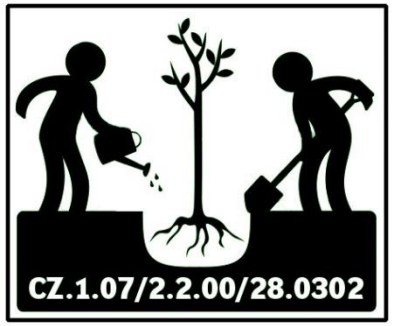
INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ



Inovace studijních programů AF a ZF MENDELU směřující k vytvoření mezioborové integrace CZ.1.07/2.2.00/28.0302

Tato prezentace je spolufinancovaná z Evropského sociálního fondu a státního rozpočtu České republiky

Morphology of Grapevine

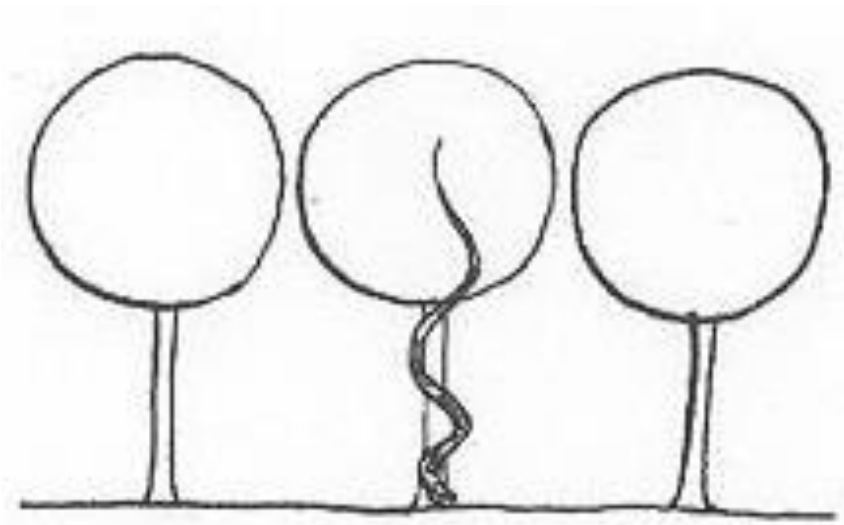
Knowing the morphology of grapevine structure and functions of individual parts is a must for cultivation

Grapevine characteristics

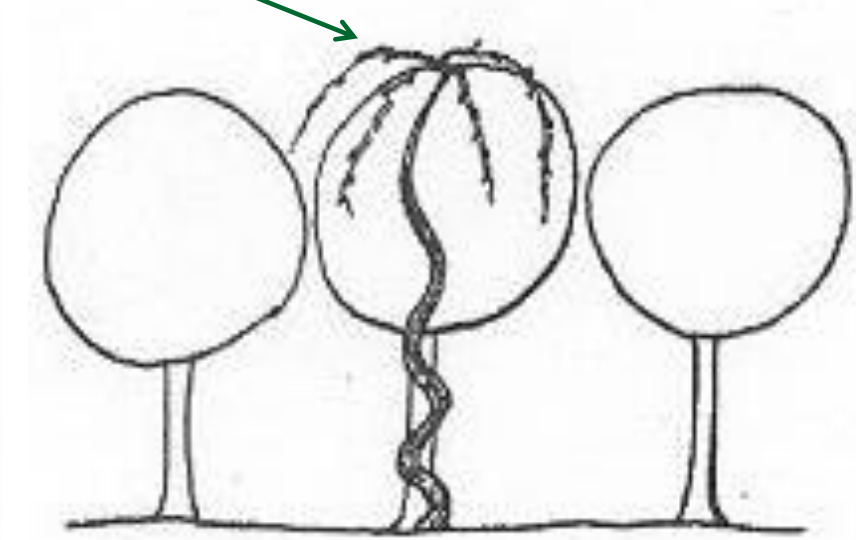
- 1. Heat-demanding and light-demanding climbing plant
- Originally, grapevine was a shrub-like plant growing on sunny forest steppes
- Originally, stalk branching was monopodial
- One major stalk and shorter side branches
- Stalk and branches terminated with an inflorescence
- This vine arrangement did not allow to constantly prolong annual shoots (bloom at the top terminated growth)

Later - in the shades of the forest, vines had to compete for light:

- Novel type of monopodial-sympodial branching evolved and the vine became climbing, a vine with tendrils
- Fast prolongation of its vertical axes allowed the vine to climb to the tops of near trees and absorb sun-light



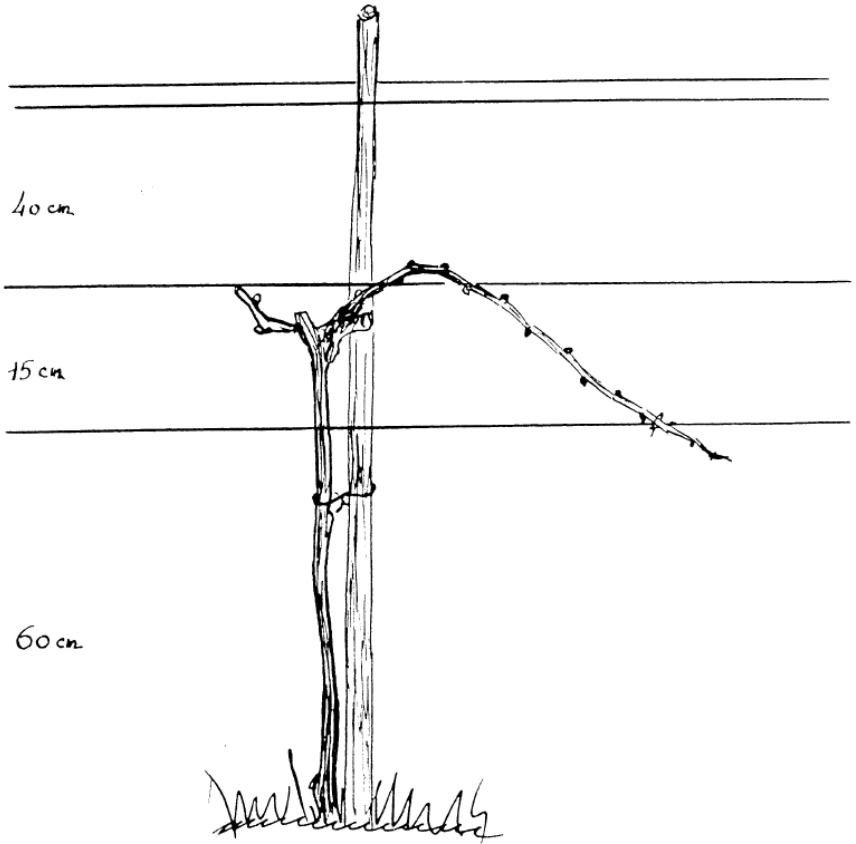
Higher moisture, less light



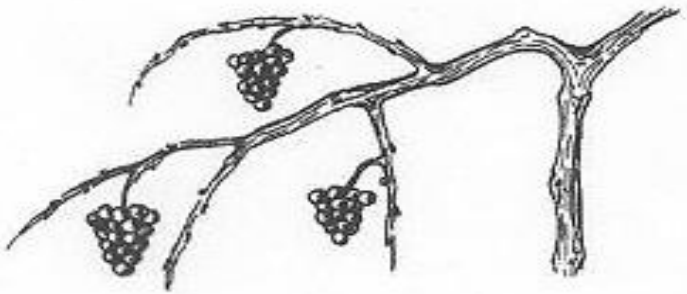
Full irradiation, inflorescence development

2. Polarity – apical dominance

- Growth dominance of annual shoots growing from buds close to the apex
- In order to suppress the polarity and promote basal buds break, shoots are trained in horizontal direction and/or are heading downwards

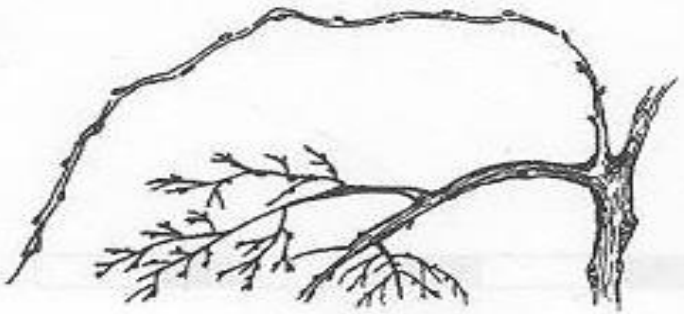


3. Renewal of fruiting wood on wild grapevines, several vine tiers



Při první plodnosti se vyvíjejí na málo rozvětvených větvích hrozny v menším počtu, ale o velké průměrné hmotnosti s vyšším obsahem cukrů.

Původní růstové patro se neustálým rozvětvováním silně zahustí. Narůstají jen krátké letorosty a velký počet malých hroznů s nízkým obsahem cukrů



Na stařině vyroste ze spícího očka bujný a dlouhý letorost, z něhož vznikne patro nové, výhodněji položené

Classification of grapevine organs

- Underground organs – a root system
- Aboveground organs:
- Lignified: Old wood, 2-year old wood, 1-year old wood
- Not lignified: annual shoots, leaves, tendrils, perianth, multiple fruits, berries, seeds

1. Underground organs

- Root system
- Old roots, lignified roots, and new roots for nutrients intake
- Large and deep root system (due to climbing nature of the vine)
- Functions:
- Anchoring of the vine in soil
- Intake and distribution of water and nutrients
- Storage of reserve substances (carbohydrates, minerals)
- Phytohormones production

Phytohormones production:

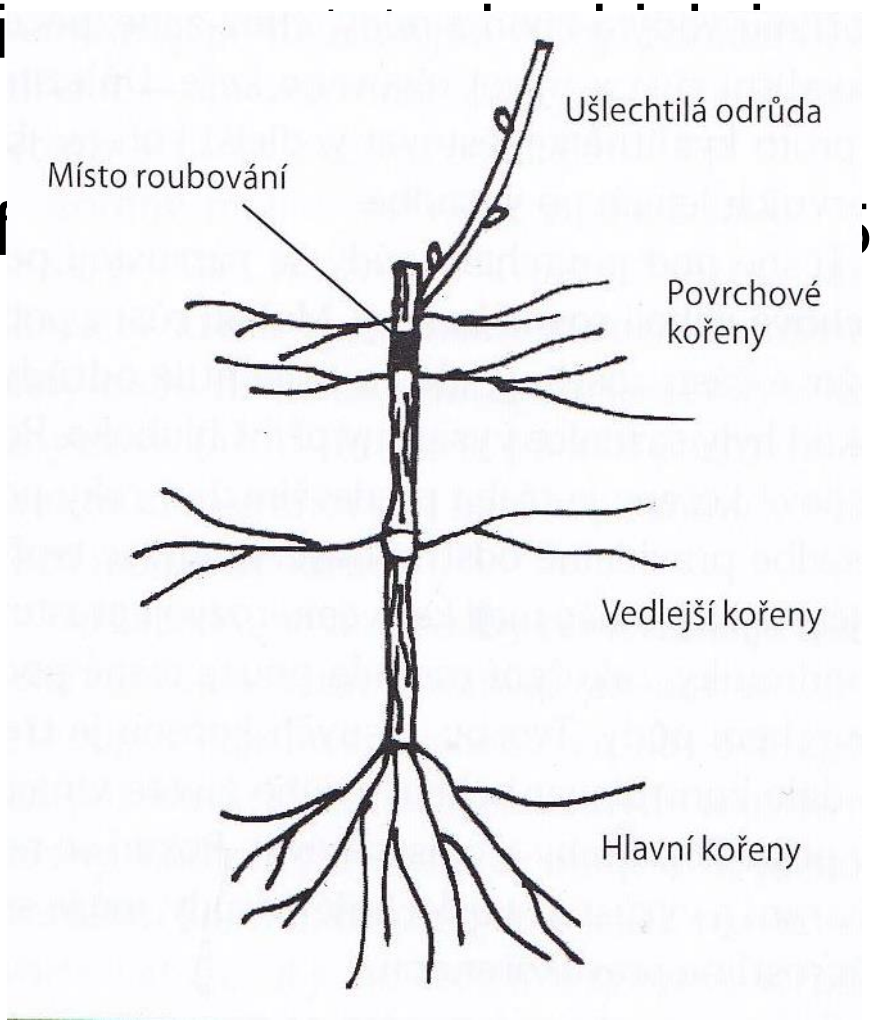
- Cytokinins and gibberellins are produced in root apex and are further distributed to the aboveground parts via vascular tissues; hormones promote balance between aboveground and underground part of the vine, and initiate bloom and berry development
- Auxins are produced in annual shoot apex and are transported to roots via phloem; auxins are responsible for cell division and thus promote root development
- Root system is directly linked to vine canopy; canopy loss or damage has negative impact on growth and development of the roots

