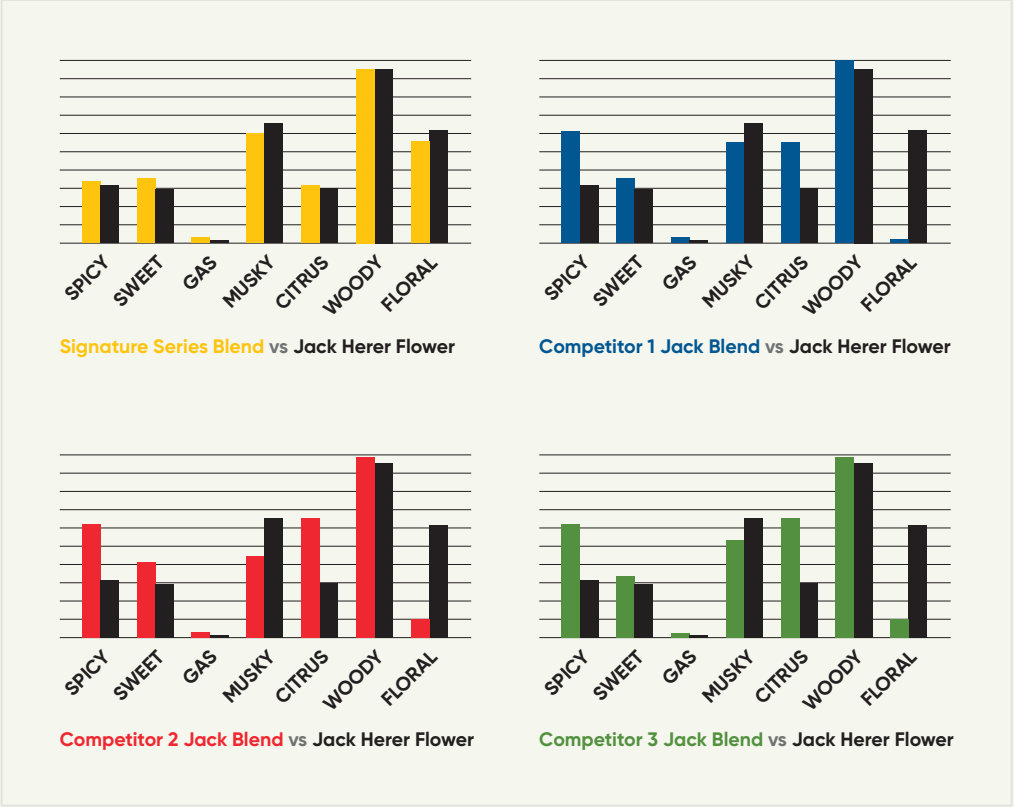


Figure 5. Mapping the aromas of terpene blends to Jack.

Understanding the aroma of Jack Herer on the molecular level

To understand all of the detail and nuance of a certain cannabis cultivar's aroma, it is necessary to break down its aroma into all of the chemical constituents, referred to colloquially as terpenes. Doing this allows us to understand what kinds of compounds are present, as well as to approximate the amount of each. But the aroma of cannabis is highly complex, with hundreds of compounds reported to exist in this plant. Only by using 2-dimensional gas chromatography, GC×GC, were we able to elucidate the fine details of the aroma. For an explanation of our technologies and instrumentation, click here.[2] This technique reveals many more compounds than using traditional 1-dimensional gas chromatography.

Using this method, we have detected over 350 compounds in Jack Herer. Just as importantly, we have been able to determine with great accuracy the majority of these compounds. These two facts have allowed us to not only understand the scent of Jack Herer in greater detail than ever before, but they also give us the information necessary to replicate the flavor and aroma of this cultivar with great accuracy and precision. **Figure 6** shows the top 20 terpenes detected using our technique on a sample of Jack Herer flower.

