Vanilla Bean Volatile Analysis
Origin & Species

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We Interrupt This Program…

- Topic has changed from the abstract
  - Difficulty of presenting applications.
  - Current topic more in-line with our work.
Vanilla is Important -
But Has The World Noticed?
Has The World Noticed?
Has The World Noticed?
Has The World Noticed?
Has The World Noticed?
Has the World Noticed?

The History of Vanilla
Has The World Noticed?

The History of Vanilla
Vanilla World Is Dynamic

DANGER AHEAD
FASTEN SAFETY BELTS
AND REMOVE DENTURES

GEVAAR VOOR
MAAK GORDELS VAST
EN VERWYDER KUNSTANDOENEN
Production of Vanilla Is Changing

- More plentiful
- Different origins
  - Madagascar, Indonesia, Tahitian, Comoros
  - PNG, Uganda, India, Mexico, Tahiti, Hawaii
- Different species
  - *Vanilla planifolia*
  - *Vanilla tahitensis*
  - PNG Hybrid?
Objectives

- Identify and compare volatile compounds
  - Beans from different origins
    - Madagascar
    - Indonesia
    - Mexico
    - PNG
    - Tahiti
  - Beans from different species
    - Planifolia vs. Tahitensis vs. PNG
- Identify “flavor-active” compounds
Volatile Collection

- Beans chopped
  - 9 grams, 2 beans
  - 0.5 cm pieces

- Solid Phase Micro-Extraction - “Twister”
  - 30 minute exposure
  - Binds volatile compounds
  - Releases with heat
Caveats

- This Is One Set
  - Not a comprehensive study of bean variability

- Bean Handling Was Not Controlled
  - Madagascan, PNG and Indonesian - atmospheric packaging
  - Mexican and Tahitian - vacuum packaging
    - higher moisture

- Twister method ‘semi-quantitative’
  - Only headspace volatiles
  - Trapping can be affected by environment - bias
Volatile Collection

300mL Mason Jar

Twister

Teflon Gauze

Petri Dish

Vanilla sample
Volatile Identification

- Gas-Chromatography/Mass Spectrometry
  - Compound separation & identification

- Gas-Chromatography/Olfactometry
  - Flavor-active compounds
Compound Separation and Identification

Diagram:
- Septum
- Gas-tight syringe
- Sample
- Water-bath
- Injector
- Helium flow (20 ml/min)
- Glass liner, empty
- Purge and trap System
- Cold trap
- Injector
- GC
- Column
- FID
- Sniffing-port
Madagascan Vanilla

TIC: 102705E.D

Abundance

Time -> 0.00  5.00  10.00  15.00  20.00  25.00

Abundance

102705E.DAVID1A (*)

Time -> 0.00  5.00  10.00  15.00  20.00  25.00
Vanillin and Guaiacol

Vanillin

CHO
OCH$_3$
OH
Odor Threshold ~ 100ppm

Guaiacol

OH
OCH$_3$
Odor Threshold ~ 0.1ppb
Indonesian

Acetic Acid
3-methyl butanal
1,3-Butanediol
2,3-Butanediol
Furfural
Hexanal
Amyl furan
Guaiacol
Octanal
Anise alcohol
Anisaldehyde
Vanillin

Butter
Green
Cut Grass
Faint Creamy/Vanilla
Green Beans
Citrus
Chocolate
Strong Antiseptic/Vanilla
Vanilla Yogurt
Nutty
Brown Fruit
Vanillin
Mexican Acetic Acid
Acetoin
Green
Formic Acid
Diacetyl
me-butanals
Pentanal
Acetoin
Hexanal
Furfural
Pentylfuran
\(\delta\)-Butyrolactone
Heptanal
Benzaldehyde
Decane
Decanal/
Dodecanal
Vanillin
Dodecanal
Geranyl-
acetone
Undecanol
Orange
Cotton Candy
Strong
Antiseptic/Vanilla
Chocolate
Vanilla Yogurt
Caramel/Nutty
Brown Fruit
Vanillin
Methyl
Cinnamate
Rancid
Butter
Faint Creamy Vanilla
Green
Rotten
Brussel
Sprout
Citrus
Mushroom
Cotton Candy
Strong
Antiseptic/Vanilla
Chocolate
Vanilla Yogurt
Caramel/Nutty
Brown Fruit
Vanillin
Methyl
Cinnamate
Diacetyl Acetic Acid Ethyl Acetate
me-butanals Acetoin
3-me-1-butanol 2-me-1-butanol Furfural
Octanal ρ-me-anisole Methyl salicylate
Naphthalene Menthol
ρ-Cresol Guaiacol Nonanal
Anisaldehyde ρ-Anisyl acetate Methyl cinnamate
Methyl anisole Vanillin
Vanillinacetate t-caryophyllene

Butter Licorice Paint Fruity Faint Creamy Vanilla
Citrus Green Strong Antiseptic/Vanilla Chocolate Nutty
Vanilla Yogurt Licorice Vanillin Toffee
Tahitian

Butter
Licorice
Paint
Creamy
Green
Beans
Citrus
Vanilla
Toffee
Fruity
Buttery
Diacetyl
Acetic Acid
me-butanalns
Pentanal
Acetoin
Hexanal
Furfural
Heptanal
Benzaldehyde
Octanal
Limonene
Nonanal
Decanal
Menthol
Ethyl Octanoate
Dodecanal
Anisaldehyde
Anise Alcohol
Methyl - ρ-Anisate
Methyl Salicylate
Vanillin
Anisyl Acetate
Vanillin
Vanillin and Guaiacol

Area count X 1000

- Madagascar
- Indonesia
- Mexico
- Tahiti
- PNG

- Vanillin
- Guaiacol
Butter Compounds

Area count X 1000

Diacetyl
Acetoin

Madagascar Indonesia Mexico Tahiti PNG

0 100 200 300 400 500 600 700 800 900
Acetic Acid

Area count X 1000

Madagascar  Indonesia  Mexico  Tahiti  PNG

Acetic Acid

0
500
1000
1500
2000
2500
3000
3500
Madagascar Indonesia Mexico Tahiti PNG

0
500
1000
1500
2000
2500
3000
3500
Madagascar Indonesia Mexico Tahiti PNG

Area count X 1000
In Summary

- Beans are clearly different
- Vanillin is only part of the story
- PNG more similar to Tahitian - New Hybrid?
- Method - Useful for screening?
- Opportunities for new vanillas
We’ll Continue to Work. . .
Thanks

- Jean-Paul Schirlé-Keller
- Daniel Martinez
Madagascan vs. Mexican
Madagascan v. Tahitian
Tahitian vs. PNG