- Generative propagation, i.e. from seeds, is used only in a breeding process for hybridization of novel varieties

Seedlings have a taproot

Grape-growers propagate grapevine using vegetative propagation only:

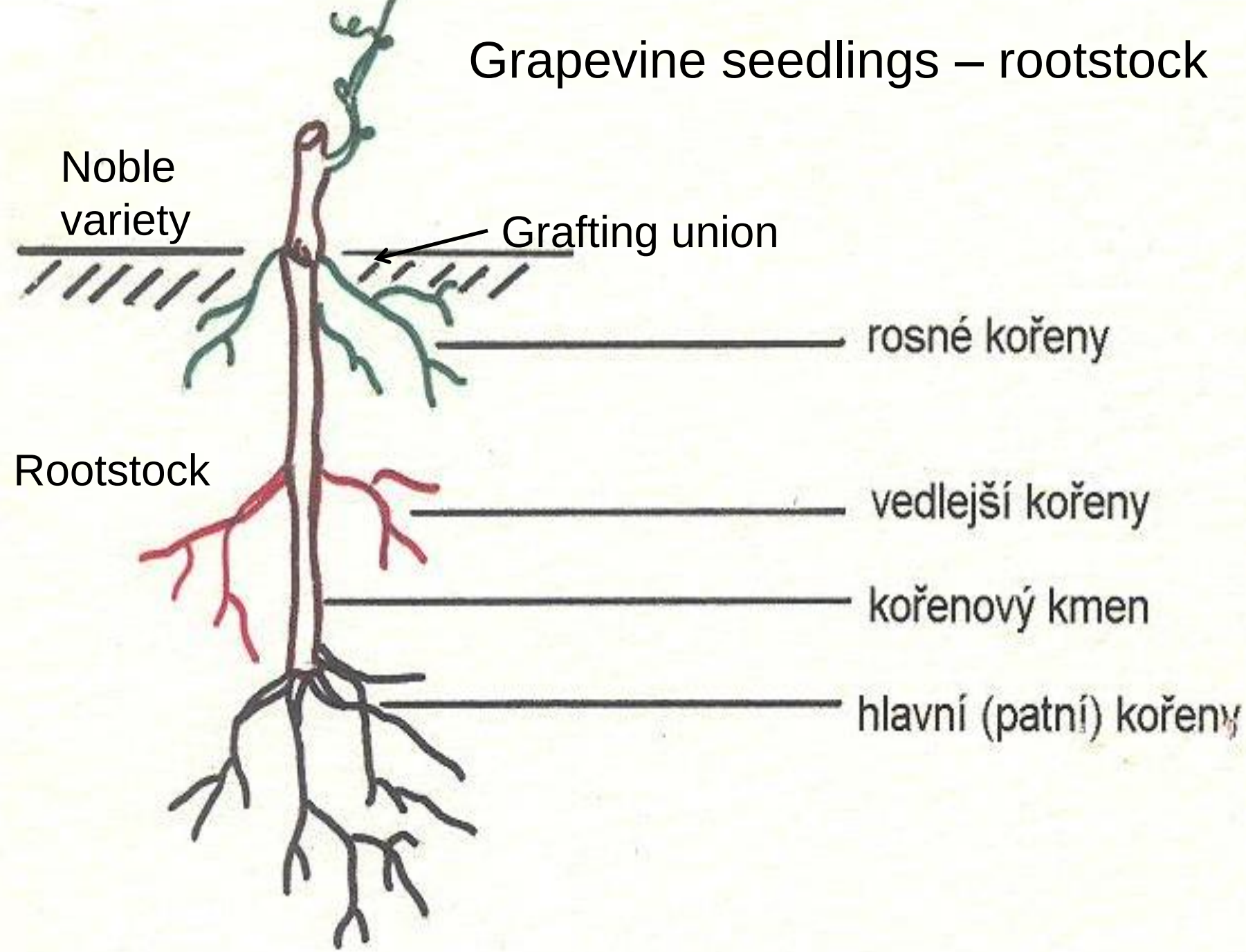
- Grafting of noble varieti
  resistant to phylloxera
- Root system develops f
  50 cm) which make up



a) Root stem

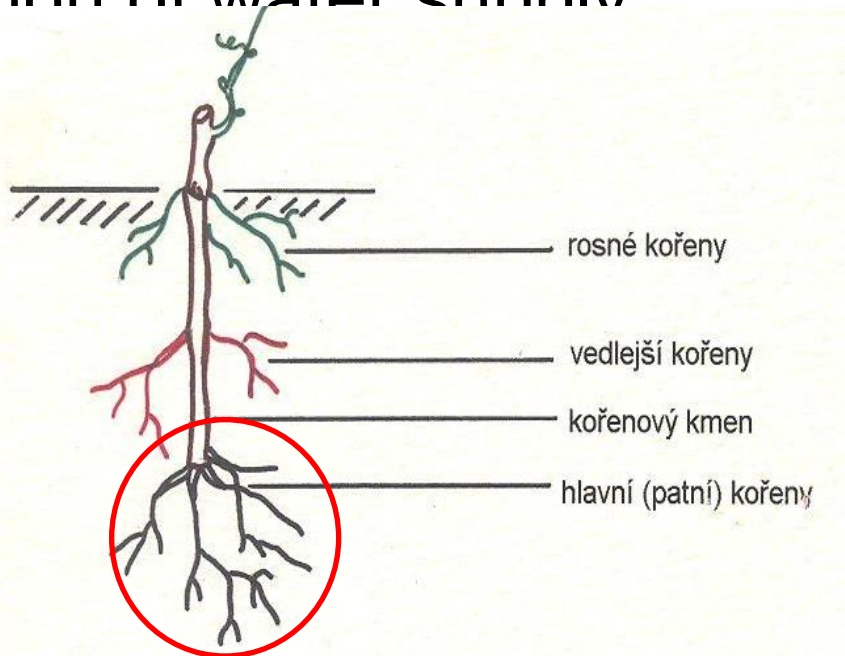
- In grafted vines, root stem is a rootstock (0.35-0.50 m)
- Root stem anchors the vine in soil and prevents out-rooting of the vine by wa
- Supplies nutrients both to a nd parts of the vine
- Develops lateral roots and r

Grapevine seedlings – rootstock



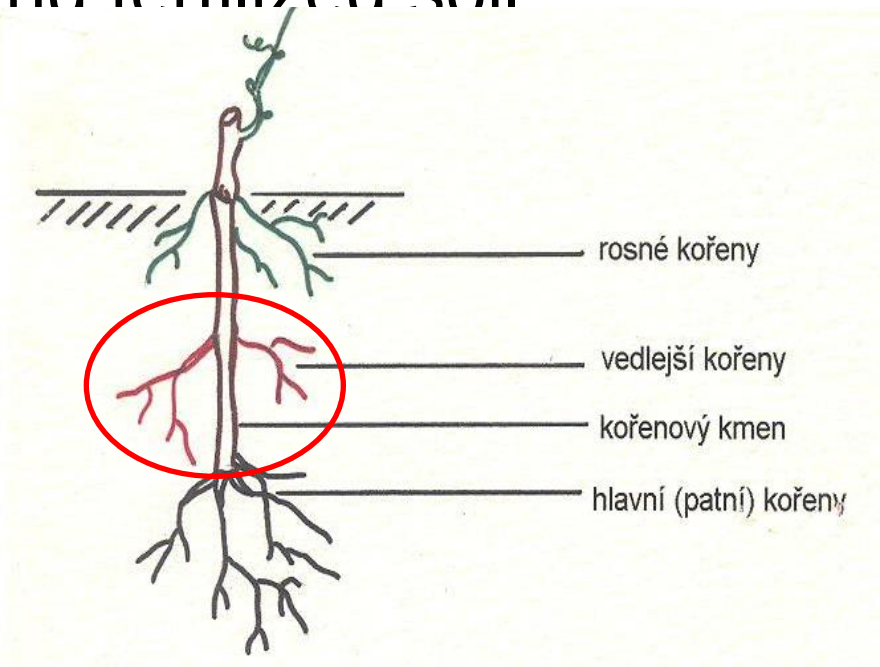
b) Taproot

- Develop at the base of root stem
- 3-6 roots
- Taproot may be several meters long, and the length depends on soil, parent material and water table
- Taproot grows in the direction of water supply and ensures water supply
- Anchoring in soil, water su



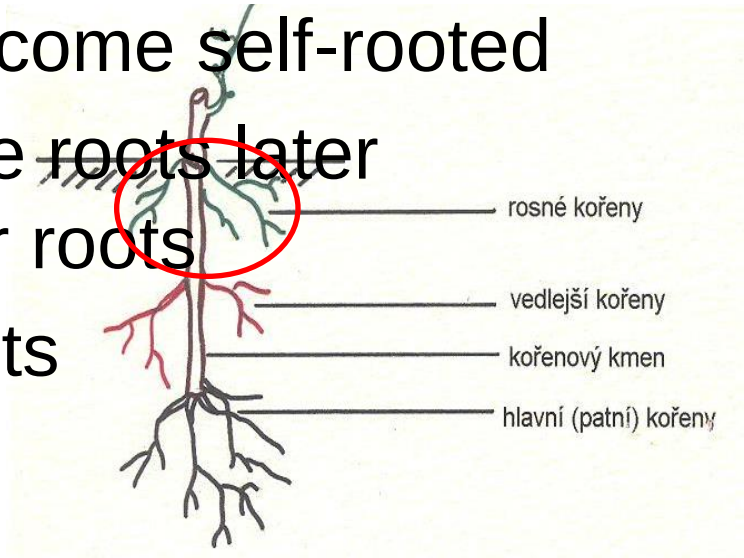
c) Lateral roots

- Develop after replanting
- Grow from central part of the root stem, i.e. 20-30 cm deep
- Highly branched, lots of root hairs which are responsible for water supply and intake of nutrients from cultivated and fertilized soil
- Responsible for nutrition c



d) Surface roots (dewing roots)

