

# Ethnobotany. Lecture 21

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# Outline

- 1 Fruits, nuts and vegetables
  - Berries
  - Nuts
  - Gourd plants



## Characterization of the Major Odor-Active Compounds in Thai Durian (*Durio zibethinus* L. 'Monthong') by Aroma Extract Dilution Analysis and Headspace Gas Chromatography–Olfactometry

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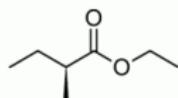
Supporting Information

**ABSTRACT:** An aroma extract dilution analysis applied on the volatile fraction isolated from Thai durian by solvent extraction and solvent-assisted flavor evaporation resulted in 44 odor-active compounds in the flavor dilution (FD) factor range of 1–16384, 41 of which could be identified and 24 that had not been reported in durian before. High FD factors were found for ethyl (2S)-2-methylbutanoate (fruity; FD 16384), ethyl cinnamate (honey; FD 4096), and 1-(ethylsulfanyl)ethanethiol (roasted onion; FD 1024), followed by 1-(ethyldisulfanyl)-1-(ethylsulfanyl)ethane (sulfury, onion), 2(S)-ethyl-4-hydroxy-5(2)-methylfuran-3(2H)-one (caramel), 3-hydroxy-4,5-dimethylfuran-2(SH)-one (soup seasoning), ethyl 2-methylpropanoate (fruity), ethyl butanoate (fruity), 3-methylbut-2-ene-1-thiol (skunky), ethane-1,1-dithiol (sulfury, durian), 1-(methylsulfanyl)-ethanethiol (roasted onion), 1-(ethylsulfanyl)propane-1-thiol (roasted onion), and 4-hydroxy-2,5-dimethylfuran-3(2H)-one (caramel). Among the highly volatile compounds screened by static headspace gas chromatography–olfactometry, hydrogen sulfide (rotten egg), acetaldehyde (fresh, fruity), methanethiol (rotten, cabbage), ethanethiol (rotten, onion), and propane-1-thiol (rotten, durian) were found as additional potent odor-active compounds. Fourteen of the 41 characterized durian odors showed an alkane-1,1-dithiol, 1-(alkylsulfanyl)alkane-1-thiol, or 1,1-bis(alkylsulfanyl)alkane structure derived from acetaldehyde, propanal, hydrogen sulfide, and alkane-1-thiols. Among these, 1-(propylsulfanyl)ethanethiol, 1-[[1-(methylsulfanyl)ethyl]sulfanyl]ethanethiol, and 1-[[1-(ethylsulfanyl)ethyl]sulfanyl]ethanethiol were reported for the first time in a natural product.

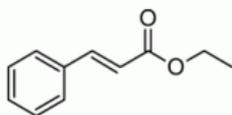
**KEYWORDS:** dithiohemiacetal, dithioacetal



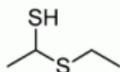
# Durian chemistry II



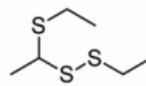
**6**  
fruity (16384)



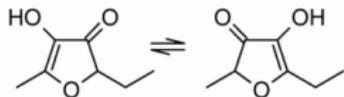
**43**  
honey (4096)



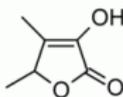
**13**  
roasted onion (1024)



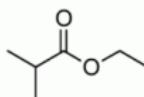
**33**  
sulfury, onion (512)



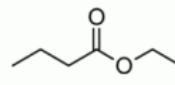
**42**  
caramel (512)



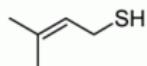
**44**  
soup-seasoning (512)



**2**  
fruity (256)



**5**  
fruity (256)



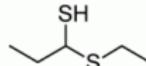
**7**  
skunky (256)



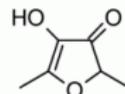
**9**  
sulfury, durian (256)



**11**  
roasted onion (256)



**19**  
roasted onion (256)



**40**  
caramel (128)

Figure 8. Most aroma-active compounds in the SAFE distillate obtained from durian pulp (FD factors in parentheses).



# Chocolate tree fruits (cacao “beans”)



# Chocolate tree, *Theobroma cacao*



# Avocado (*Persea americana*) pollination



# Fruits, nuts and vegetables

## Berries

# Currants and gooseberries

- Belong to Saxifragaceae family; multiple species of genus *Ribes* are cultivated
- All are shrubs, gooseberries (*Ribes uva-crispa*) have spines whereas currants (mostly *R. rubrum* and *R. nigrum*) not
- Rich of pectins and vitamin C



# Gooseberry



# Black currant



# Blueberry and cranberry

- Belong to heath family, Ericaceae and genus *Vaccinium*
- *Vaccinium macrocarpon* is American cranberry; *V.corymbosum* is the most cultivated species of blueberries
- Have high food and medicinal value, provide vitamins, antioxidants (carotenoids) and organic acids; *V. vitis-idaea* (lingonberry) is probably most valuable



