

# Ethnobotany. Lecture 14

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# Outline

- 1 Oil plants
  - Safflower, *Carthamnus tinctorius*
  - Oil palm, *Elaeis guineensis*
  - New oil cultures
  - Lesser oil plants
  - Technical oil plants

# Safflower, *Carthamnus tinctorius*

- Belongs to Mediterranean *Carhtamnus* (distaff thistles) genus and atser family, Compositae
- Highly ornamental cultivated plant
- Multiple uses: as oil plant, as medicinal plant and as saffron substitute (red dye)

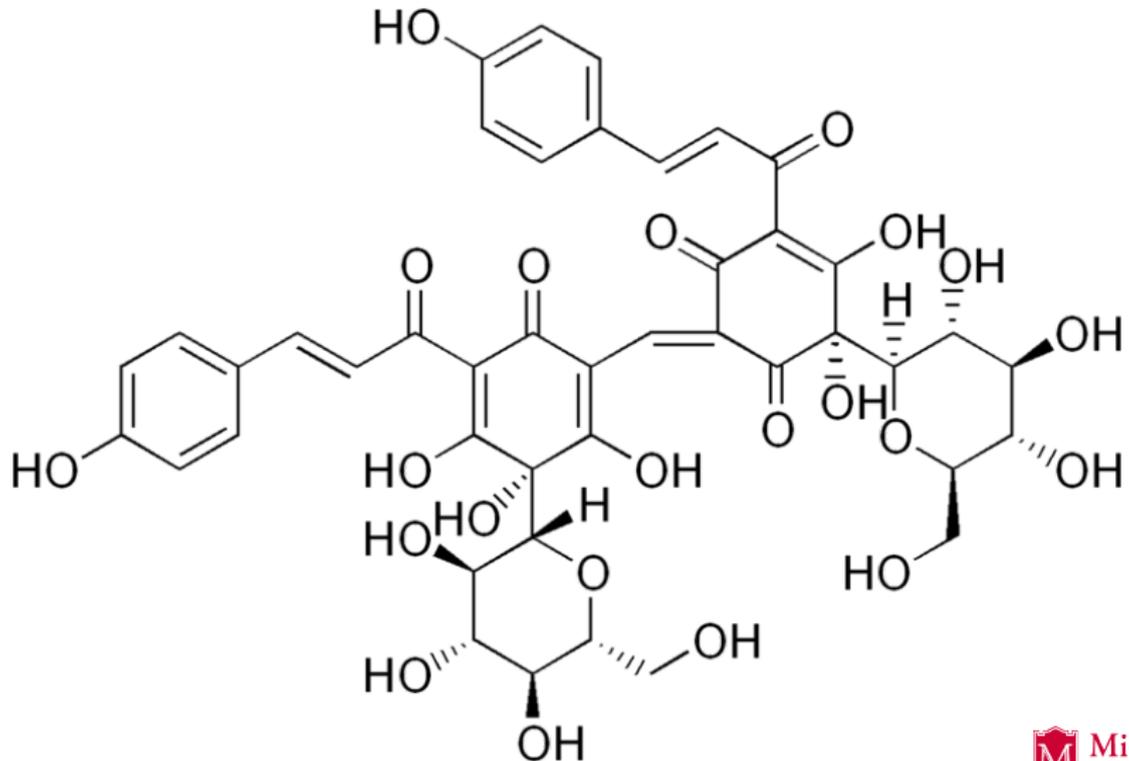
# Safflower field



# Safflower features

- Achenes contain 15–35% of oil
- Oil contains mono- and polyunsaturated fatty acids, and therefore may be used for painting (fast-dried oil)
- Flowers contain carthamin which produces a red-brown color, often used in food production
- Rich of tokoferols (vitamin E)

# Carthamin



# Safflower history

- One of the most ancient cultivated plants, used in Old Egypt
- Went to Japan and used there as a plant which dye had ceremonial meanings

# Making Japanese clothes



# Painted with safflower



Shuntei (1898): *Shadow of the Castle*

# Oil palm, *Elaeis guineensis*

- Used in Africa from prehistorical times, but the mass cultivation started only in the beginning of XX century
- Belongs to palm family, Palmae
- Palm oils are semi-solid at the room temperature: plant fats