- Surface roots grow from rootstock (directly beneath the soil surface) and also, if the seedling was planted too deep, from the graft (of the noble variety)
- Must be regularly removed the first 1–4 years after replanting and further on
- Unless the surface roots are removed from the noble variety, the plant may become self-rooted
- This is unwanted as the surface roots later suppress development of lower roots
- Regular removal of surface roots



e) Root hairs

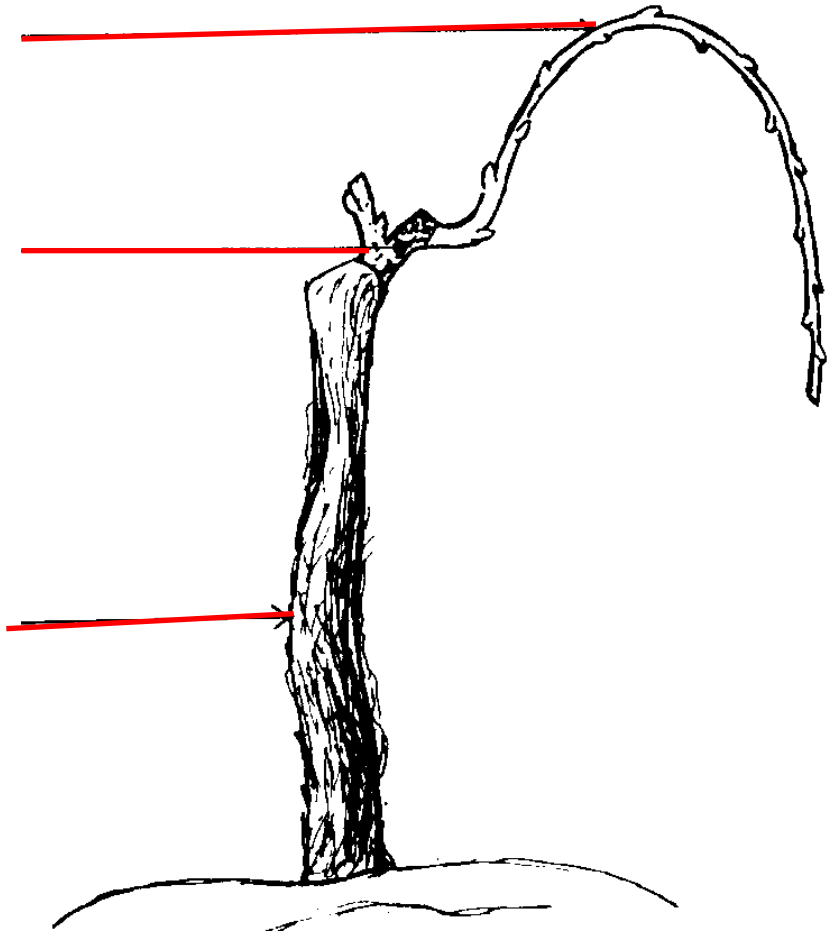
- The youngest and most important part of a root system
- Absorption root organs
- Life cycle: 10-20 days

2. Aboveground organs

One-year old wood (vine shoots)

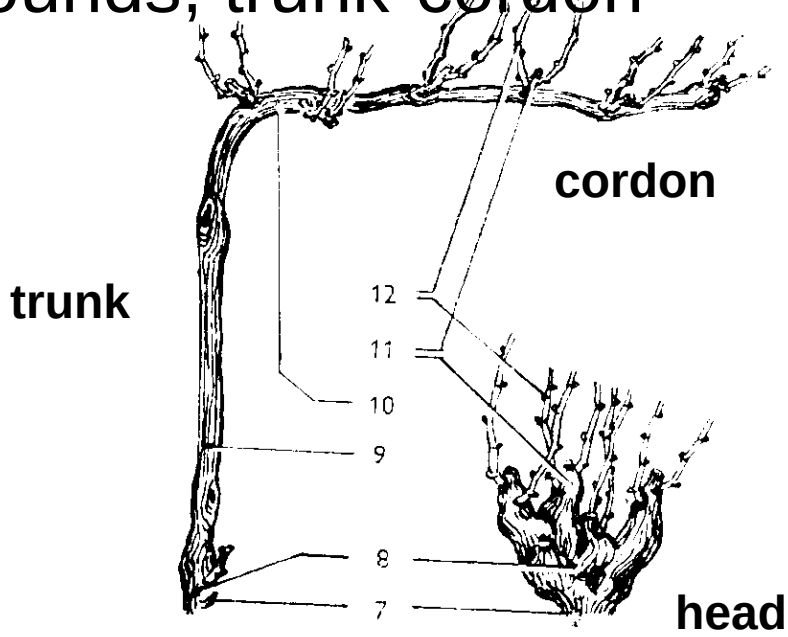
Two-year old wood (short)

Old wood



a) Old wood

- 3- and more year old wood, various shapes according to training systems: Head, 1 or more trunks, cordons
- Covered with black bark which may be peeled away
- In order to fulfil its functions, old wood must be: Smooth, no cutting wounds, trunk-cordon bending is gradual



Trunk

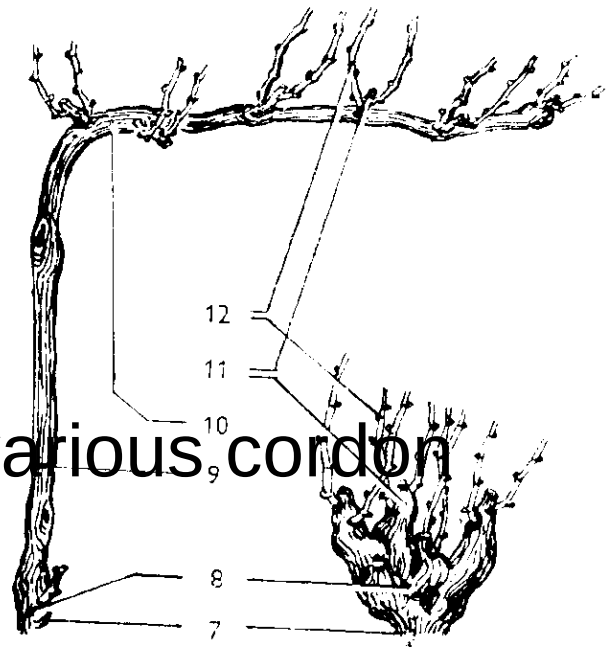
- Develops from a root stem
- Various lengths, depends on training systems

Head

- Wood is pruned directly above the ground surface
- Wood branches and thickens; the head shape resembles a head

Cordons

- Branched parts of old wood
- Various types of training systems, various cordon lengths

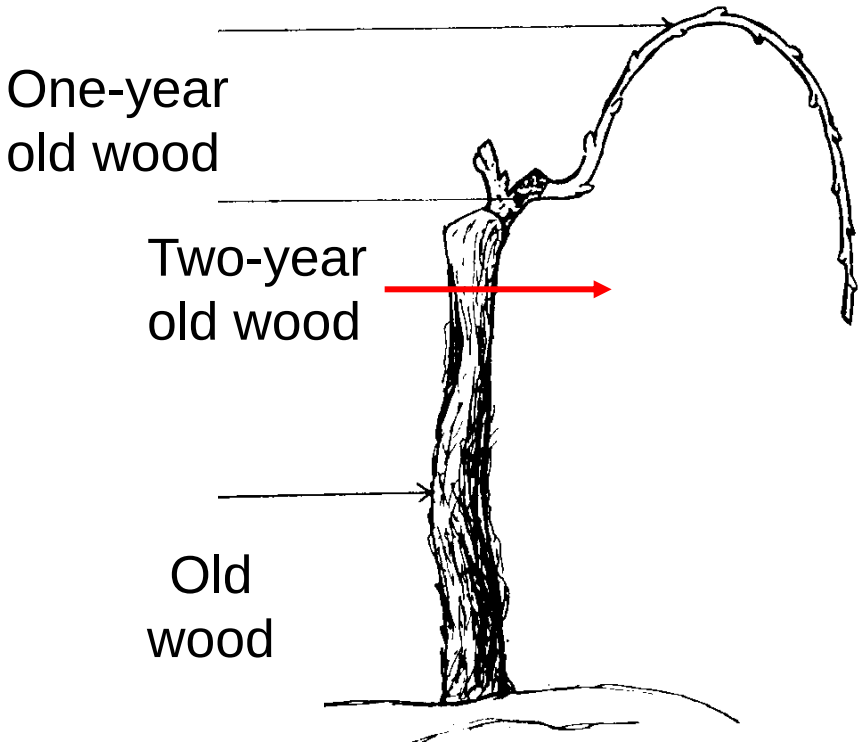


Old wood is responsible for:

- Proper positioning of fruiting and renewal wood
- Supply of water and minerals for fruiting and renewal annual shoots, and supply of assimilates for the roots
- Storage of nutrients (starch, sugars), minerals
- Affects productiveness: Shorter trunk:
  - Warmer temperatures - closer to the soil surface
  - Acceleration of phenophases, earlier grape ripening
  - Shorter transport of assimilates, water and nutrients
  - Faster elimination of acids, faster transport of sugars from leaves into grapes
  - More colorants and aromas

b) Two-year old wood

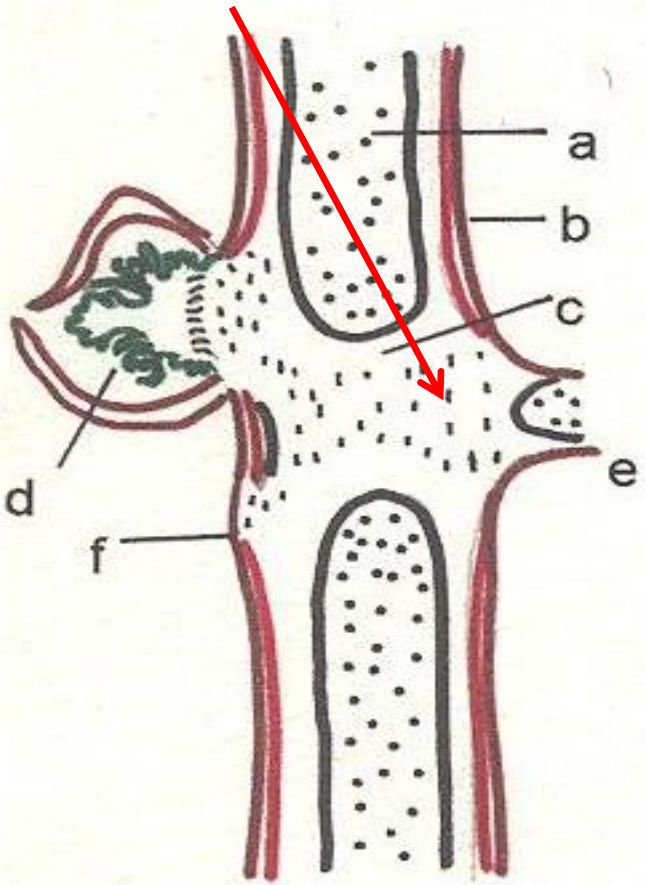
- Grows from the old wood
- Short stubs, ”spurs”, left after previous year pruning
- Covered with thin bark which peels off in thin stripes
- Fruiting vine shoots grow f
- Non-fruiting shoots grow fr fruits only at the shoot tips



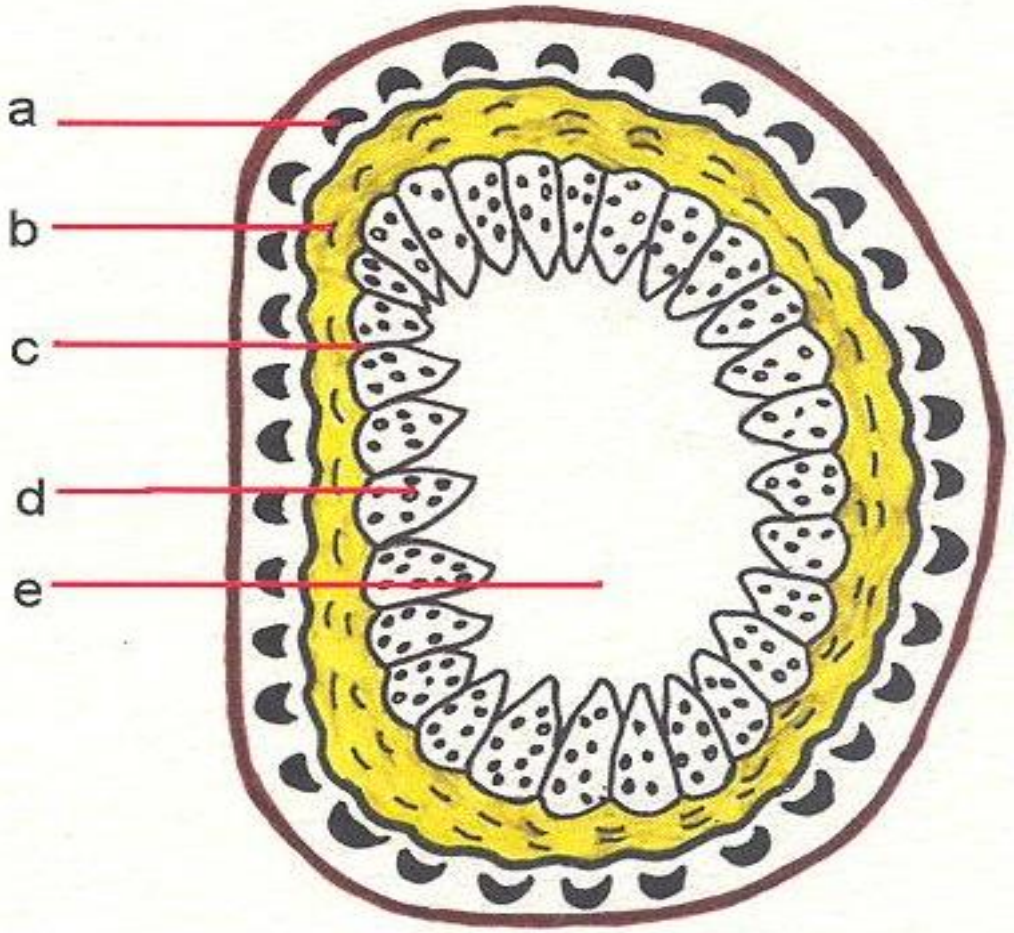
c) One-year old wood (vine shoots) – annual shoots which lignified after a blossom drop

