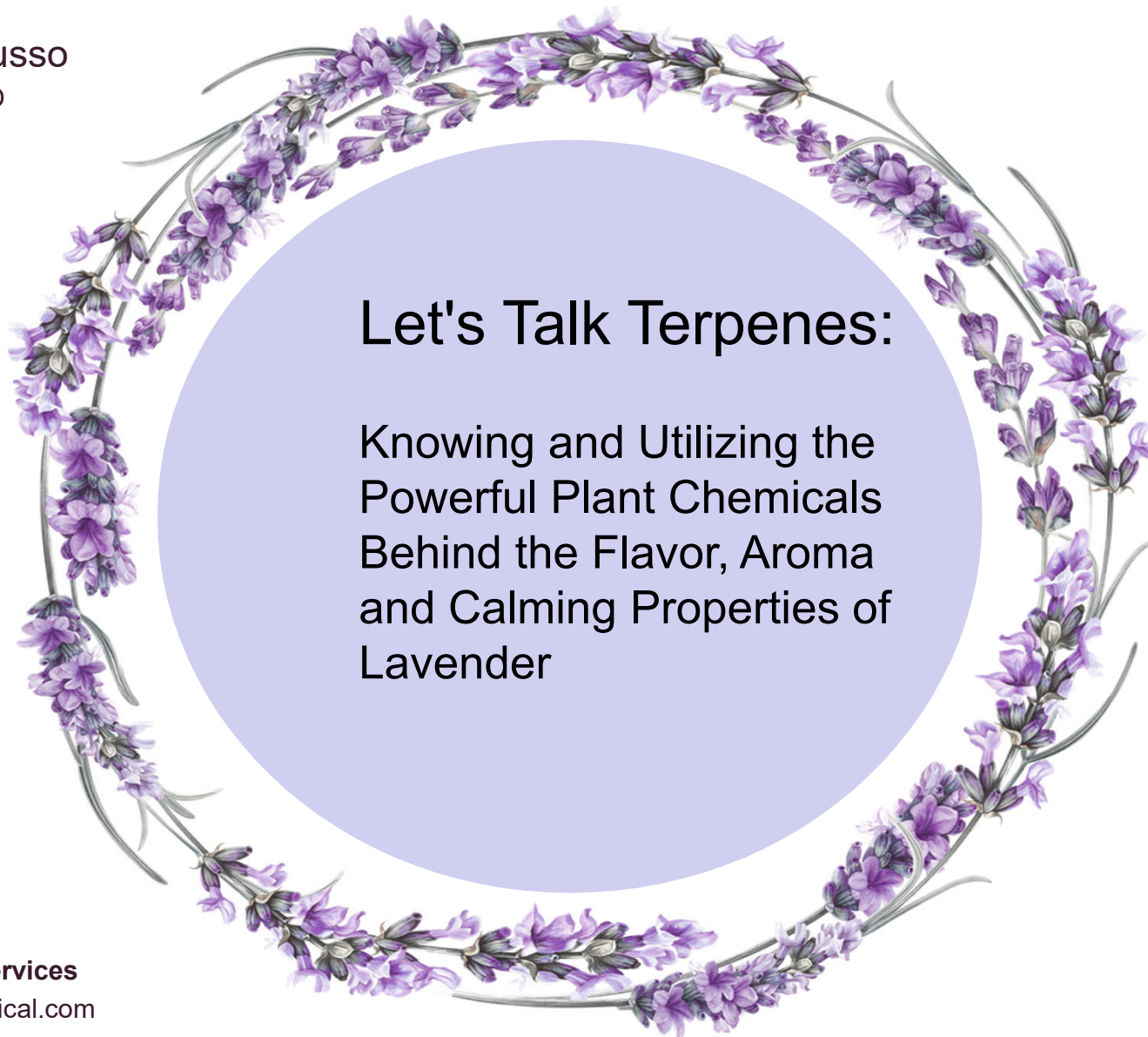


Concetta C. DiRusso

President and CEO

Let's Talk Terpenes:

