

# Ethnobotany. Lectures 20-21

Alexey Shipunov

Minot State University

March 11, 2015



# Outline

## 1 Fruits and vegetables

- Introduction

## 2 Rosaceae fruits

- Rosaceae fruits in general
- Rosaceae with multiple fruits
- Rosaceae with stone fruits
- Rosaceae with pome fruits



# Outline

- 1 Fruits and vegetables
  - Introduction
  
- 2 Rosaceae fruits
  - Rosaceae fruits in general
  - Rosaceae with multiple fruits
  - Rosaceae with stone fruits
  - Rosaceae with pome fruits



# Fruits and vegetables

## Introduction



# Fruits—and vegetables

- The main “common sense” difference is the low amounts of sugars in vegetables, plus tree origin of fruits
- However, there are multiple exceptions: beet, avocado, plantains etc.
- In addition, pumpkins and relatives (melon, watermelon, squashes) normally treated as separate group
- Morphologically, fruits are fruits (and sometimes seeds like litchi or pomegranate, or riped inflorescences like pineapple or fig), and vegetables are everything else



# Main components of fruits

- Water
- Dietary fiber
- Sugars
- Organic acids
- Vitamins

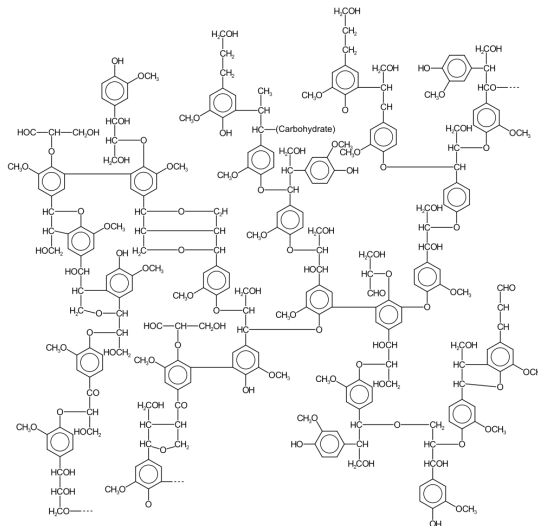


# Dietary fiber

- Polysaccharides
- Lignin
- Other constituents of plant cell walls (glycoproteins etc.)
- Improve intestinal transit, lowering the risk of colorectal cancer



# Lignin





# Fruit sugars

- Mostly fructose and its derivatives (kestoses)
- Sweeter 1.7 times more than sucrose, but only at room temperature

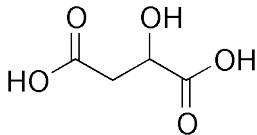
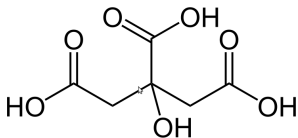


# Organic acids

- Malic (*Pyrus malus*, apple and other Rosaceae fruits)
- Citric (*Citrus* fruits etc.)
- Tartaric (e.g., in wine)
- Are good antioxidants



# Citric and malic acids

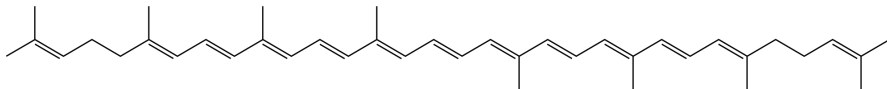
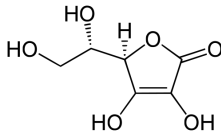


# Fruit vitamins

- Vitamin C (ascorbic acid)
- Pro-vitamin A ( $\beta$ -carotene)
- Other carotenes (lycopene etc.)



# Ascorbic acid and lycopene

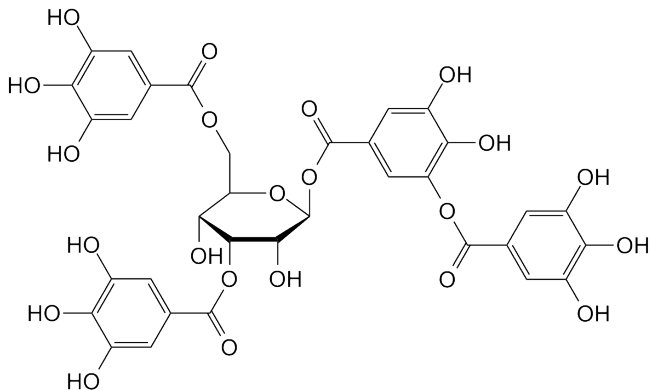


# Specific components which are restricted to few species

- Lipids
- Starch
- Gums, mucilages, pectins
- Astringent chemicals (e.g., tannic acid)
- Aroma compounds
- Other secondary\* metabolites (latex, alkaloids, glycosides)



