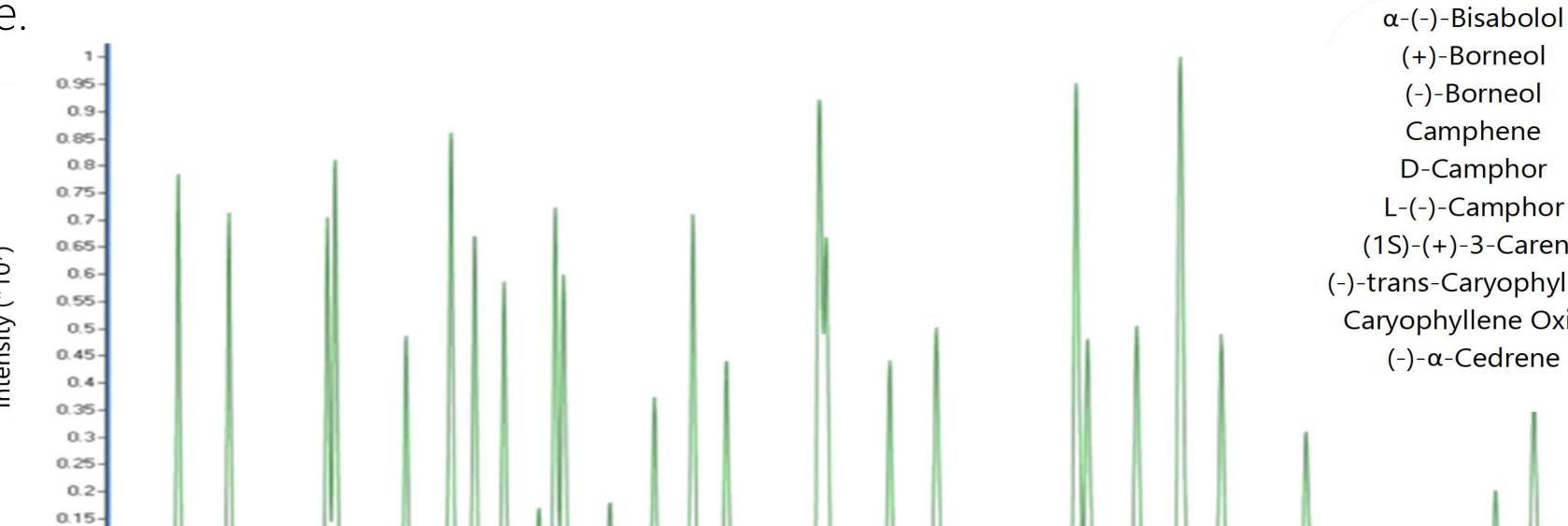


# Terpenes & Terpenoids

What is being measured: Global profiling of non-polar terpene (hydrocarbon) and terpenoid (oxygenated) compound classes. Terpenes/terpenoids make up a large group of structurally diverse compounds that serve a variety of physiological functions in plants and animals including cellular structure and signaling, plant defense from biotic and abiotic stressors, pollinator attraction, etc.

How it is done: Terpenes and terpenoids are extracted from samples in hexane and analyzed on gas chromatograph coupled to a high resolution accurate mass spectrometer (GC-QToF). Compound identification is achieved through the matching accurate mass and El fragmentation pattern with in-house mass spectral libraries (Wiley, NIST, Kovats). Absolute quantitation is possible when the authentic standards are available.