Knowing and Utilizing the
Powerful Plant Chemicals
Behind the Flavor, Aroma
and Calming Properties of
Lavender



Kennebec Analytical Services

concetta@kennebecanalytical.com

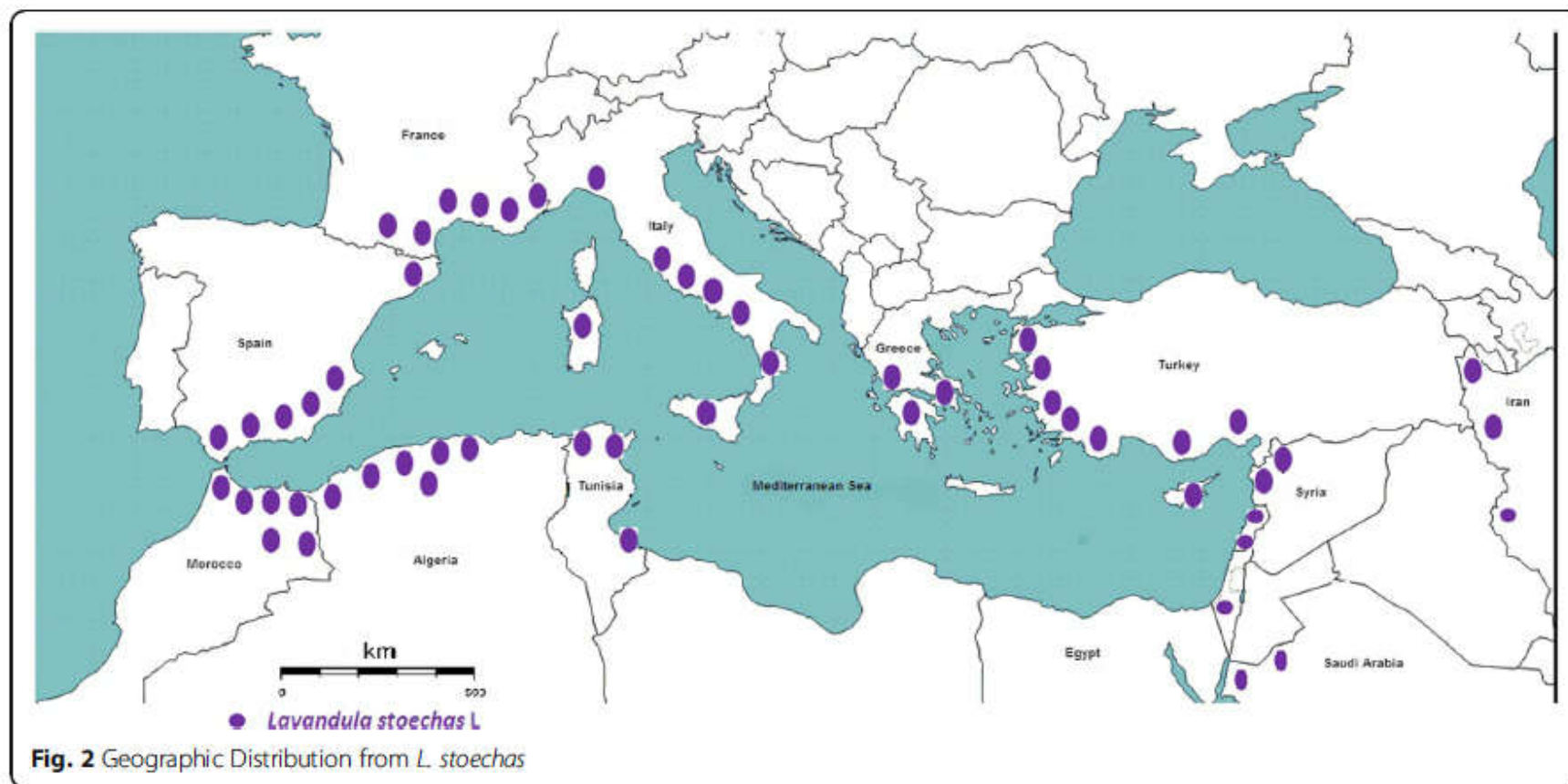
“Lavender is the most useful of all the essential oils and perhaps is the safest.”