# Tannic acid



# Rosaceae fruits

## Rosaceae fruits in general





# Rosaceae in general

- Medium-sized family ( $\approx 3,000$  species) of small trees, shrubs and herbs from subtropical and temperate regions
- Flower contains numerous stamens (secondary multiplied), free pistils and hypanthium
- Fruit is mostly fleshy



# Rosaceae groups

- Rosoideae—herbs or shrubs, leaves often compound, receptacle large, fruit aggregate
- Spiraeoideae—shrubs or trees, leaves simple, receptacle small, fruit often monomerous
- Maloideae—trees, leaves simple, receptacle and pistils fused



# Rosaceae fruits

## Rosaceae with multiple fruits



# Rosaceae with multiple (aggregate) fruits

- Most primitive group
- Tangled genetic systems: apomixis, polyploidy and permanent odd pentaploidy ( $2n = 35$  in *Rosa canina*)
- *Rosa* is ornamental and medicine plant with
- *Rubus* and *Fragaria* are also widely cultivated



# Rubus

- Biennial semi-shrubs, sometimes herbs
- Multiple wild species, only two are widely cultivated: raspberry (*Rubus idaeus*) and blackberry, *Rubus caesius* forms and hybrids



## *Rubus idaeus* from Koehler's "Medizinal Pflanzen"



## *Rubus* features

- Two aboveground stem types: primocane and floricane, plus underground rhizomes
- Fruits contain (among other) salicylic acid and different antioxidants



# Blackberries on the different stages or ripening





## *Fragaria* × *ananassa*, strawberry

- Octoploid ( $2n = 56$ ) hybrid species of two other octoploid strawberries, *Fragaria virginiana* from North America and *F. chiloensis* from Chile.
- Garden hybrid, first occurrences are in France from  $\approx 1740$
- Herb with runner stems and accessory multiple nut fruit (the edible part is a receptacle)



# Strawberry features

- Susceptible to multiple diseases, often cultivated in semi-artificial conditions as plasticulture
- Cultivated as annual or perennial
- Long-day cultivars flower early in May and capable to produce fruits in June



# Plasticulture of strawberries



## *Rubus chamaemorus*, cloudberry

- One of the northernmost berry plants
- Semi-shrub; the only dioecious *Rubus*
- Food of many Arctic mammals and birds, e.g. reindeer
- When ripe (yellow), have a creamy texture and tart taste
- Contains benzoic acid content acting as a natural preservative:: stays all winter without additional preparations
- Rich of vitamin C: used against scurvy



# *Rubus chamaemorus*



# Roses as food plants

- Roses (*Rosa* spp. including North Dakota state flower, *Rosa arkansana*) are edible plants.
- Hypanthium is rich of vitamins, especially vitamin C. Typically, accessibility of vitamins from fruits are higher than from synthetic products.



# Rosaceae fruits

## Rosaceae with stone fruits



## Rosaceae with stone fruits, *Prunus*

- Multiple ( $\approx 430$ ) species often separated in different genera on the base of fruit morphology
- Often hairy exocarp, juicy mesocarp and stone endocarp
- Distributed almost equally among Eurasia and North America
- Flower before appearance of leaves, inflorescences are umbels





## *Prunus avium*, cherry

- Mediterranean tree, cultivated from Roman times
- Used also as timber and ornamental plant
- All parts except “berries” (drupes) contain cyanogenic glycosides
- Sweet/early and sour/late groups of cultivars.



# *Prunus*



# Cherry



## Other cherries

- Black cherry (*Prunus serotina*) and choke cherry (*Prunus virginiana*) are two frequently cultivated North American species
- Choke cherry is a state fruit of North Dakota
- It is also a hosts of tent caterpillar, *Malacosoma* sp.