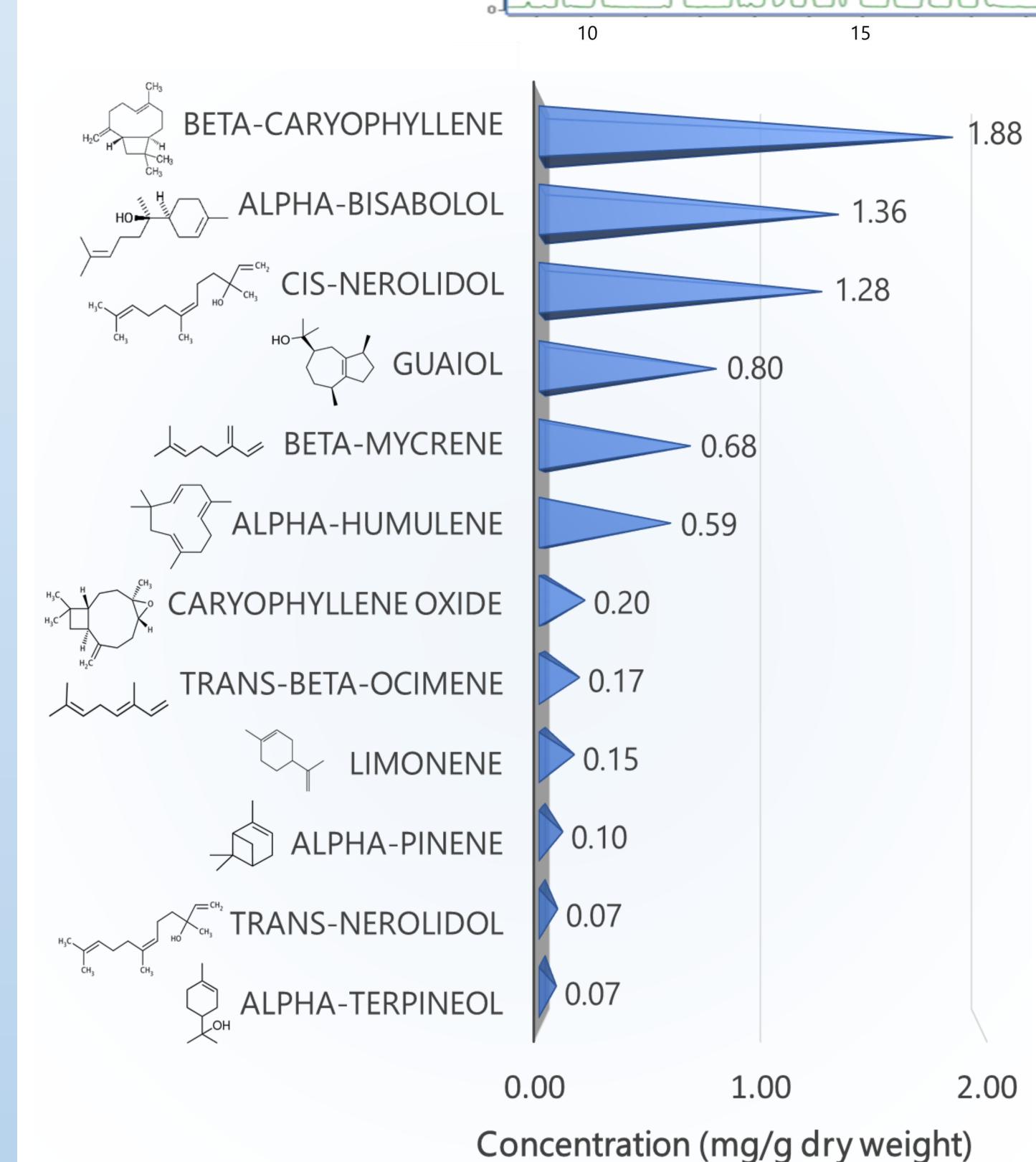
Relative quantitation is determined by normalization with isotope labeled internal standard.



Cedrol (-)-Isopulegol α-Pinene (-)-Cotinine Isoborneol (+)-Borneol β-Pinene D-Limonene (+)-Pulegone (-)-Borneol Eucalyptol Camphene **DL-Linalool** Sabinene Farnesene Sabinene hydrate **D-Camphor DL-Menthol** (+)-Fenchone L-(-)-Camphor (-)-Fenchone α-Terpinene Myrcene (1S)-(+)-3-Carene (+)-Fenchyl Alcohol γ-Terpinene Nerol cis-Nerolidol Terpineol (-)-trans-Caryophyllene Geraniol Terpinolene Caryophyllene Oxide Geranyl Acetate trans-Nerolidol (-)-α-Cedrene β-Ocimene Guaiol Valencene  $\alpha$ -Phellandrene α-Humulene

### RESULTS

Figure 1. Chromatographic separation of over 40 terpenes and terpenoids using GC-QToF (MUAL data).



0.1

0.05-

# Major Terpenoids of Hemp Varieties Concentration in mg/g dry weight B-Myrcene A-Humulene Limonene Linalool A-Pinene Hemp Variety E O.6 O.6 Hemp Variety B

β-Pinene
 Valencene
 α-Terpineol

**Figure 2.** Major terpenes and terpenoids detected above 0.05 mg/g dry weight in industrial hemp; average concentration from five hemp varieties (MUAL data).

## **INSTRUMENTATION**

### Agilent GC/Q-TOF (7890B/7250)

### **Primary Applications**

- Global Metabolomics
- Characterization & Quantitation of GC-amenable compounds

# Features

Hemp Variety D

Quadrupole Time-of-flight mass spectrometer

**Figure 3.** Relative quantities (mg/g dry weight) of major terpenes and terpenoids in five

industrial hemp cultivars highlighting the diversity among plant terpenes (MUAL data).

- Delivers full-spectrum, high-resolution, accurate-mass data
- Low-energy EI for softer ionization and molecular ion enhancement
- Elucidates chemical structures with MS/MS capabilities
- TOF mass accuracy- < 2ppm RMS
- TOF Resolution > 25,000 at m/z 271.896
- Data acquisition rates of up to 50 spectra per second
- Electron Ionization, settable 5-200 eV

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Hemp Variety C