- Vine shoots are arranged into nodes and internodes
- The area between nodes is called the internodes
- Enlarged area, the nodes, store nutrients and stabilize the plant
- Buds grow on the nodes, they are a growing point for fruiting annual shoot in the upcoming year – fruiting annual shoot develops 2-3 inflorescences at the third to fifth leaves from the base of the shoot

Diaphragm – divides core between two internodes, increases hardiness of annual shoots, and stores reserve substances



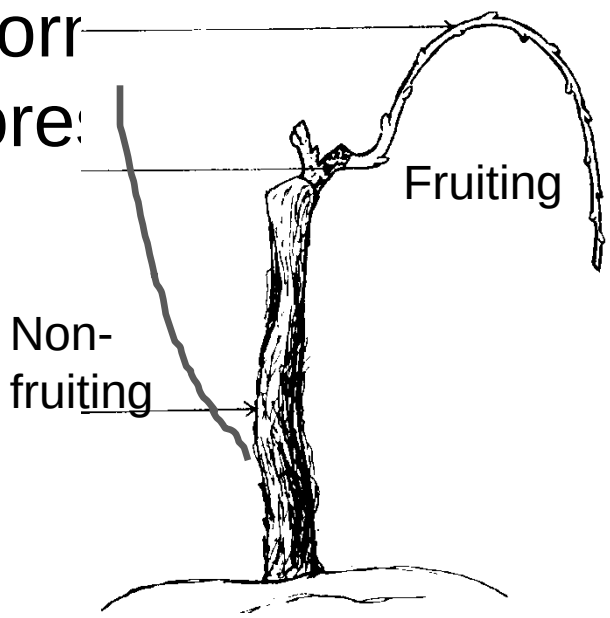
a- dřeň
b- kůra
c- přepážka
d- očko
e- úponka
f- místo opadu listu



a- borka
b- lýko
c- kambium (dělivé pletivo)
d- dřevo
e- dřeň

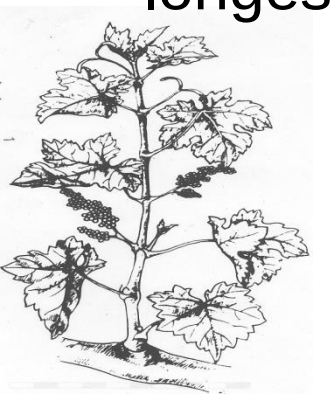
One-year old wood may be classified according to position on the vine:

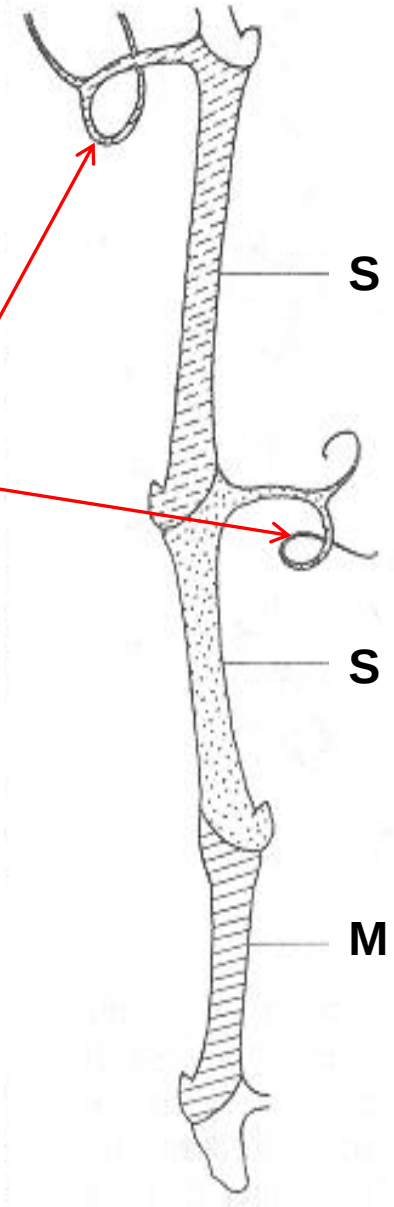
- Fruiting shoots: Grow from two-year old wood; annual shoots grow from buds on the one-year old wood and bear inflorescences at the third to fifth nodes. Each annual shoot has 2-3 inflorescences.
- Non-fruiting shoots: Grow from dorr
  3-year old wood (and older); inflore
  develop at the shoot tip



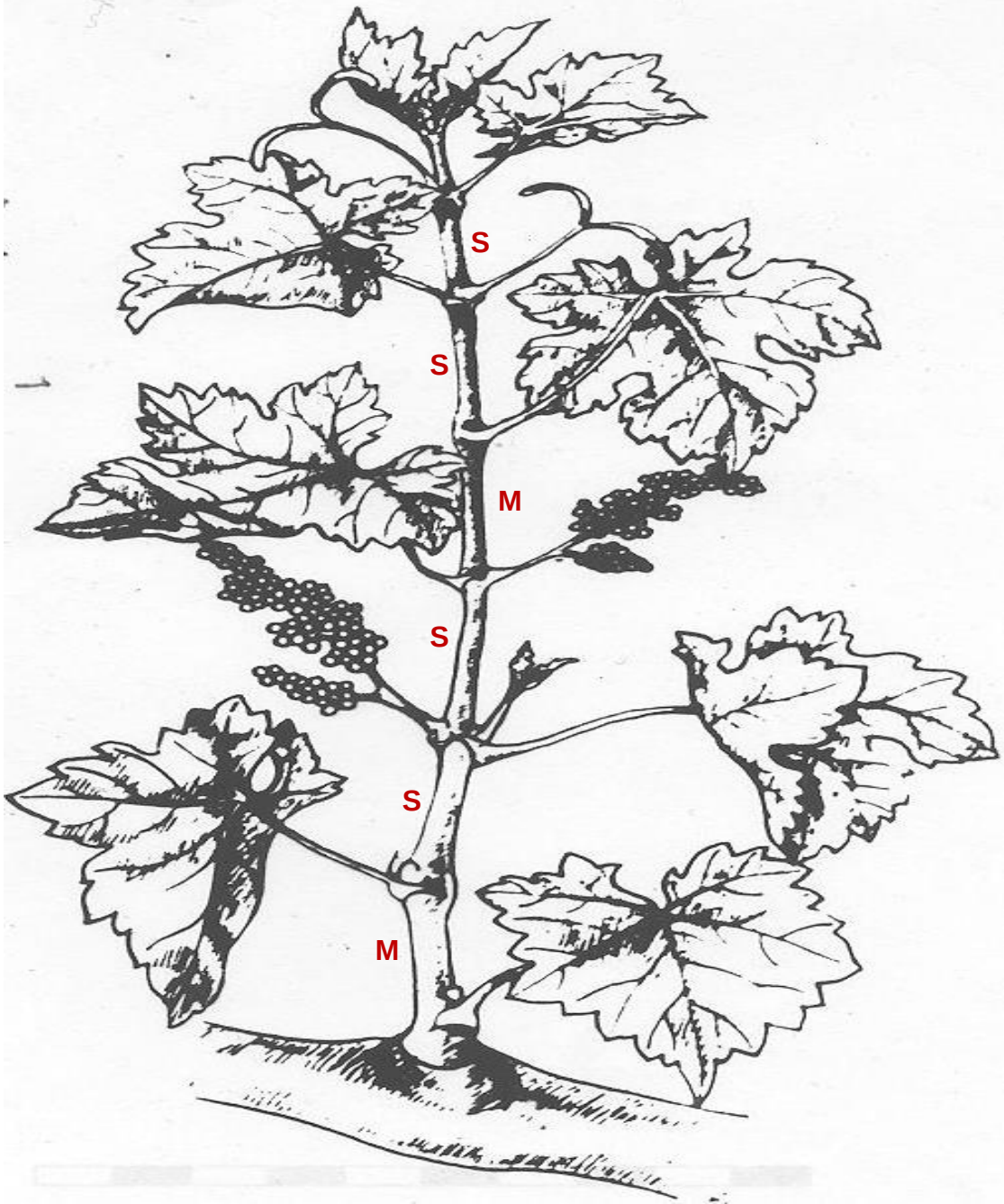
d) Annual shoot: Green shoot growing from a bud on a one-year old wood (and older)

- Branching of annual shoots is monopodial-sympodial (1:2)
- Main axis may be sympodial, bends and is transformed into a tendril or inflorescence
- Internodes without tendrils – monopodium (M) alternate with two internodes terminated with a tendril or blooms – sympodium (S)
- Internodes with no tendrils are the shortest – monopodium, followed by a medium-long sympodium and a second sympodium, the longest internode