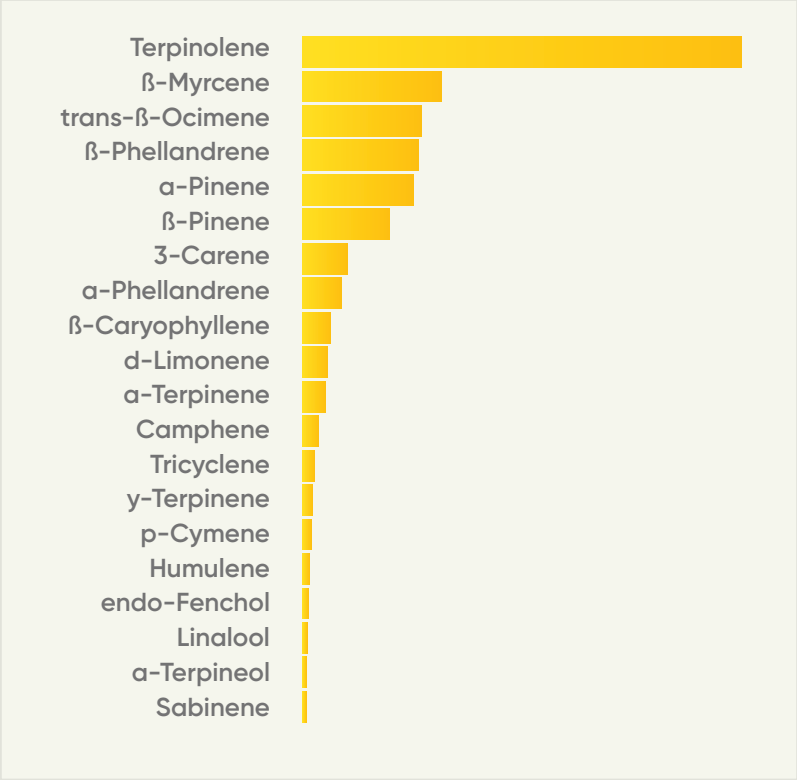


Figure 6. Aroma profile of major compounds found in Jack Herer flower sample.

The most important aspect of Jack, which aligns it with many other classic energetic cultivars, is the large amount of Terpinolene. For instance, other energetic cultivars with this terpene present in high amounts are shown in **Table 2.** This compound engenders Jack with some of the quintessentially bright aromas it produces.

CULTIVAR	HIGH TERPINOLENE?*	EFFECTS	AROMA
Jack Herer Flower	YES	Energetic, euphoric	Woody, citrus
Durban Poison	YES	Energetic, productive	Woody, citrus
Super Silver Haze	YES	Energetic, happy	Woody, citrus
Sojay Haze	YES	Energetic, uplifting	Woody, citrus, floral

*High Terpinolene is defined as the terpene with highest concentration as measured internally at Abstrax Tech.

Table 2. Cultivars with similar chemical aroma profiles as Jack Herer.

Shown in **Figure 7** are some key aroma compounds found in Jack Herer identified in our GC×GC analysis. We found Terpinolene accounting for over 30% of the total aroma content. After Terpinolene, other woody, citrus and floral-leaning terpenes such as ß-Myrcene, d-Limonene and cis-ß-Ocimene occur in high concentrations. But most importantly, and a detail that is overlooked – if not omitted completely – is the presence of ß-Phellandrene. This compound is not to be confused with a-Phellandrene, which has a more citrus and herbal aroma. ß-Phellandrene has minty, terpenic, and mildly woody notes that creates a more nuanced aroma in Jack. While many analytical cannabis labs will identify a-Phellandrene in cannabis and routinely test for it, none are currently suited to detect and quantify ß-Phellandrene to our knowledge.