The Encyclopedia of Herbs and spices,
Clevely, et al, 1997, Hermes House
publisher, page 248





<https://onbetterliving.com/lavender-cookies/>



A Phytopharmacological review of a Mediterranean plant: *Lavandula stoechas* L

Yassine Ez zoubi^{1,2*}, Dalila Boust³ and Abdellah Farah²

Ez zoubi et al. Clinical Phytoscience (2020) 6:9
<https://doi.org/10.1186/s40816-019-0142-y>

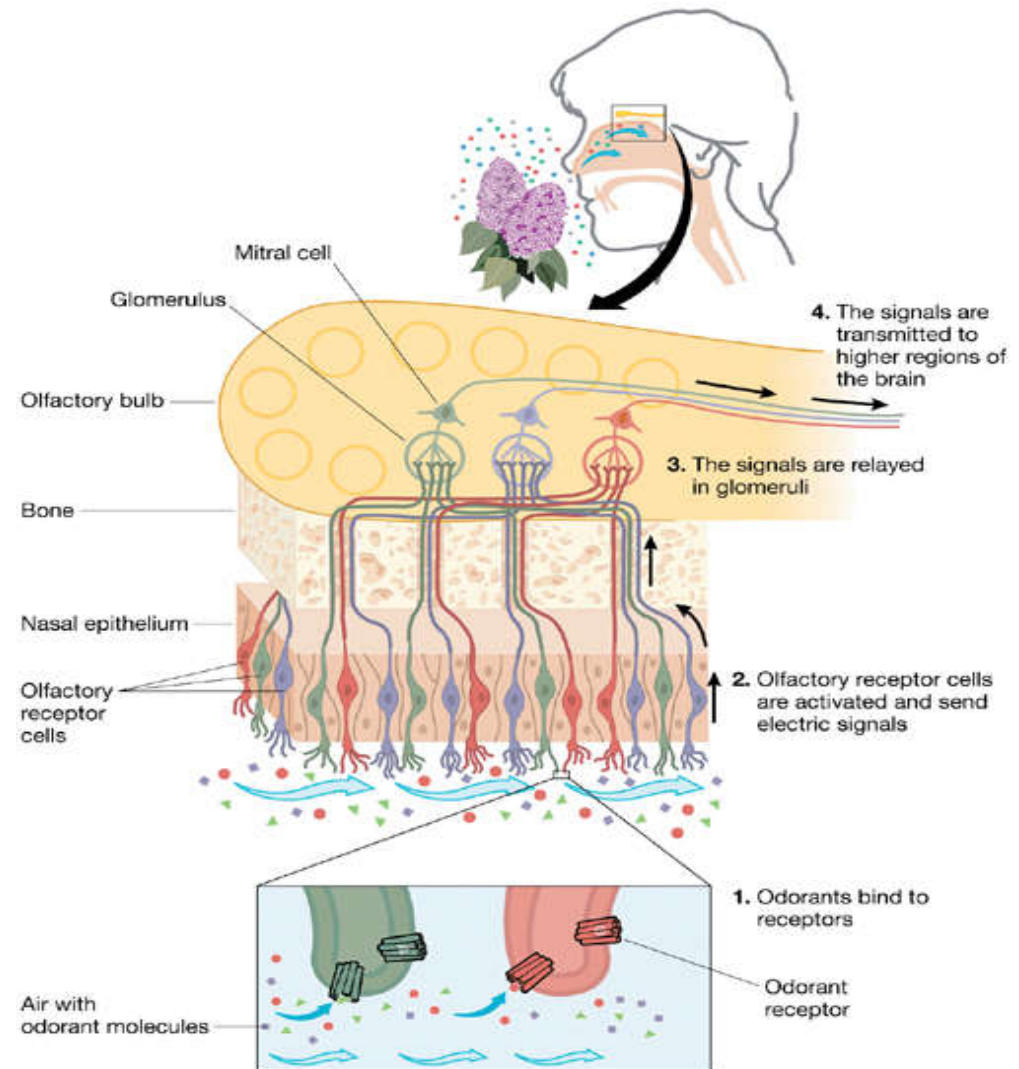
Ancient uses of Lavender flowers and oils:

- Lovely flower shape, color, scents
- Herbal mixtures used for centuries for aesthetic pleasure, flavoring, relaxing bath oils/soaps, teas and tisanes
- Enhance storage of other materials (e.g. linen, floor rushes)
- Medicinal Value
 - Tonic for headaches, feeling of well-being
 - Relieve skin irritations
 - Depression
 - Diabetes
 - Inflammation
 - Anti-flatulent



How are odors detected
in our bodies?

The human olfactory
system.



Why is analytical testing recommended and of value in marketing?

1. To measure bioactive terpene profile
2. Increased acknowledgment of the value of phytochemicals including terpenes
3. Assure safety of products, especially those that are inhaled, ingested and used topically, for both humans and pets
4. While essential lavender oils are “Generally Recognized as Safe” (GRAS) FDA requires that all foods including those containing these ingredients are safety tested and shelf life evaluated



KAS Credentials

ISO/IEC 17025:2017 Laboratory Accreditation

- Proficiency testing and technical competence
- Traceability and in-house calibration tracking
- Standard Operating Procedures (SOP)
- Record Keeping

KAS Certificate: AT-2939



CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Kennebec Analytical Services, LLC
1014 Boswell Ave.
Crete, NE 68333

Fulfills the requirements of

ISO/IEC 17025:2017

In the field of

TESTING

This certificate is valid only when accompanied by a current scope of accreditation document.
The current scope of accreditation can be verified at www.anab.org.

A handwritten signature in black ink, appearing to read "RDL", is positioned above the printed name of the official.

R. Douglas Leonard Jr., VP, PILR SBU
Expiry Date: 31 December 2022
Certificate Number: AT-2939



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory
quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

What kinds of useful information do we get from testing essential oils?





Oil quality and clarity

- Refractive index – measures the passage of light through the oil
- Specific Gravity – measure of density relative to water
- Optical rotation – measures polarity or circular birefringence contributed by the molecules in the oil

Potential chemical and metal contaminants

Heavy Metals – Lead, Mercury, Cadmium, Zinc

Pesticides – applied to plants or absorbed in the roots

Mycotoxins – microbial defense chemicals that are toxic to humans



How does the terpene profile of lavender compare with other flower oils?

Terpene	% of Flower oil				
	Lavender (KAS)	¹ Jasmine	¹ Myrtle	¹ Chamomile	¹ Chrysanthemum
Linalool	16.20 - 33.63	8.2	0	0	0
Linalyl acetate	15.21 - 40.75	0	0	0	0
Eucalyptol	0.32 - 12.55	0	12.7	0	0
Limonene	0.82 - 4.06	0	10.1	0	0
Camphor	0.32 - 11.08	0	0	0	29.2
α -Bisabolol oxide (A+B)	ND	0	0	71.5	0
α -pinene	ND	0.6	17.5	0	14.8

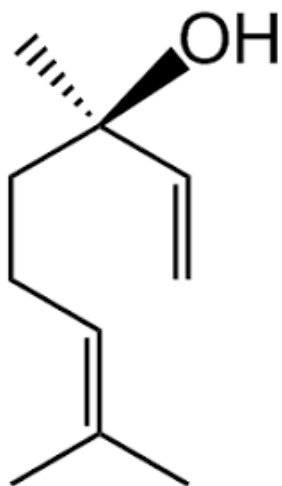
¹Ref: Edible flower essential oils: A review of chemical compositions, bioactivities, safety and applications in food preservation, Food Research International 139 (2021) 109809