# Fruits of oil palm



# Blocks of palm oil



# Oil palm features and history

- Oil is rich of saturated fatty acids, especially palmitic ( $C_{16}$ ) acid, also rich of carotenes and often has a reddish color
- Yield is high (up to 100 kg of oil from one tree per year), and therefore palm oil is very common oils in tropics
- Biggest producers are Malaysia and Indonesia
- Also famous as the source of Greek fire and napalm (mixture of palmitic acids, several other organic compounds and aluminum)

# Making of palm oil (Kongo)



# Napalm



# Sacha inchi, *Plunkettia volubilis*—perspective oil plant

- South American, Amazonian tree from spurge family, Euphorbiaceae
- Capsules contain several large seeds, rich of oil ( $\approx 60\%$ )
- Sacha inchi oil contains highest amounts of omega-n-unsaturated fatty acids (93%!) and vitamin E (by the way, emu oil is the one of the few animal oils which also contains high high amounts of omega, up to 20%)
- Cultivation started in 2000s, mostly in Peru

# Sacha inchi



# Emu oil



# Coconut, *Cocos nucifera*

- Belong to Palmae, cultivated around the world as technical and nut plant
- Oil is similar to Africal oil palm: rich of saturated fatty acids, especially lauric acid (48%)
- Oil extracted from either coconut milk (wet process), or copra (dry process)
- Apart from food, has a wide technical use (lubricant, fuel, cosmetics)
- Coconut palm will be covered in more detail later

# Drying coconut copra for oil making



# Soybeans, *Glycine max*

- Apart from protein food, soybeans produce one of most widely used cooking oil, with high smoke point (232°C)
- Soybean oil is rich of poly-unsaturated fatty acids (especially 2-unsaturated linoleic, 51%)
- Soybean oil may also be used for painting (because it is drying slowly), as insect repellent, as fuel, and as fixative to essential oils

# Soybean oil



# Soubean oil as biofuel



# Flax, *Linum usitatissimum*

- Obtained from flax (*Linum usitatissimum* from Linaceae family) which is also used as technical plant and will be covered in more details later
- Bright yellow, very fast drying oil because it is rich of triply unsaturated fatty acid,  $\alpha$ -linolenic acid (up to 55%), smoke point is low (107°C)
- Normally, used as a technical substance for painting, for finishing wood, for linoleum (one of the first half-synthetic floor covering) and also as rich and useful food supplement ( $\alpha$ -linolenic acid =  $\omega$ -unsaturated acid, EFA)

# Wood finishing with flaxseed oil



# Cottonseed, *Gossypium* spp.

- Extracted from seeds of cotton (several species of *Gossypium* from Malvaceae family)
- Oil contains up to 52% stearic (monounsaturated) fatty acid, very stable (does not dry) and with high smoke point (232°C) [Rice oil has the highest smoke point, 254°C]
- Used in many foods, especially for salad dressings and chips, for deep frying
- High of tokoferols (vitamin E)
- Contain amounts of *gossypol*—biologically active phenolic compound which may be used in medicine (e.g., as contraceptive, for curing viral infections etc.) but should be removed from food oil