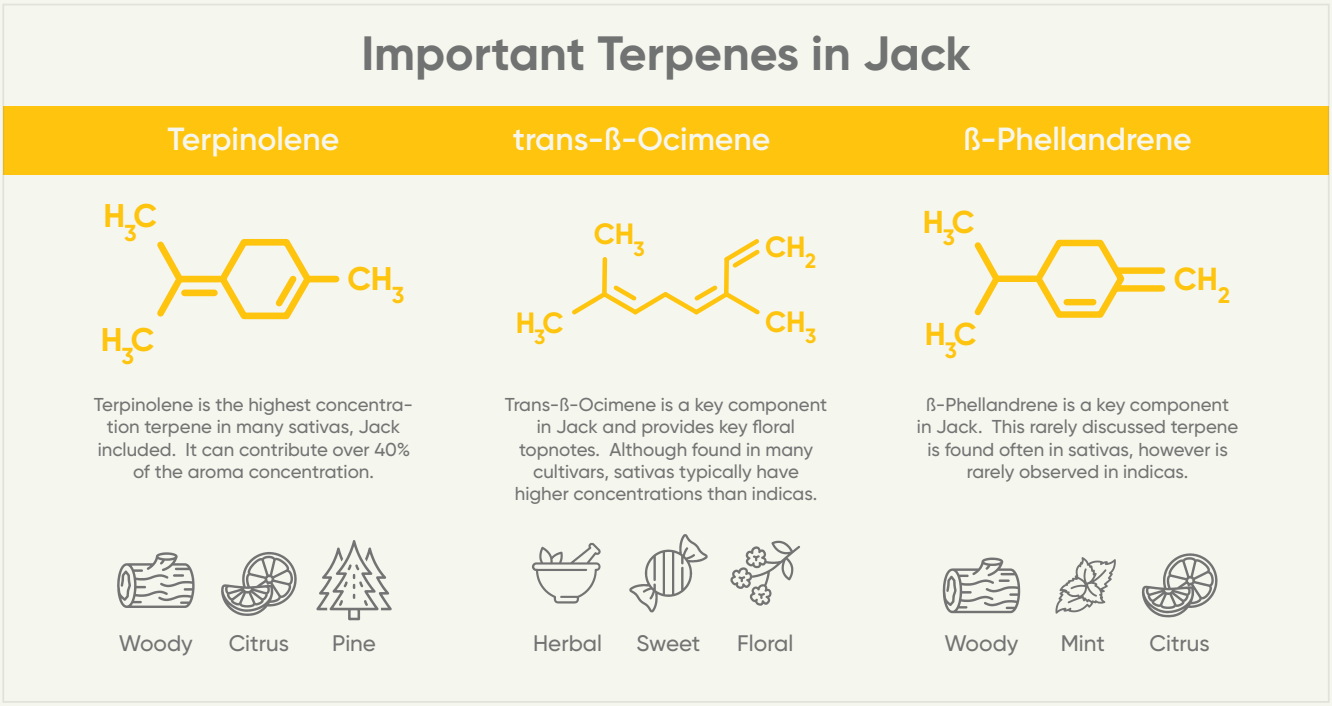


Figure 7. Some key terpenes in Jack that drive its unique flavor.

In fact, this terpene is rarely discussed in cannabis literature yet is ubiquitous in nature. It is found in many plants including cumin, black currant, and dill. Its obscurity within terpenes discussed in cannabis is possibly because it tends to elute very closely to other similar terpenes such as d-Limonene, p-Cymene, and numerous Ocimene isomers **(Figure 8)** and thus is difficult to elucidate in the data.