Ten most common terpenes in Lavender

- ❖ Linalool
- ❖ Linalyl Acetate
- ❖ Lavandulyl acetate
- ❖ Camphor
- ❖ Terpinen-4-ol
- ❖ β -myrcene
- ❖ β -carophyllene
- ❖ Limonene
- ❖ Ocimene
- ❖ Eucalyptol



Linalool



Freshly floral scent with light tart notes

- Sedative Antidepressant
- Reduces anxiety
- Antimicrobial
- Immune potentiator
- Anti-oxidant



Linalyl Acetate (a.k.a. Bergimol)

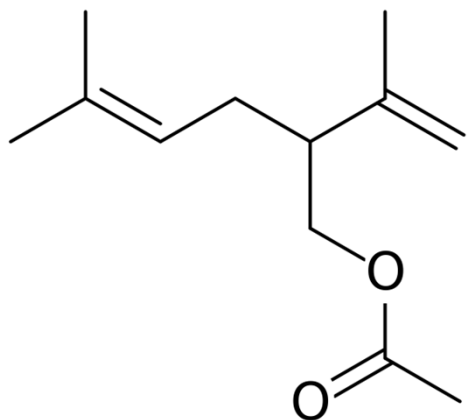


Sweet, fruity, bergamot- and pear-like with a faintly floral note;

- mildly toxic to humans;
- used as a fragrance;
- colorless liquid



Lavandulyl acetate

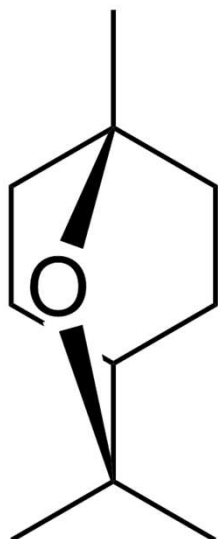


Aromatic weak floral, herbal scent with slightly lemon-like undertones

- Non-toxic
- Used as fragrance
- flavoring
- may be used in foods



Eucalyptol (a.k.a. 1,8-Cineole)

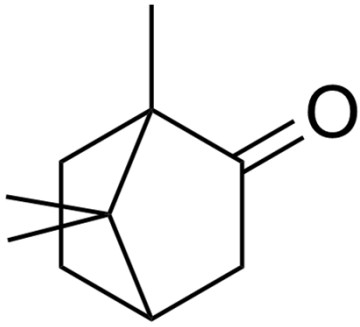


Minty, fresh aroma, camphor-like

- Stimulant;
- Antibiotic;
- Antiviral;
- Anti-inflammatory;
- Blocks pain
- Acetylcholinesterase inhibitor;
- Increases cerebral blood flow