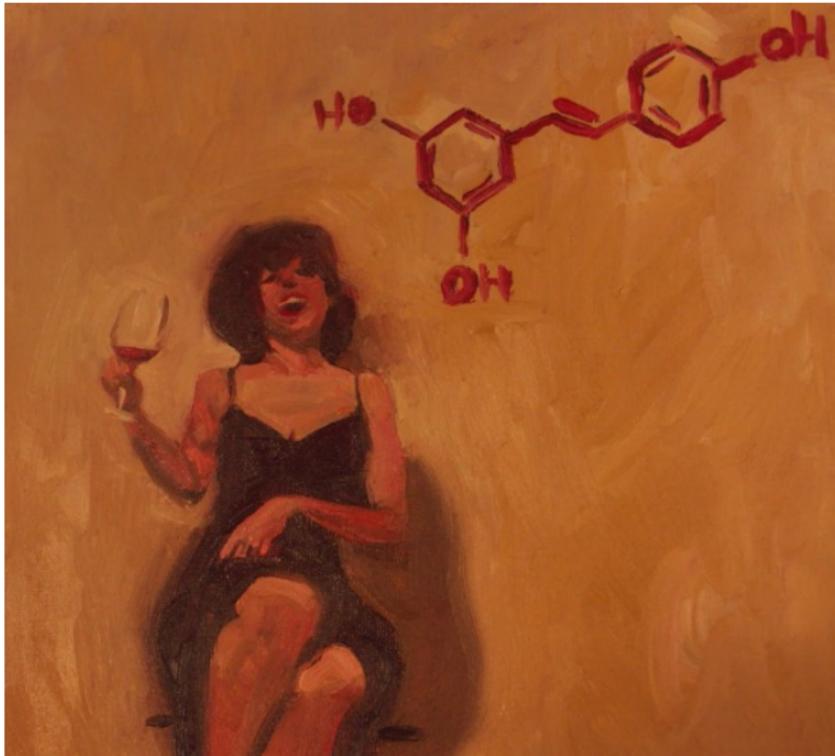
# Cottonseed oil



# Grapeseed, *Vitis vinifera*

- By-product of winemaking, extracted from grape (*Vitis vinifera* from Vitaceae family)
- Similarly to soybean oil, rich of 2-unsaturated linoleic acid (72%)
- Used similarly to cottonseed oil: salad dressings and deep frying
- Has high medicinal value: contains *phytoalexin* (plant non-specific immune chemical) **resveratrol** (also component of red wine) which is anti-cancer and anti-hypertensive drug

# Resveratrol



# Cocoa butter, from *Theobroma cacao*

- Cocoa butter from *Theobroma cacao* (Malvaceae family) is plant fat, rich on non-saturated fatty acids (stearic and palmitic together  $\approx 60\%$ )
- Has  $37^{\circ}\text{C}$  melting temperature and therefore used a lot as a subsidiary oil in medicine (e.g., in suppositories) and in cosmetics; also used for making white chocolate
- Normally, does not contain theobromine and caffeine (components of dark chocolate)

# Cocoa flower



# Essential oils

- Mixture of hydrophobic components bearing plant odors
- Used for aromatherapy and in cosmetics
- The most famous are probably rose oil and eucalyptus oil

# Ylang-ylang, *Cananga odorata*

- Tree from custard apple family (Annonaceae) which is cultivated for perfume oil
- Fast-growing tree from Indonesia
- Has diverse medical applications, used for cosmetics and in aromatherapy
- Comoros is the biggest exporter of ylang-ylang (29% of its annual export)

# Ylang-ylang



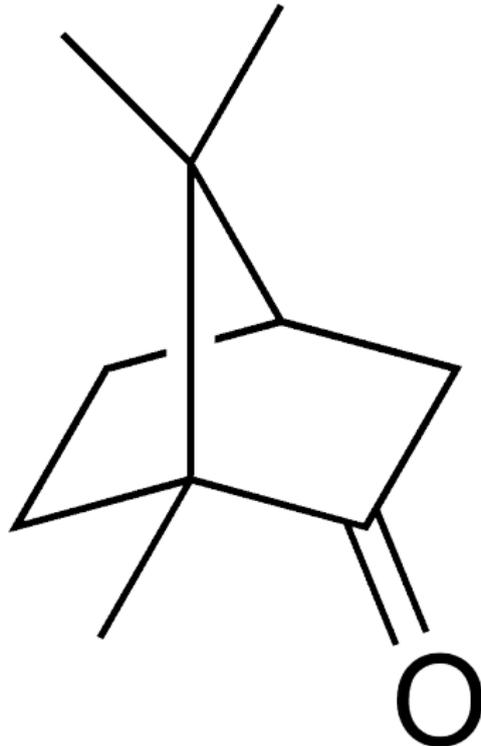
# Camphor tree, *Cinnamomum camphora*

- East Asian tree from laurel family, Lauraceae
- Contain multiple aromatic substances, e.g., camphor—unusual hydrophobic molecule
- Camphor use has the old history, it still has a high ceremonial value in Hinduism, used in sweets, for aromatherapy and in fireworks (highly flammable)
- It is a Totoro tree from H. Miyazaki's "My neighbor Totoro" anime film

# Camphor tree



# Camphor: chair molecule



# My neighbor Totoro



# Summary

- Oil palm and cocoa tree produce high amounts of plant “fats”
- The most promising contemporary oil cultures are canola and sacha inchi

# For Further Reading



A. Shipunov.

*Ethnobotany* [Electronic resource]. 2011—onwards.

Mode of access:

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



P. M. Zhukovskij.

*Cultivated plants and their wild relatives* [Electronic resource].

Commonwealth Agricultural Bureaux, 1962.

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zhukovskij1962\\_cultivated\\_plants.pdf](http://ashipunov.info/shipunov/school/biol_310/zhukovskij1962_cultivated_plants.pdf)

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