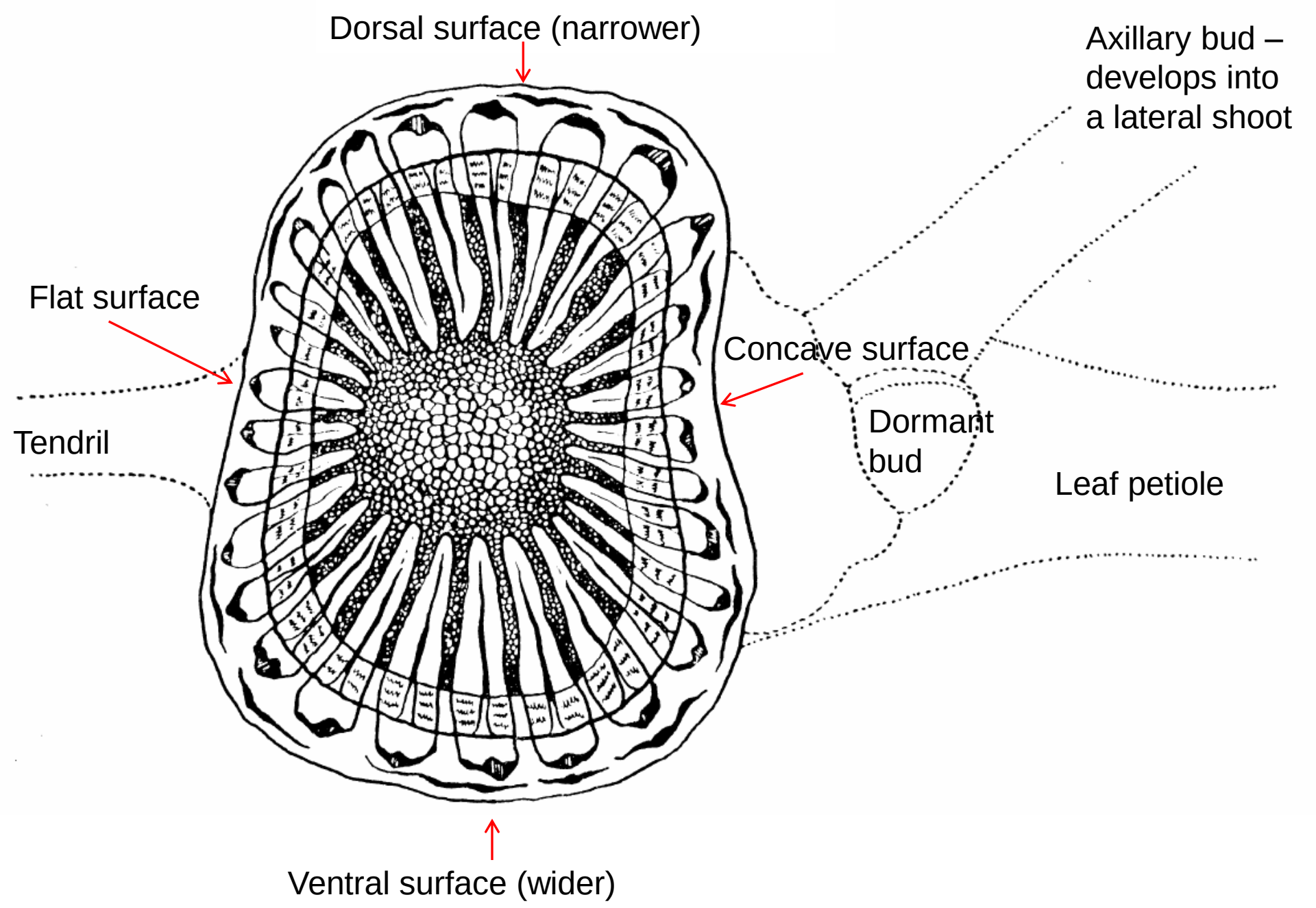


Letorost s tvorbou květních inzercí



- Annual shoots have a dorsoventral pattern: Annual shoot has a kidney-shaped profile, with a visible dorsal and ventral surface
- Other surfaces may be distinguished:
  - Concave and flat

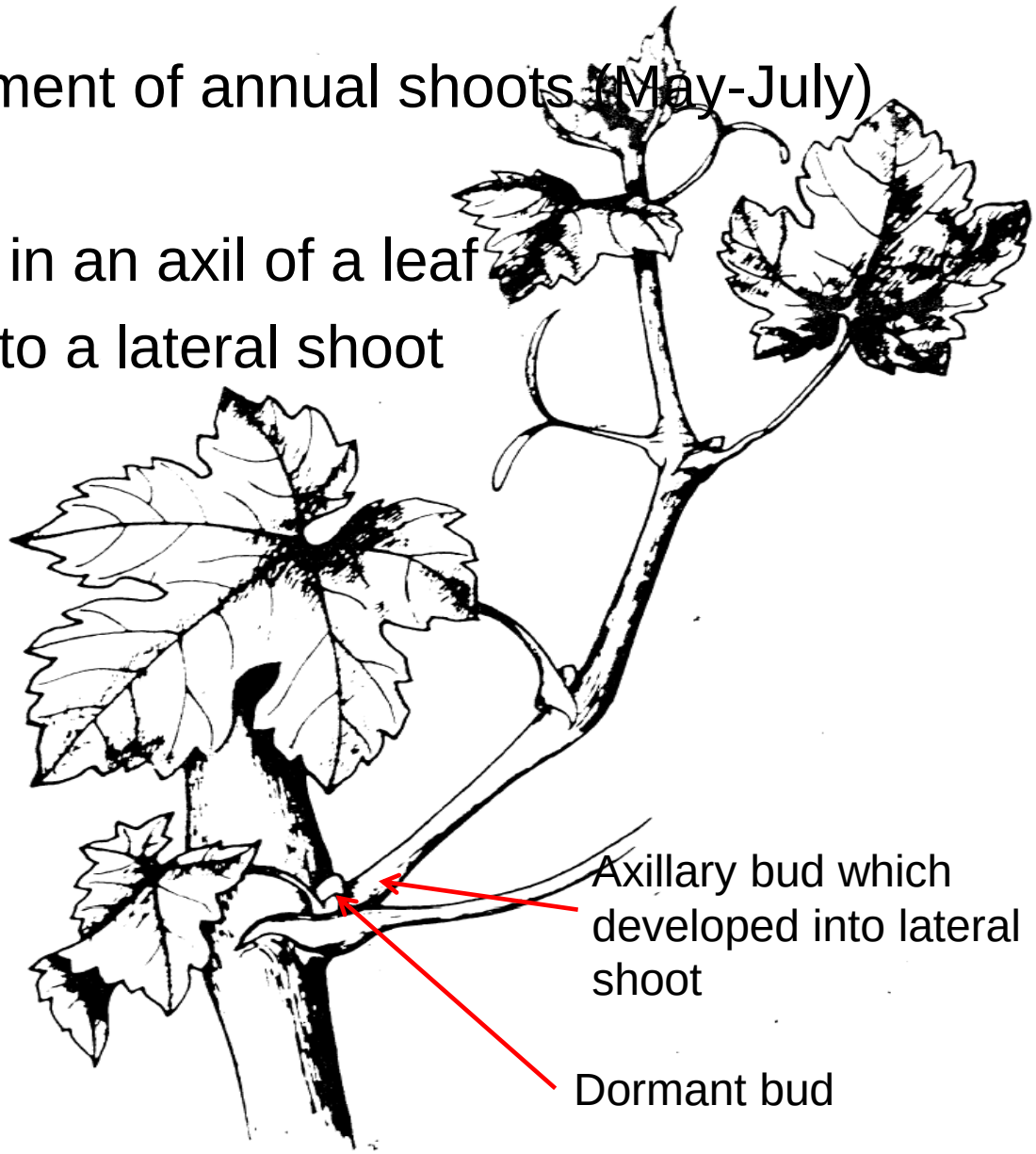
Dorsoventral pattern of a vine shoot - top view



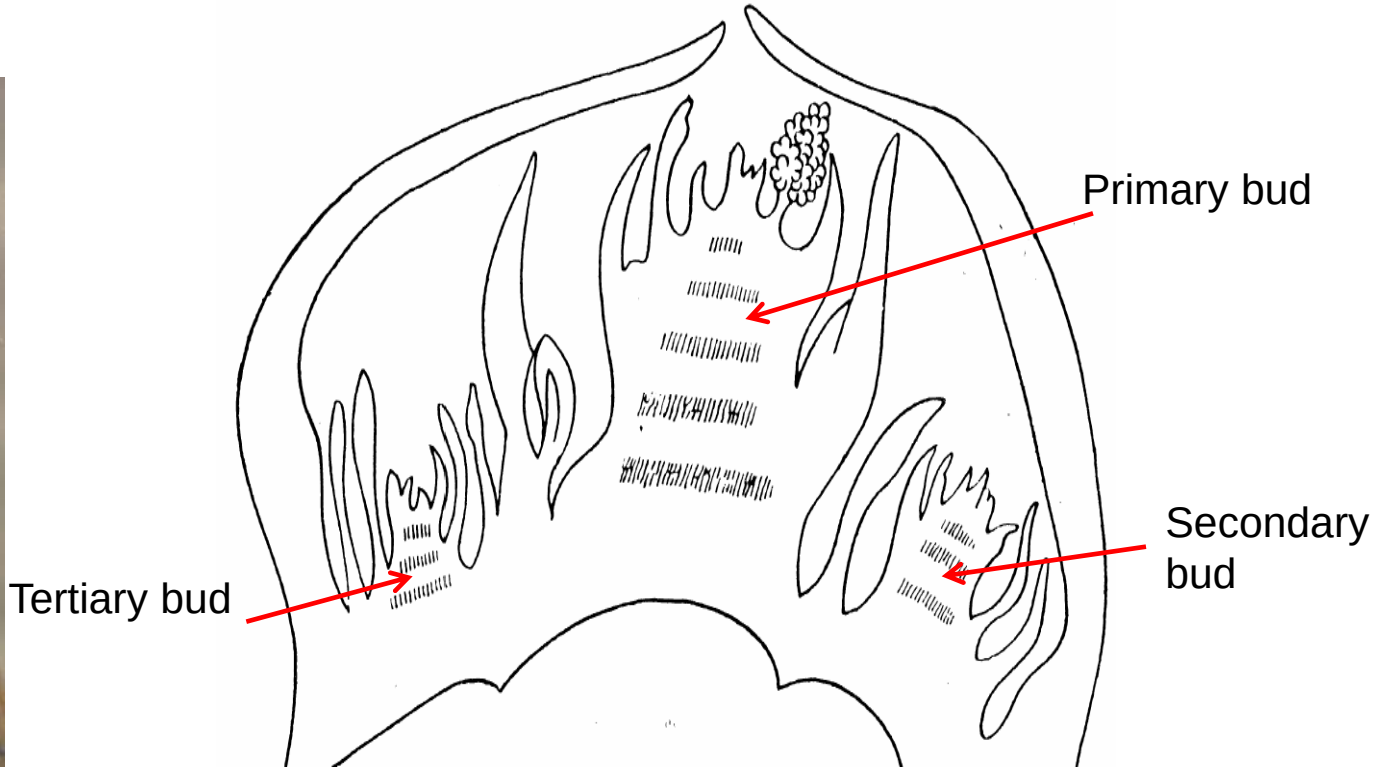
Buds

- Occur during development of annual shoots (May-July)

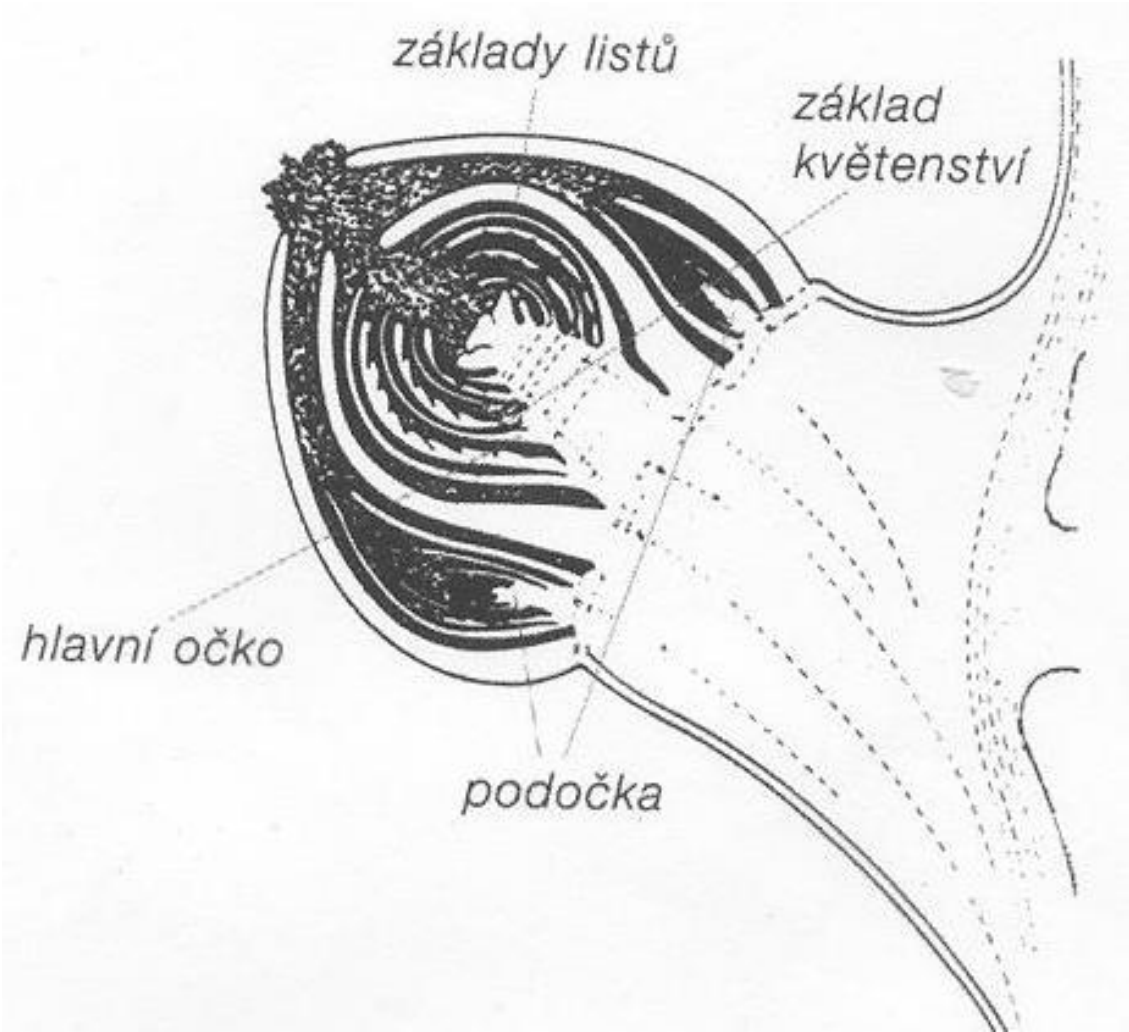
- Axillary bud is located in an axil of a leaf and may later develop into a lateral shoot