Camphor



Warm, minty, almost ethereal diffusive aroma;
strong mothball-like odor

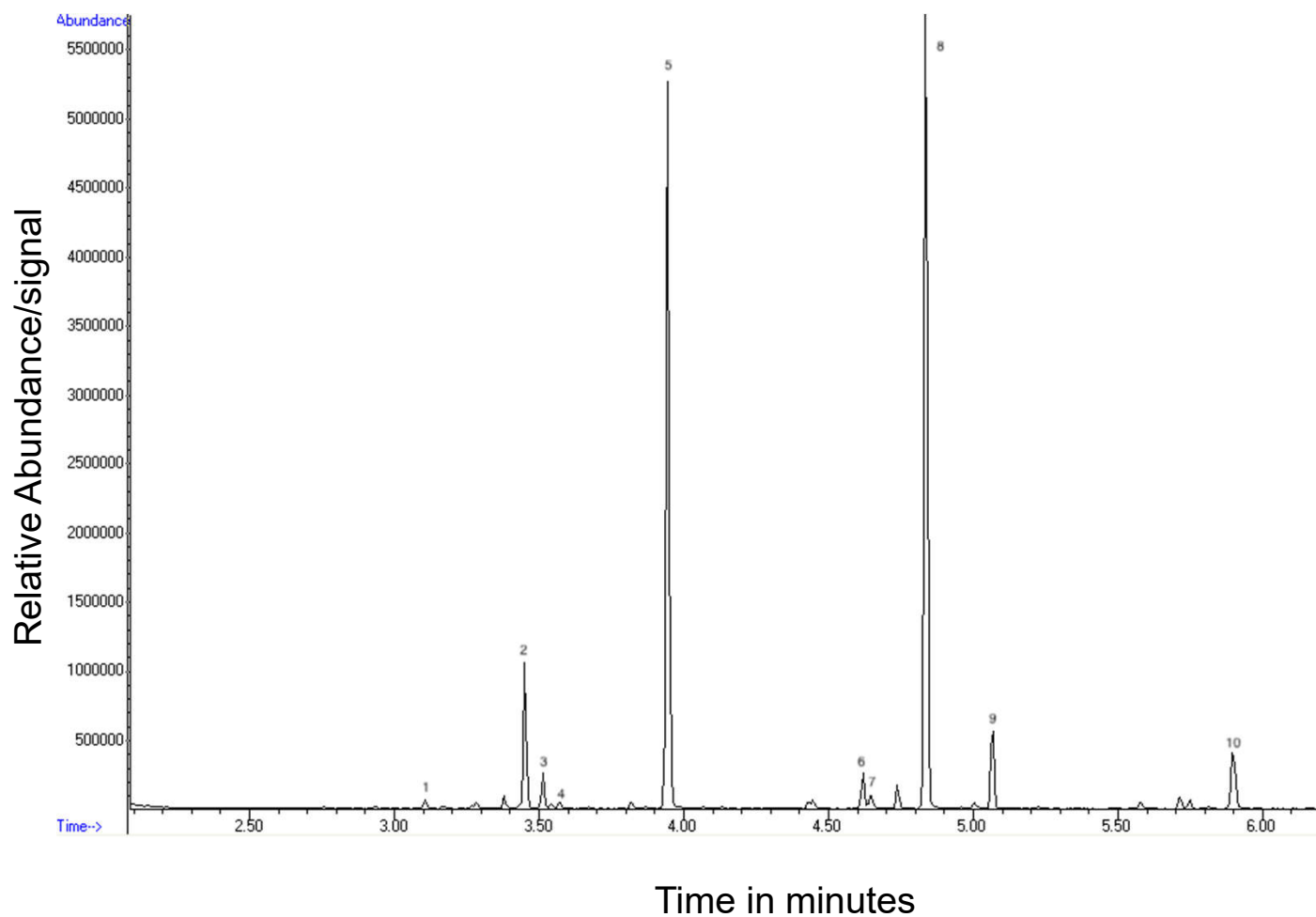
- Topical anti-infective
- Anti-itching
- Relieve muscle pain and arthritis (analgesic)
- Carminative (prevents intestinal gas)
- poisonous when ingested in high amounts
- Used to make moth proofing



Gas Chromatography-Mass Spectrometry is used to separate, identify and measure terpenes



Chromatogram of 10 lavender terpenes



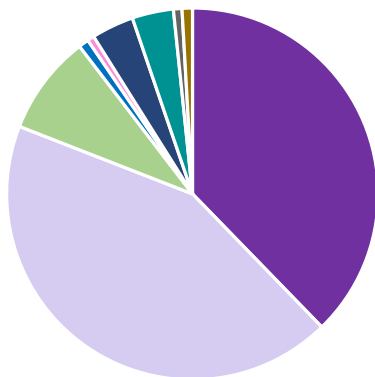
Terpene Analyte	ID #	Retention Time
β -Myrcene	1	3.11
d-Limonene	2	3.451
Ocimene	3	3.514
Eucalyptol	4	3.572
Linalool	5	3.944
Terpinen-4-ol	6	4.619
Camphor	7	4.648
Linalyl acetate	8	4.837
Lavandulyl acetate	9	5.007
β -Caryophyllene	10	5.899