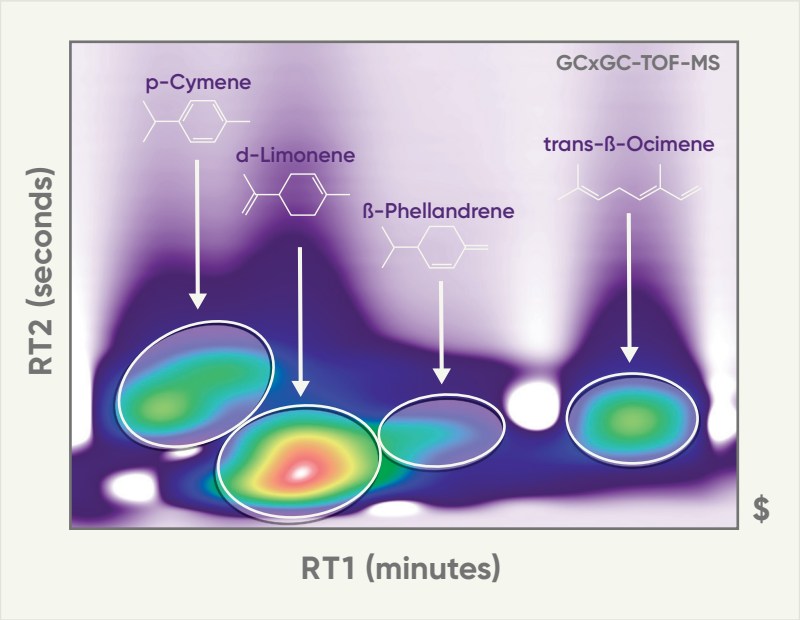


Figure 8. GC×GC peaks showing numerous compounds eluting near each other. Without mass spectrometry, ß-Phellandrene is essentially impossible to detect, let alone identify.

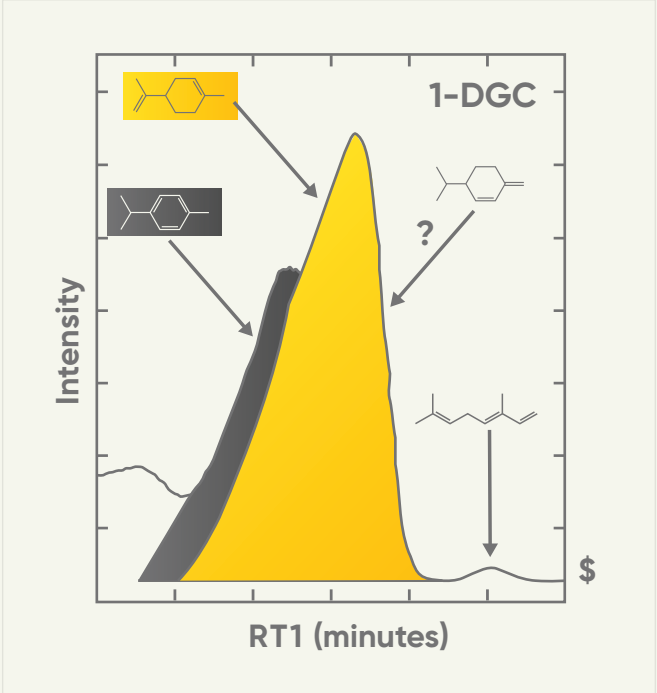


Figure 9. 1D chromatogram showing the convoluted peaks of p-Cymene, d-Limonene, and ß-Phellandrene. The colors represent the approximate peaks areas that correspond to p-Cymene and d-Limonene. ß-Phellandrene is essentially invisible in this data due to the convolution of data.

This complexity essentially requires mass spectrometry (which many labs do not have access to) to correctly identify and quantify it in the data. Furthermore, the large amount of other co-eluting compounds around ß-Phellandrene make it even more difficult to discern using only traditional 1-DGC. This is shown graphically in **Figure 9**, which shows how this elution appears in 1- dimensional GC data. The colors annotate the approximate contributions to the peak intensities from two of the more commonly identified compounds, p-Cymene and d-Limonene.