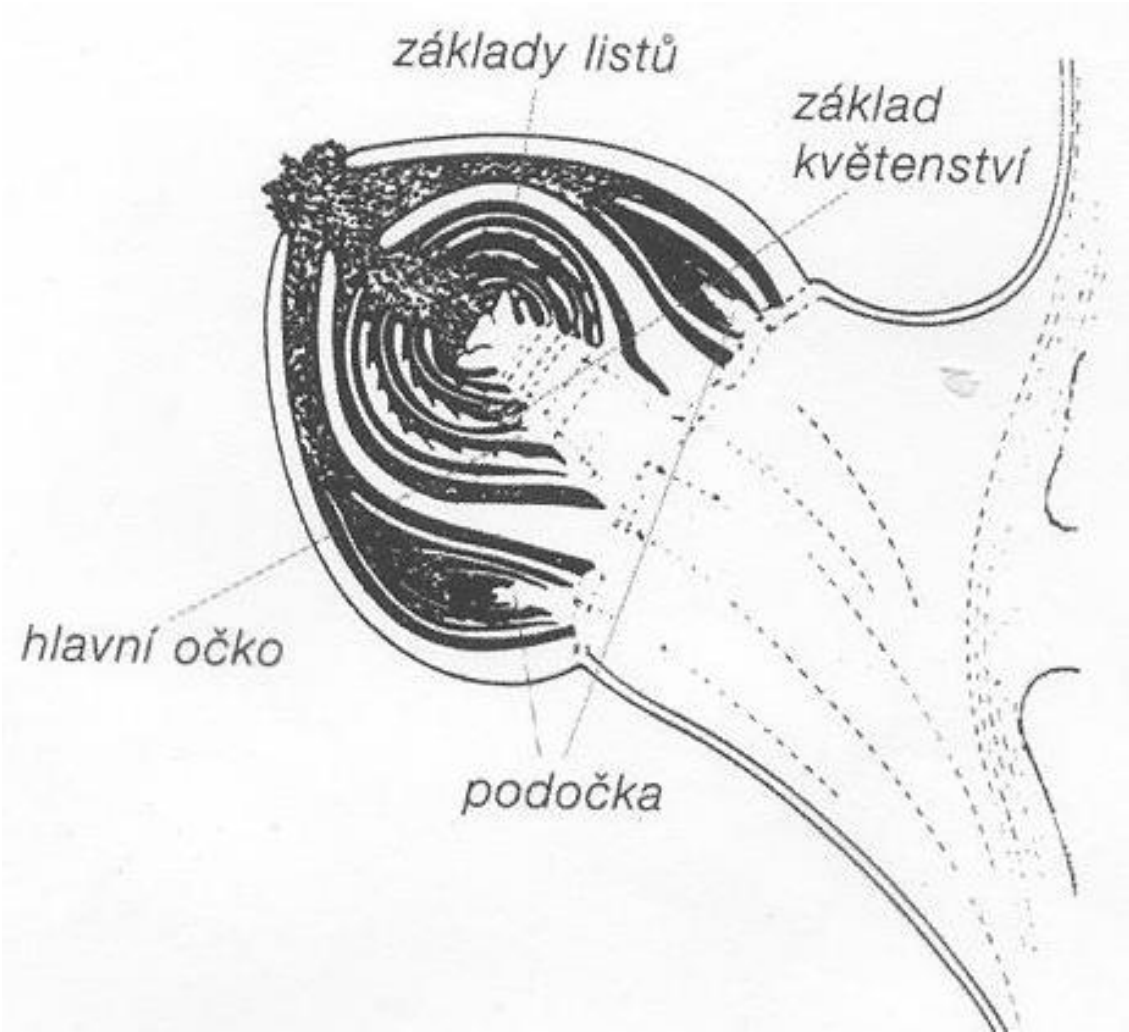
- Large, dormant bud develops at the base of the lateral shoot (next to the axillary bud) and comprises primary, secondary and tertiary buds
  - Overwinters, new annual shoot sprouts in spring
  - Ideally, one dormant bud may develop three shoots – removal of suckers controls amount of fertile shoots



- Alternate positioning of dormant buds; brown outer scales, soft tomentum on the inside (winter-frost protection)
- Dormant buds produce shoots, leaves, blooms and tendrils



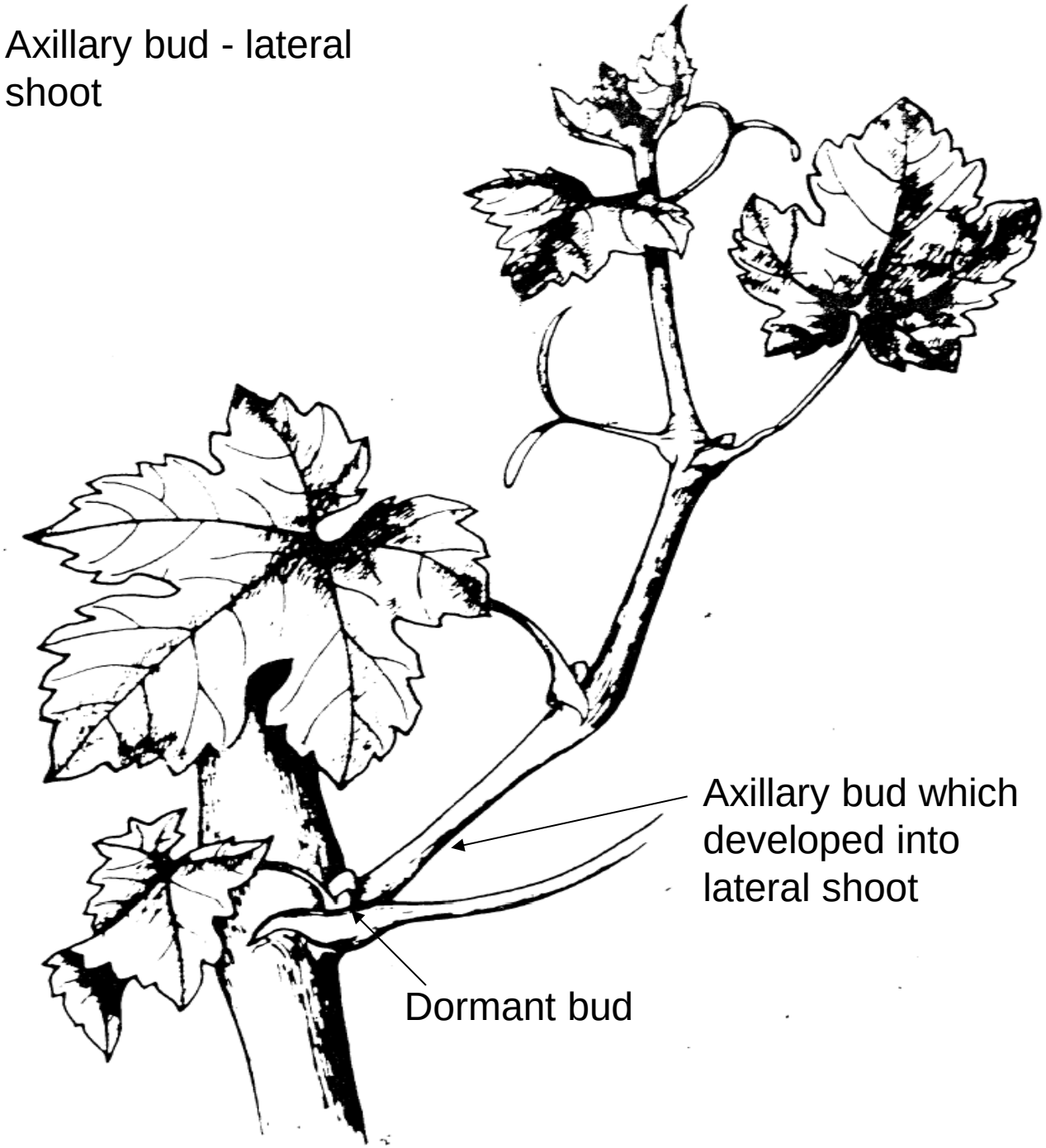
- If the secondary and tertiary buds do not develop, they may become dormant
  - Dormant buds are embedded in a shoot tissue, and they may sprout in several years from the old wood