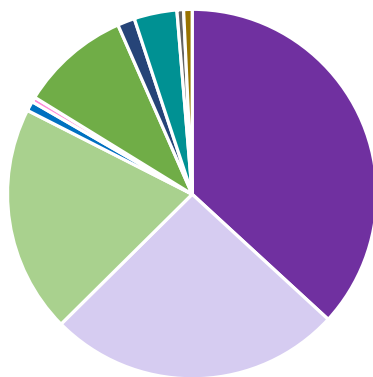
Terpene profiles in 2 Lavandula species, 3 varieties each

Lavandula angustifolia

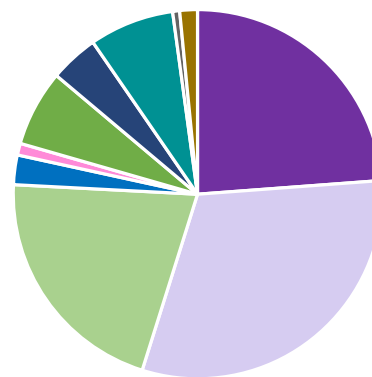
Buena vista



Pacific Blue

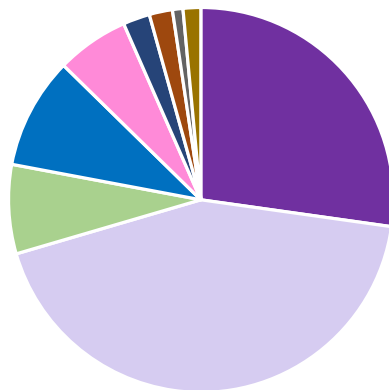


Munstead

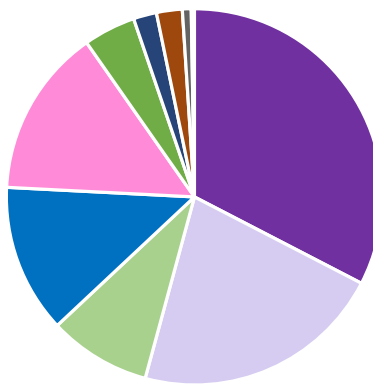


Lavandula X intermedia

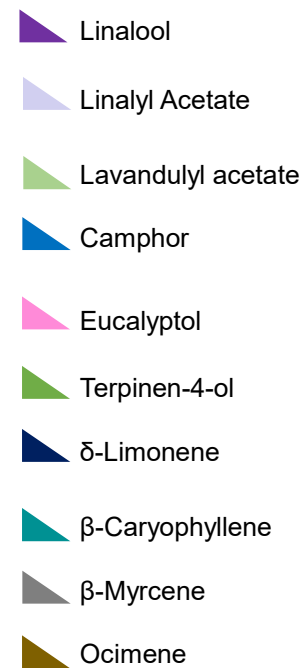
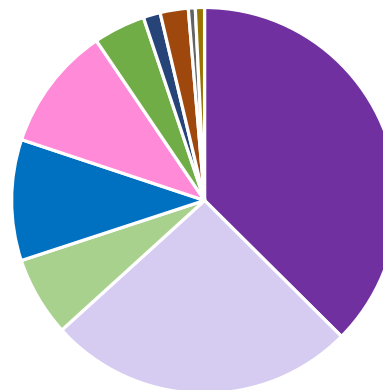
Super