# Choke cherry



# “Nest” of tent caterpillars



## *Prunus armeniaca*, apricot

- Old culture of Central Asian origin, later spread into China and Europe
- Dry fruits were traditionally used as sugar source (along with melon)
- Fruits contain oil of cooking quality
- Biggest producer is Turkey



# Drying apricots in Cappadocia, Turkey





## *Prunus* × *domestica*, plum

- Hybrid hexaploid ( $2n = 48$ ) species, originated from cherry plum *Prunus divaricata* ( $2n = 16$ ) and blackthorn *P. spinosa* ( $2n = 32$ )
- Probably of Caucasian origin, contemporary cultivars are even more complicated hybrids
- Well-known laxative fruit
- Chinese “plum” is a separate species, *Prunus mume*—kind of intermediate between apricot and plum



# Plums



# Blackthorn



# Cherry plum



# Chinese plum drawing



# *Prunus mume*



## *Prunus persica*, peach

- Tree of Chinese origin, cultivated from 1,100 BC and spread to Europe with Alexander the Great army
- Multiple cultivars including nectarines (result of bud sport mutation) and Chinese flat peaches
- Propagated mostly by grafting on adequate rootstocks (many other *Prunus* species)
- China is still a biggest producer

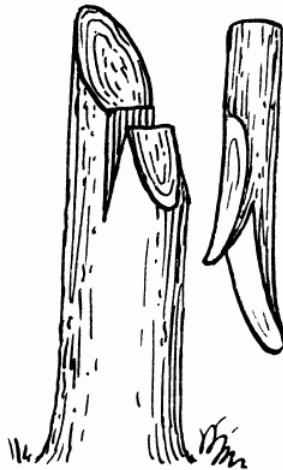
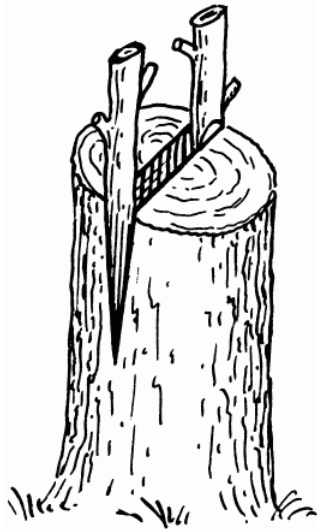


# Chinese flat peach





# Grafting



# Rosaceae fruits

## Rosaceae with pome fruits



# Pome fruits

- Result of fusion between hypanthium and pistils
- The edible part is a hypanthium wall



# *Pyrus malus*, apple

- Sometimes treated as separate genus *Malus*, in this case species has a name *Malus domestica*
- Eurasian origin, common forest plant in Europe
- Eastern Turkey is the center of species diversity



# *Malus*



# Apple features and history

- Old culture, cultivation started in pre-Roman times
- Brought to North America in 1625 (first apple tree near Boston)
- Massive mythological background
- Temperate culture; in tropics, leaves should be removed if flowering required on next year
- Biggest producers are China, U.S. and Iran



# Apple pollination



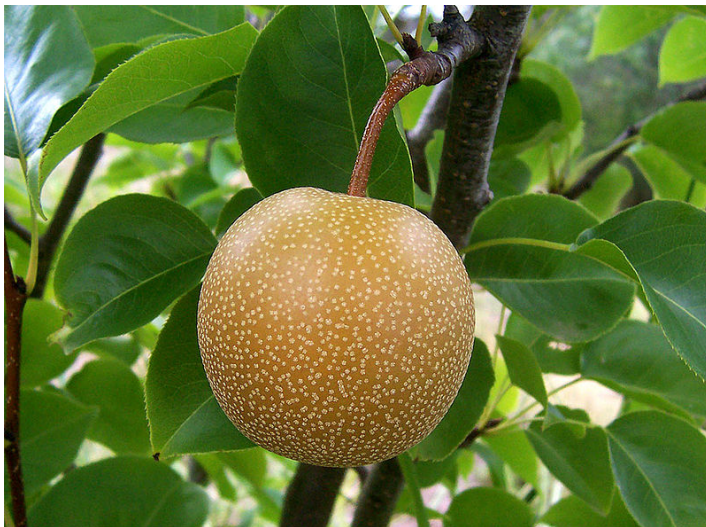
## *Pyrus communis*, pear

- Some branches transform to thorns
- Chinese origin, cultivation started there before 1,000 BC
- Went to Europe in ancient Greek times
- *Pyrus pyrifolia* is a close species—Asian pear