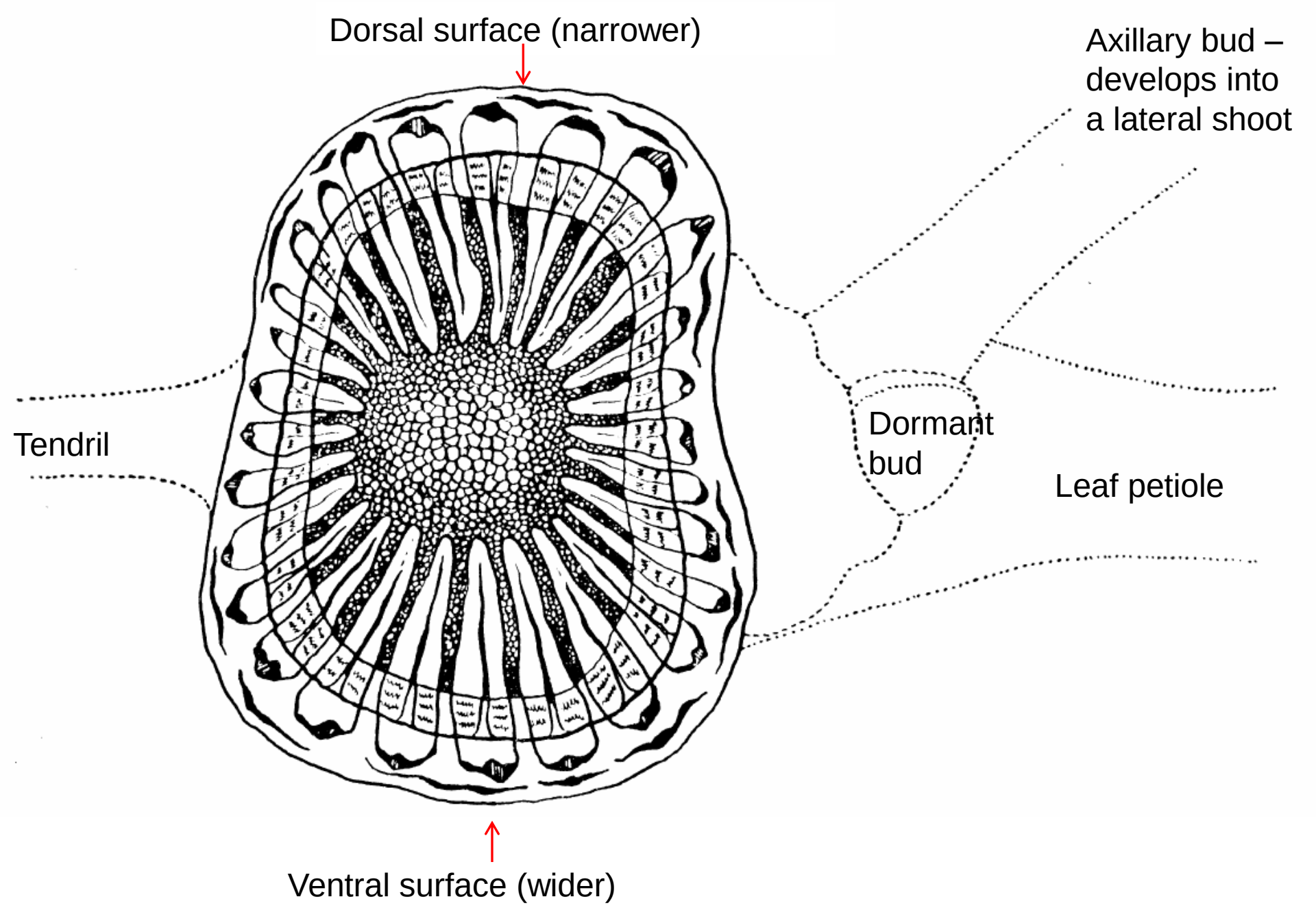


e) Lateral shoots: Develop from axillary buds in the leaf axils

- Similar structure as an annual shoot; lateral shoot develops later than an annual shoot, and only very early varieties produce grape clusters which ripen (the so called St. Martin young grapes)
- Supply nutrients to next year fertile buds
- Transport assimilates in high training systems (increase in sugar content)
- Removed in low training systems (congested vines)
- Remove lateral shoots in lower parts of the vine; pinch lateral shoots beyond third to fourth leaf in vine upper parts

Axillary bud - lateral shoot




Dorsal surface (narrower)
Axillary bud – develops into a lateral shoot
Tendril
Dormant bud
Leaf petiole
Ventral surface (wider)

f) Tendrils

- Developed from the main axis
- Tendrils grow opposite a leaf at the node, except the first two or three leaves at the base of the shoot
- Irregularities and branching are common (twisted, flattened tendrils)

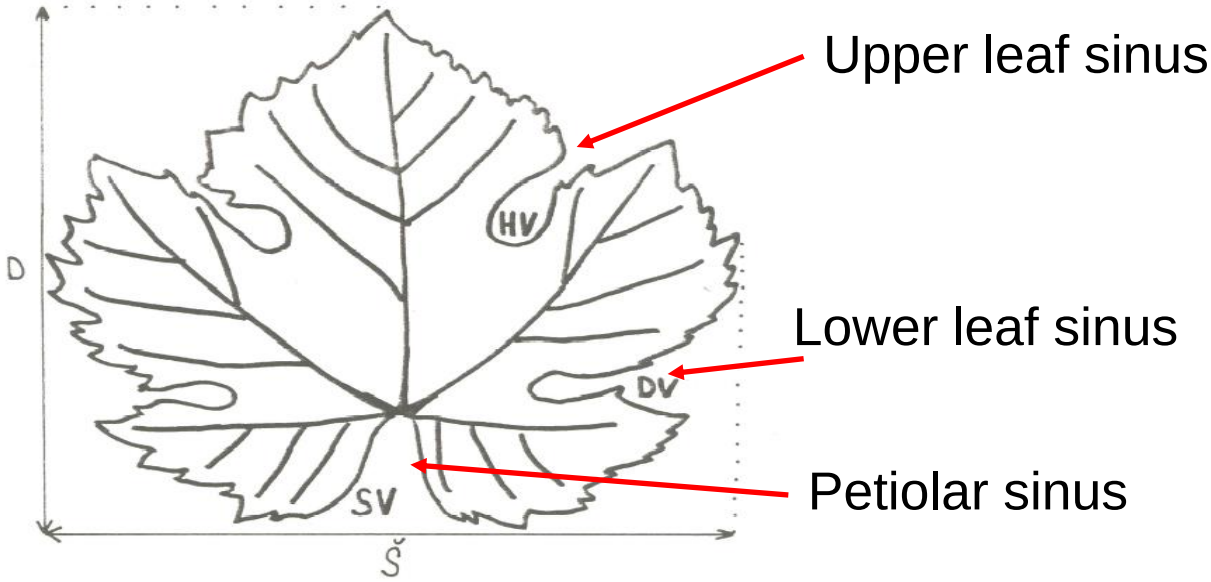
- Lignify in autumn and form libriform
- Tendrils coil around support objects, i.e. trellis wires, small stakes, pergolas

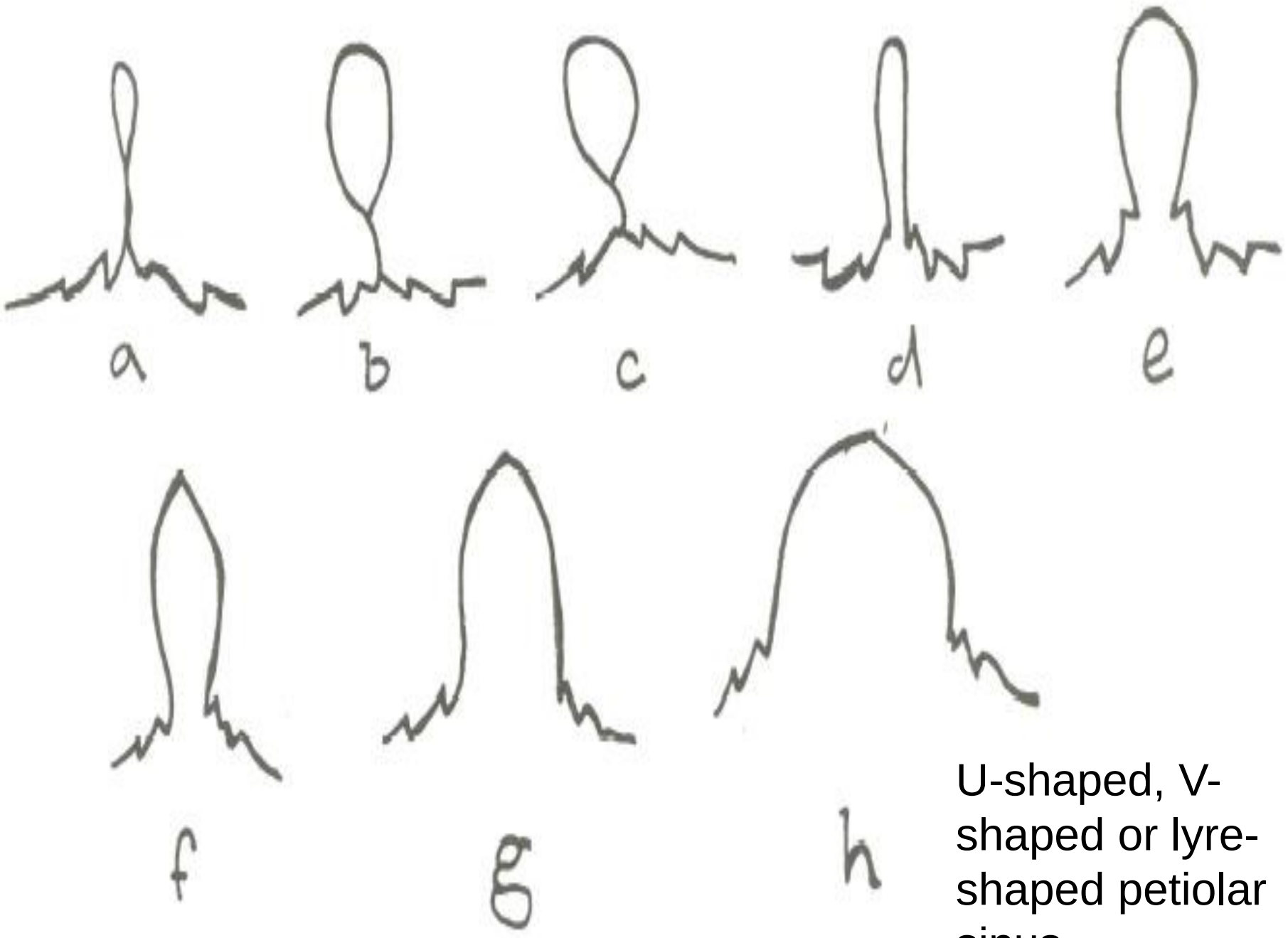
g) Leaf – a leaf blade

- Important varietal feature
- Analysis:

1. Number of lobes
2. Sinuses and leaf margins
3. Colour and hairs

- Venation structure supports hardiness of the leaf, and also supplies and takes away nutrients and water





U-shaped, V-shaped or lyre-shaped petiolar sinus

Assimilation
– photosynthesis
– optimum temperature of 25-30 °C

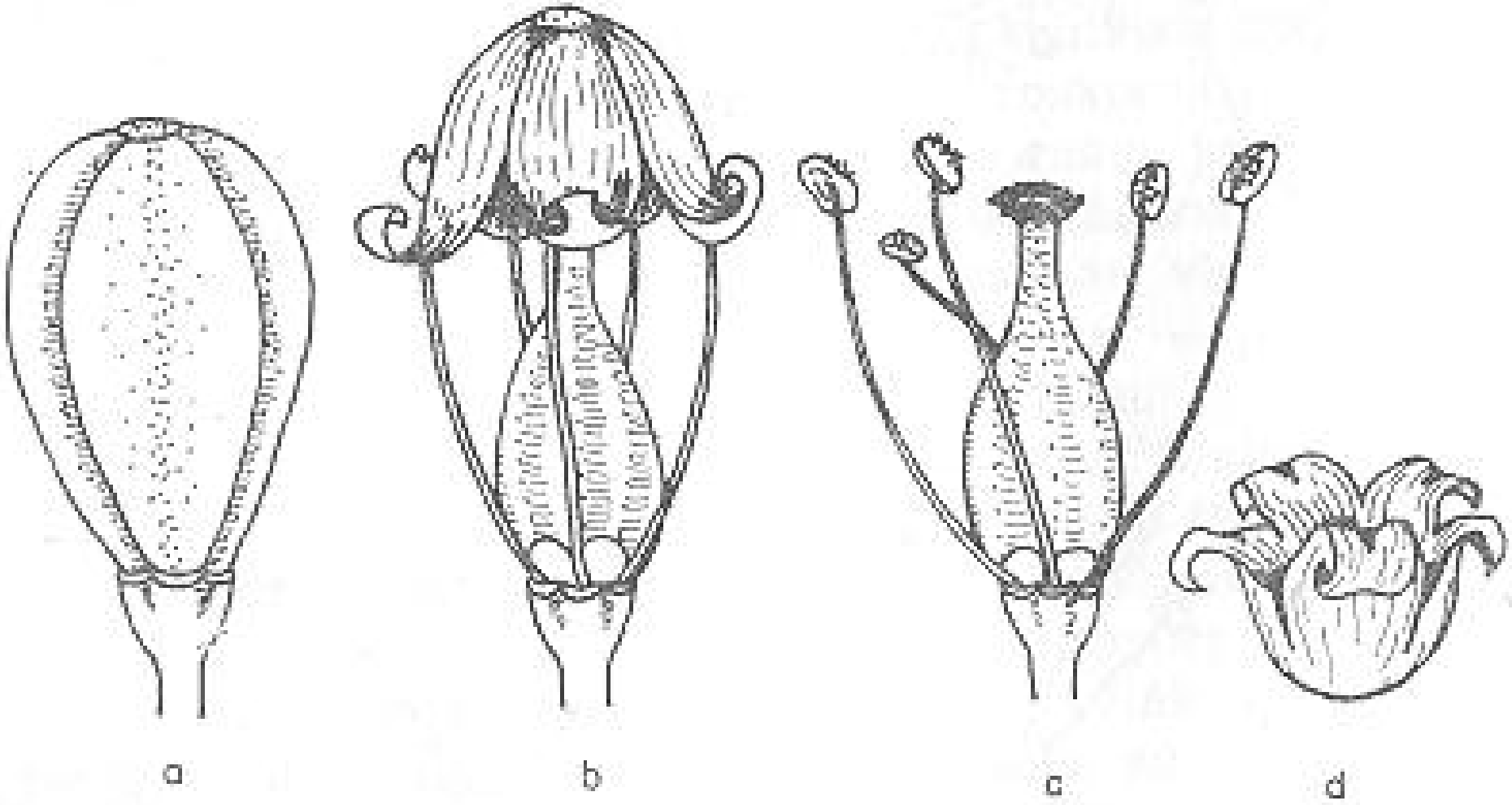
Transport of assimilates from the leav
Onset of growing season:
Bottom leaf
Other 2-4 leaves
Top leaves