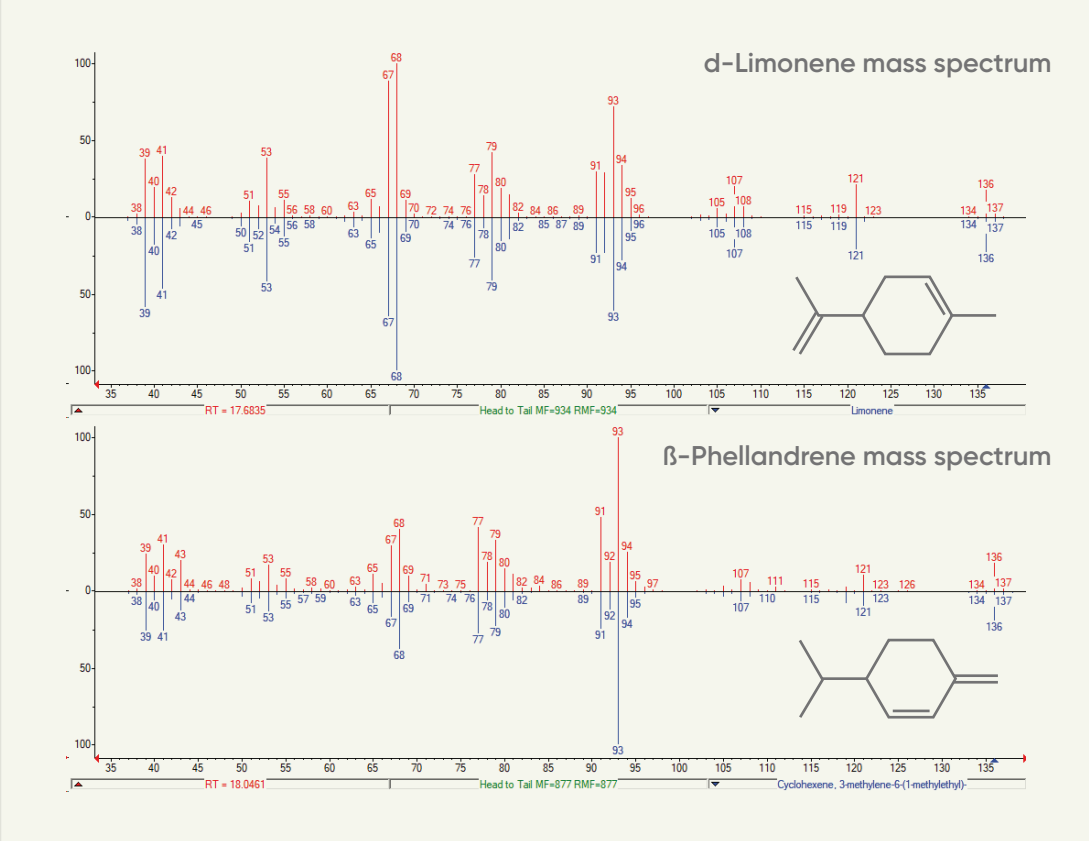


Figure 10. Mass spectral data of two similar terpenes that elute near one another using GC×GC. Red lines show the mass spectrum of our data; blue lines show known mass spectrum of each compound in the NIST mass spectral database. The similar peaks confirm the identities of both compounds.

Identifying ß-Phellandrene in this peak becomes an arduous task, along with quantifying p-Cymene and d-Limonene. Fortunately, this issue is alleviated in GC×GC due to its greater separatory power. By combining GC×GC with time-of-flight mass spectrometry, we easily identified two dissimilar mass spectrums near d-Limonene **(Figure 10)**, which revealed ß-Phellandrene to elute nearby. Each compound is then quantified analytically by using custom chemical standards.

CONCLUSION

Taken together, we describe some of the important details of the cultivar Jack Herer, also known as Jack, and what makes it special. Jack is a quintessential sativa that has a vibrant, bright, and citrus-woody aroma that provides classic sativa effects. Our analysis using 2-dimensional gas chromatography of this cultivar reveals high levels of Terpinolene such as seen in other sativas. However, it also possesses a more unique and rarely discussed terpene, ß-Phellandrene. This compound is found in relatively high concentrations and thus is critical to the flavor and aroma of Jack. Lastly, we detail how we use this data to create terpene blend formulations that are as accurate as possible. This process, along with access to some of the best genetics and freshness of samples, ensures that our Signature Series process is unrivaled leading to the most accurate terpene formulations available on the market.

ABSTRAX Signature SERIES

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(2) The Science of Dank - Discovery of New Cannasulfur Compounds https://abstraxtech.com/blogs/news/discovery-of-new-cannasulfur-compounds.


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