# Blueberry



# Cranberry



# Cranberry harvesting



# Lingonberry



# Fruits, nuts and vegetables

## Nuts



# Nuts in general

- Contain proteins and oil in seed endosperm and/or cotyledons
- The main way of dispersal is the weak memory of collecting animals



# Walnut, *Juglans regia*

- Belongs to walnut family, Juglandaceae, only one species is cultivated
- Asian origin
- Huge deciduous tree, nuts are rich of tannins and group B vitamins



# Walnut



# Pecan

- *Carya illinoensis*, one species of hickory
- American origin
- Similar to walnut, but has less proteins and more sugars



# Pecan



# Hazelnut, *Corylus avellana* and other species

- Shrub of birch family, Betulaceae; several species are cultivated
- Nut is (among other common compounds) rich of carotenes



# Hazel female flower



# Pistachio, *Pistacia vera*

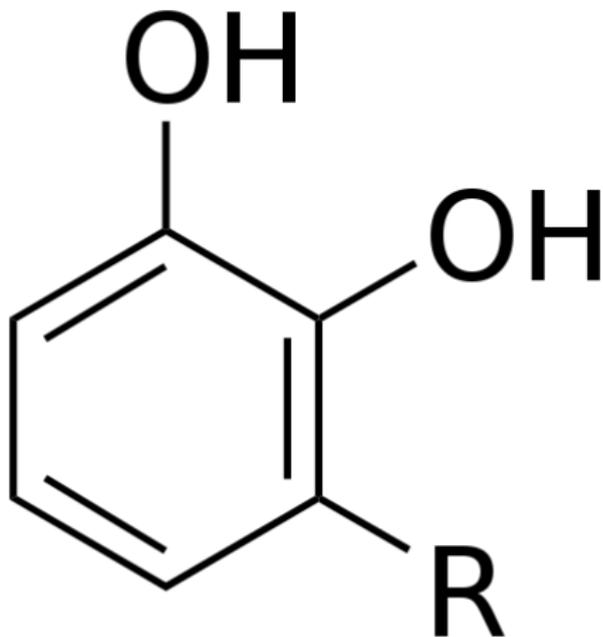
- Deciduous trees of Central Asian origin
- Nuts promote the lowering of cholesterol level
- Green parts of tree contain poisonous urushiol, like all Anacardiaceae family (including poison ivy)



# Pistachio



# Urushiol



# Brazil nut, *Bertholletia excelsa*

- Large tropical tree of Lecythidaceae family
- Among others, it is the richest dietary source of selenium



# Brazil nut flowers



# Brazil nut fruit



# Macadamia, *Macadamia integrifolia*

- Member of Proteaceae family; Australian plant
- Rich of fats and microelements; toxic to dogs



# Macadamia



# Chestnut, *Castanea sativa*

- Member of oak family, Fagaceae
- Old European culture, traditional to France, England and Germany
- Rich of tannins and therefore usually fried



# Chestnut



# Fruits, nuts and vegetables

## Gourd plants



# Gourds, Cucurbitaceae family

- $\approx$  900 species, mostly tropical and subtropical plants
- Prefer dry regions, important component of different deserts
- Hairy herbs or vines with tendrils (modified shoots)
- Flowers unisexual
- Petals and stamens fused
- Pistil with 3 carpels, ovary inferior
- Fruit is a berry