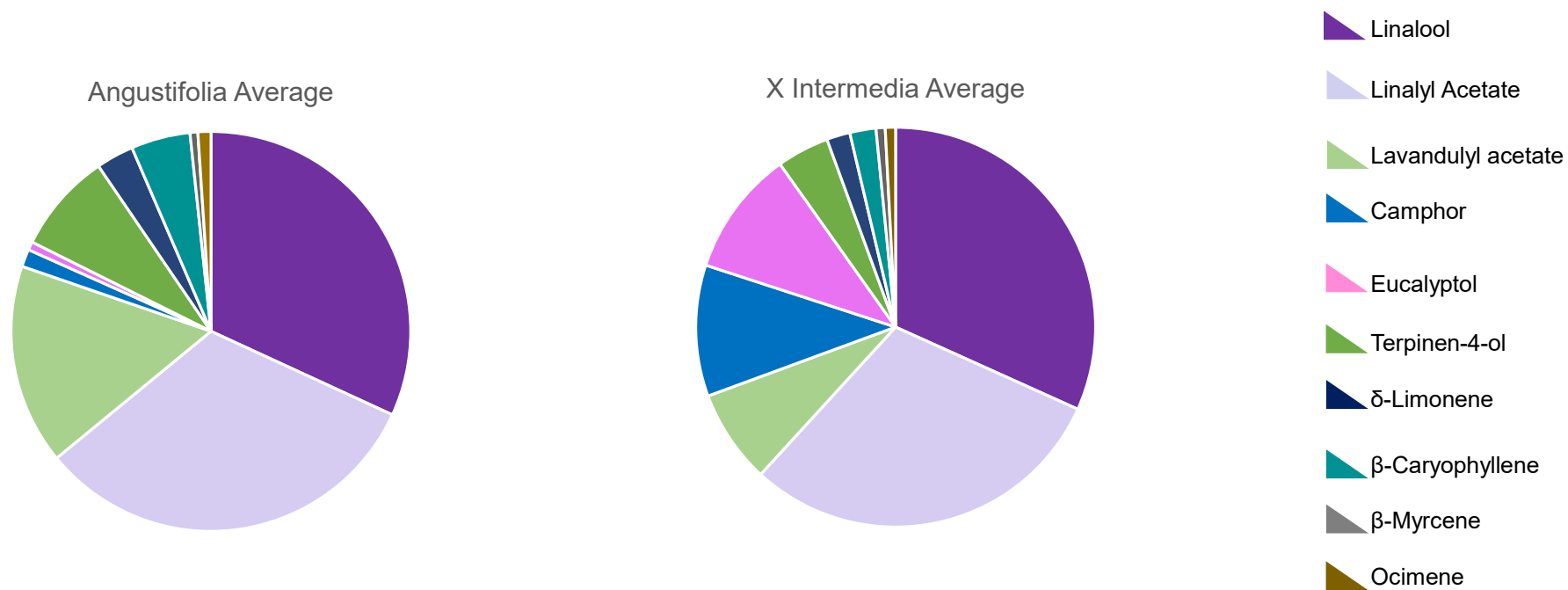
Grosso (n=1)



Thomas



Terpene profiles in 2 Lavandula species, pooled for variety



What factors affect may terpene profiles in lavender?

1. Variety of plants of the same genus and species, e.g. *Lavandula Angustifolia* vs *Lavandula Latifolia* vs hybrid Lavandin
2. Environment where grown, e.g. geographical location, altitude, climate
3. Water, soil conditions, temperature variability
4. Flower maturity
5. Storage after harvest



Want more information?

- National Center for Complementary and Integrative Health (NCCIH)
<https://www.nccih.nih.gov/health/lavender>
- Food and Agricultural Organization, Food Safety and Quality, Online addition: “Specifications for Flavorings”. <https://www.fao.org/food/food-safety-quality/scientific-advice/en/>
- Mt. Sinai Health Library <https://www.mountsinai.org/health-library/herb/lavender>
- Chemometric Analysis of Lavender Essential Oils Using Targeted and Untargeted GC-MS Acquired Data for the Rapid Identification and Characterization of Oil Quality. D.J. Beale, et al. 2017, Molecules 2017, 22, 1339; doi:10.3390/molecules22081339
- Edible flower essential oils: A review of chemical compositions, bioactivities, safety and applications in food preservation, Food Research International, Chen et al, Volume 139, January 2021, 109809

Thank you for your time and attention

Special thanks to:

Beth Hammerberg, Down by the River Lavender

Sherri Wood, Capay Lavender



For more 2023 Testing Information



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