## Asian pear, *Pyrus pyrifolia*



## *Cydonia oblonga*, quince

- Caucasian origin, spread to the cultivation in Balkans
- Rich of microelements
- Used mostly for jams and jellies



# *Cydonia*



# Quince flowers



# Quince fruits



## *Chaenomeles japonica* and hybrids, Japanese Quince

- East Asian deciduous spiny shrubs, usually small
- Red flowers and relatively big, hard fruits
- Fruits are edible after frost (“bletted”)
- Have more vitamin C than lemons (up to 150 mg/100 g)



# Japanese Quince, *Chaenomeles*



## *Mespilus germanica*, medlar

- Caucasian hardy culture
- Contains significant amounts of pectins, used for jams and jellies





# Medlar fruits



## *Eriobotrya japonica*, loquat

- Evergreen tree from central China
- Flowering in November, has fruits in April and May
- Cultivated also as ornamental plant



# Loquat flowers



# Loquat fruits



## *Aronia* spp., chokeberries

- North American genus with 2–3 species, grows well in North Dakota
- Fruits are rich of antioxidants
- Used also as ornamental
- In Russia, cultivated hybrid (origin is still unclear, but probably with European common whitebeam, *Sorbus aria*) *Aronia* × *mitchurinii* is one of the northernmost fruit plants



## *Aronia* × *mitchurinii*



## *Amelanchier* spp., serviceberry, juneberry

- North American genus with  $\approx 20$  species, some are cultivating
- Fruits are rich of vitamins (A, C and even E) and minerals
- Grows well on poor soils and dry conditions, recommended for prairie cultivation



# Serviceberry





## *Sorbus* spp., mountain ash

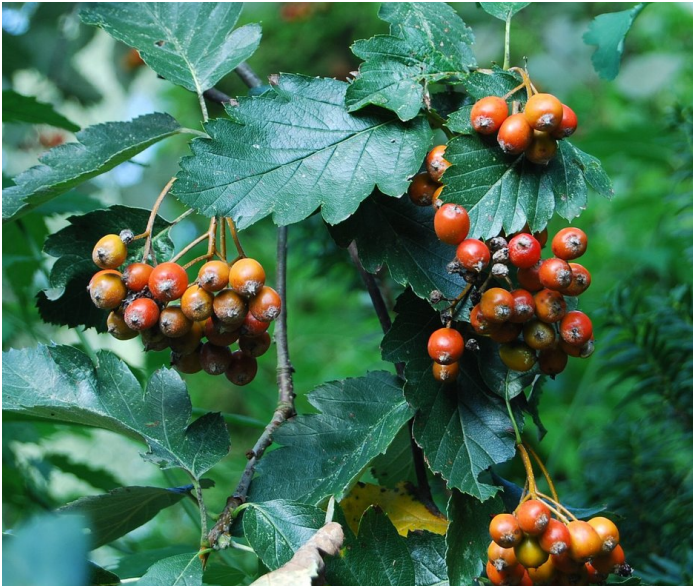
- Large (up to 200 species) genus occurred in North America and Eurasia
- Most species have edible fruits
- European rowan (*Sorbus aucuparia*), and common whitebeam (*Sorbus aria*) are main cultivated species (also as ornamentals)
- Fruits are mostly used for wines, jams and jellies; bitter taste is normally gone after first frosts



# European rowan, *Sorbus aucuparia*



# Common whitebeam, *Sorbus aria*



## *Crataegus* spp., hawthorn

- More than 200 species of shrubs and small trees from Eurasia and North America
- Many species are cultivated for their fruits and also as ornamentals, for aroma compounds and/or as tea surrogate
- Used in multiple traditional medicine practices, one proven use is treating chronic heart diseases



# Hawthorn fruits



# Summary

- The main “common sense” difference of vegetables is the low amounts of sugars, most vegetables are also herbs
- Most of fruits are sources of water, sugars, organic acids and plant vitamins
- Rosaceae is one of the most important temperate fruit families
- Most of Rosaceae cultivated fruits are result of long selection involved multiple hybridization
- Most of Rosaceae cultivated fruits are propagated by grafting on appropriate rootstocks



# 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. Abridged translation from Russian.

Mode of access:

[http://ashipunov.info/shipunov/school/biol\\_310/zhukovskij1962\\_cultivated\\_plants.djvu](http://ashipunov.info/shipunov/school/biol_310/zhukovskij1962_cultivated_plants.djvu).