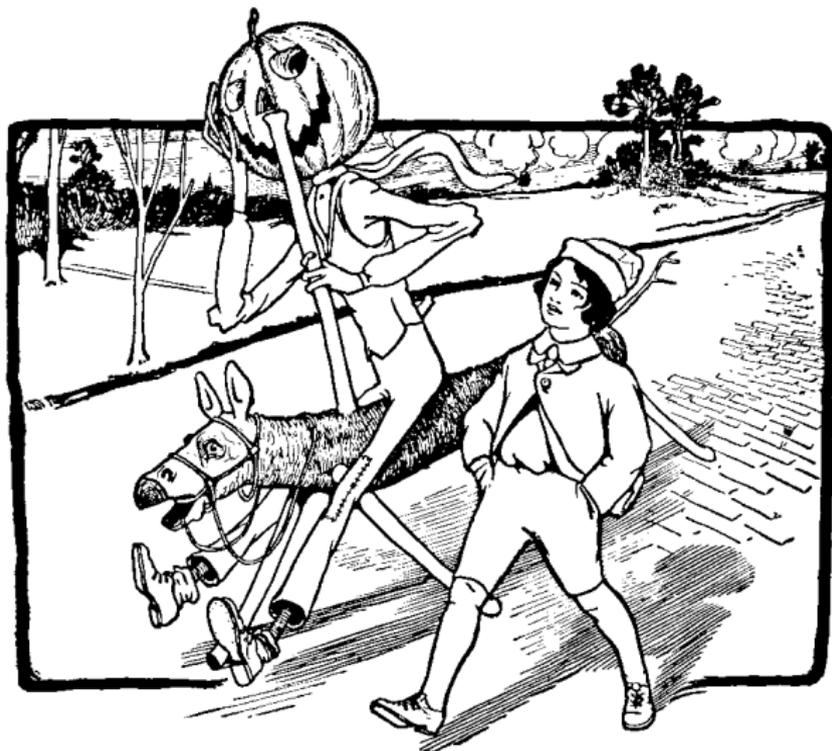


# Pumpkins and squashes, *Cucurbita* spp.

- Central American origin
- Plants of multiple uses; it is normal to harvest the underripened



# Pumpkinhead, Sawhorse and Tip (Ozma)



# Watermelon, *Citrullus lanatus*

- African origin
- The source of water, multiple medicine uses (e.g., for kidney diseases)



# Watermelon flower

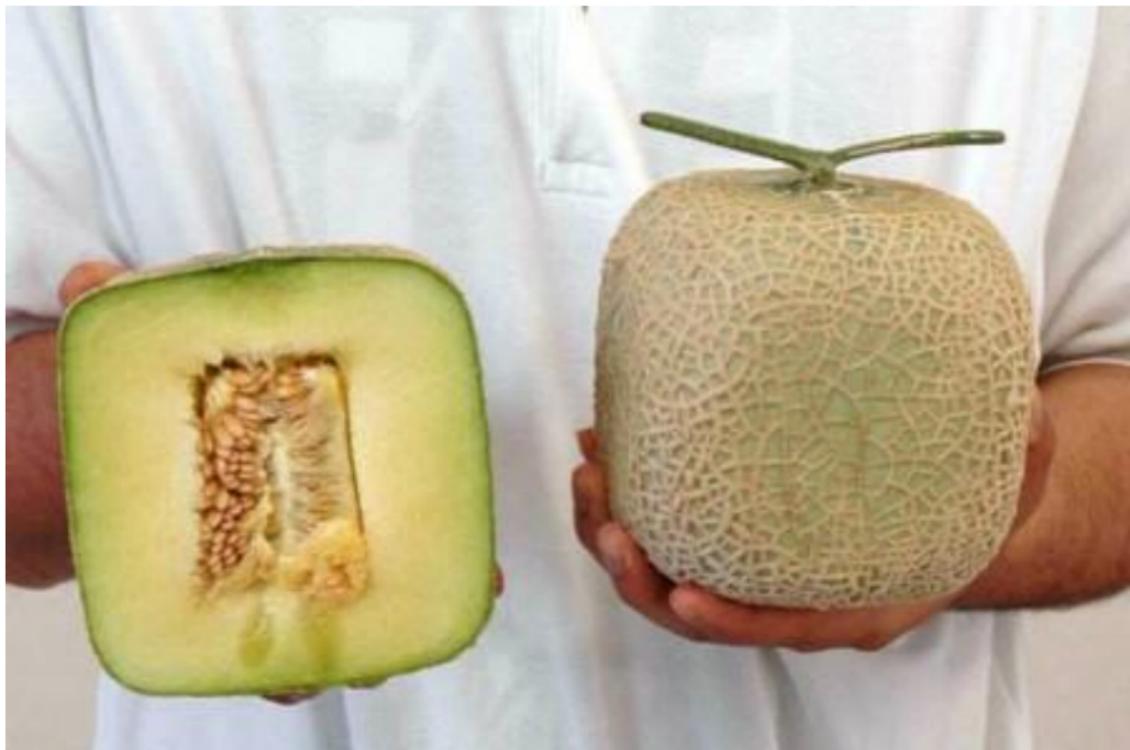


# Melon, *Cucumis melo*

- Central Asian origin
- Rich of sugars (some cultivars up to 20%), used as sugar source in Central Asia



# Japanese square melon



# Cucumber, *Cucumis sativus*

- Annual herbaceous vine from India forests, wild relatives not found
- May grow as water culture, widely cultivated in greenhouses, some cultivars have one week for fruit development



# Indian Dosakai round cucumber



# Chayote, *Sechium edule*

- One of relatively “new” cultures from Mexico
- High yield culture, one plant may give up to 40 kg of fruits



# Chayote



# Summary

- Nuts are plants accumulating oils and proteins in their seeds, they mostly dispersed by “bad memory” animals
- Gourd plants are intermediates between fruits and vegetables



# For Further Reading



A. Shipunov.

*Ethnobotany* [Electronic resource].

2011—onwards.

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[http://ashipunov.info/shipunov/school/biol\\_310](http://ashipunov.info/shipunov/school/biol_310)