After blossom loss: Into grapes (redistribution among shoots)

h) Inflorescence – a panicle with various amounts of flowers (100 – 200, depends on a variety)

- Inflorescences develop on lower nodes of fertile shoots, usually on a second to fourth node from the shoot base
- 1-3 inflorescences per an annual shoot (4-5 is less common, 6-7 is rare); annual shoots may also be infertile
- Existing varieties as well as novel varieties have androgynous flowers
- However, certain flowers may contain only stamens or only pistils (rootstock grapevine)

Grapevine blooming



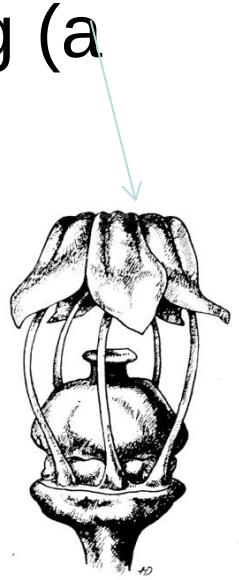
Flower bud

Cap separation

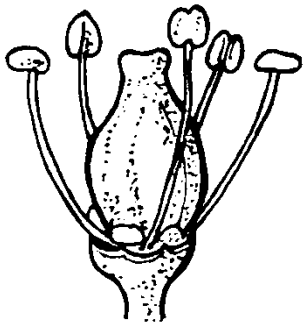
Flower in full bloom

Separated cap

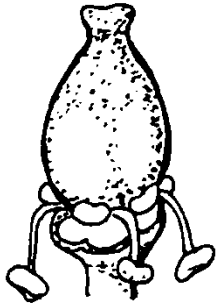
- Standard flower has a two-compartment ovary, each having two ovules, and five stamens
- The whole flower is covered with petals which are fused, and fall off at the onset of blooming (a cap)
- Weather has major impact on blooming, optimum temperature: 20-30 °C
- Negative impact:
  - Rainy weather
    - Cap is not fully separated, stays attached, and the plant is infested with grey mould (Botrytis cinerea)
    - Consistent rain and below 15°C temperatures: Flowers open poorly, pollen is washed away
  - Extreme drought/wind
    - Stigma dries out, pollination is affected



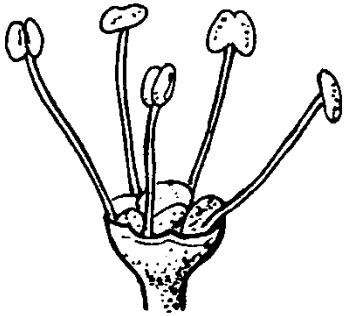
Flowers



Androgynous



Pistil



Stamen

Petals - the caps fall off

Inflorescence

- Panicle

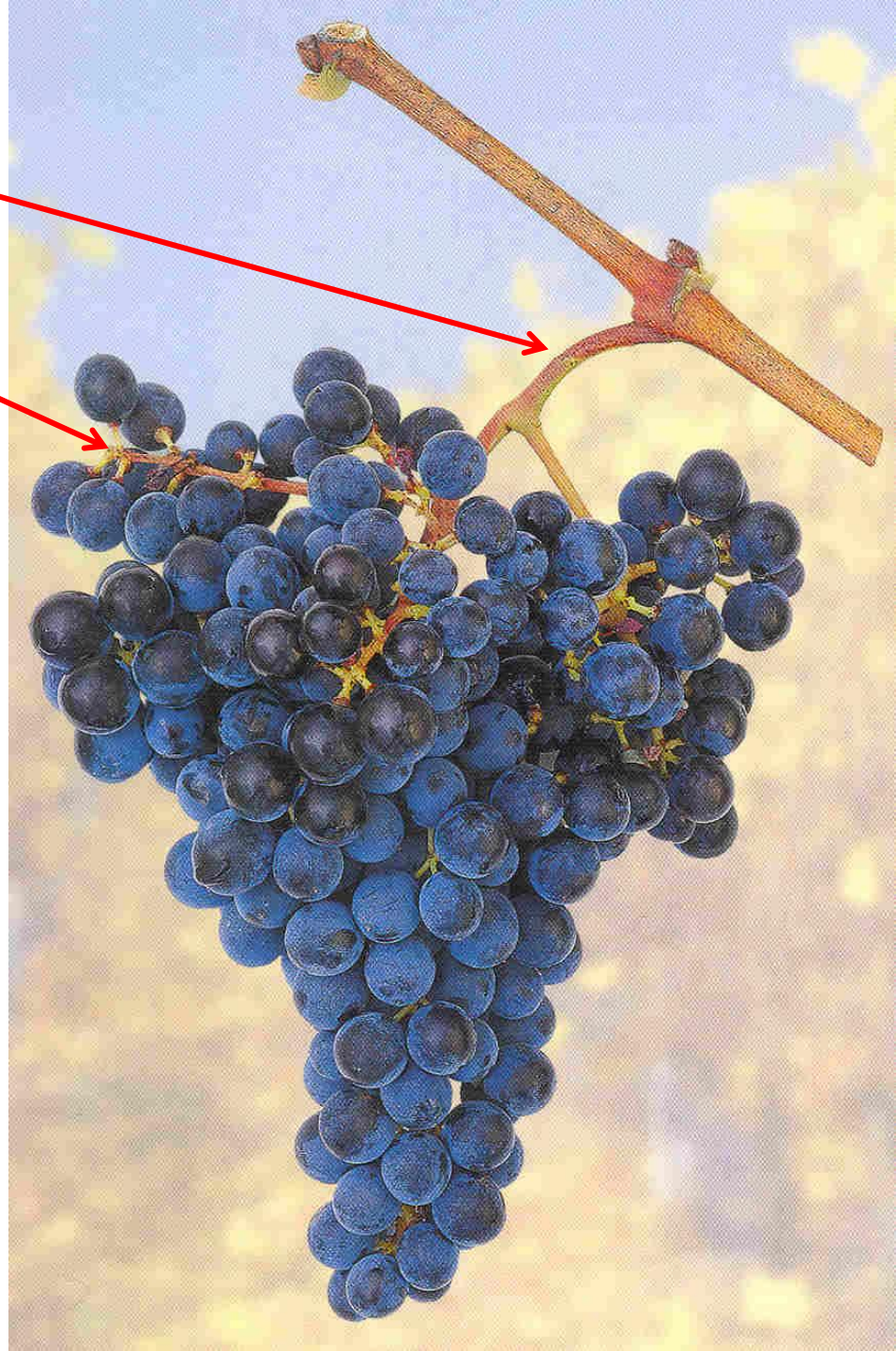
i) Berry cluster

- Commonly 2-3 clusters per one annual shoot
- A peduncle attaches the cluster to the shoot
- A stalk is a branched system with one main axis and lateral axes
- Peduncles are terminated with a pedicel, a small flat surface where the berries are attached

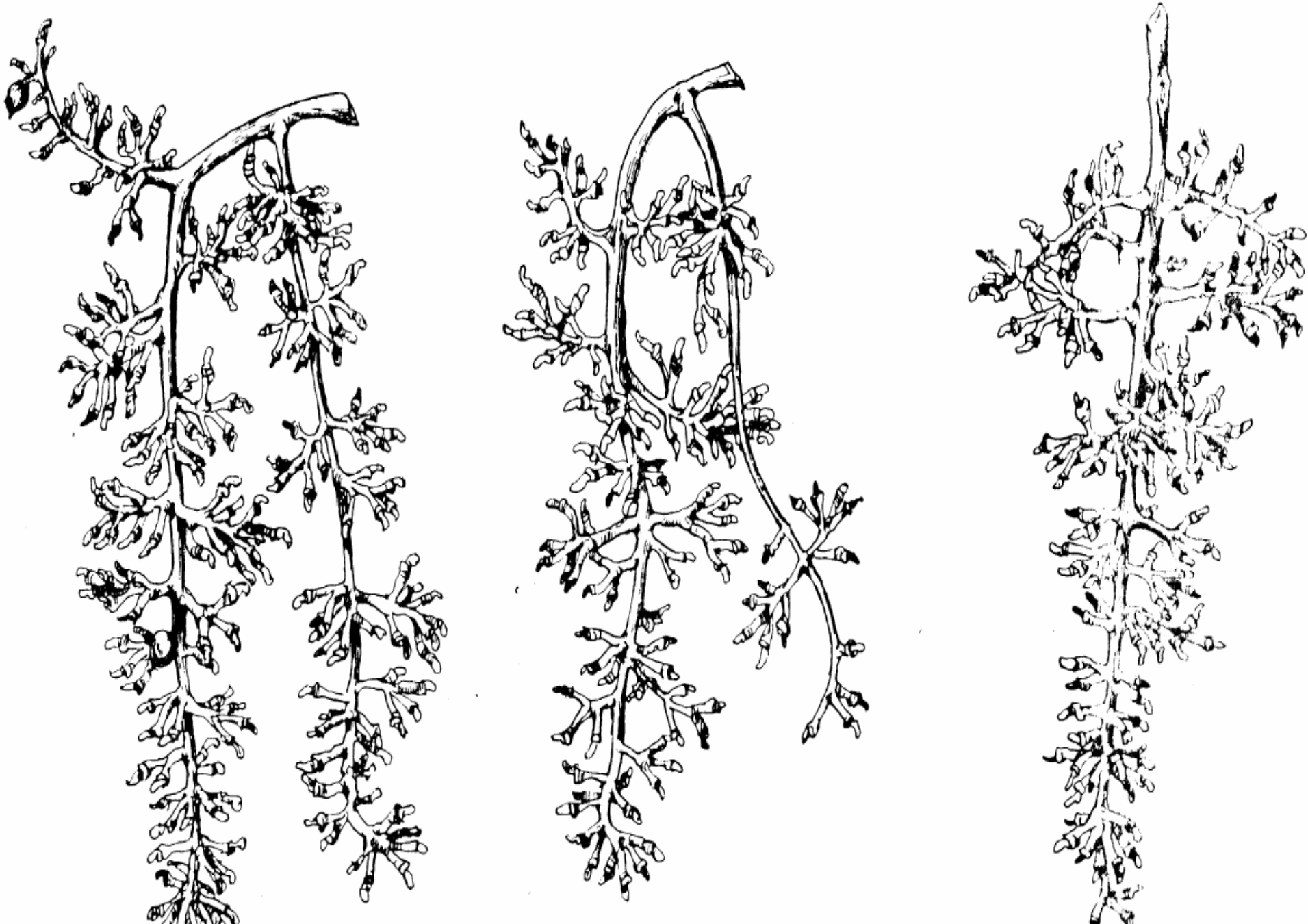
Peduncle

Stalk

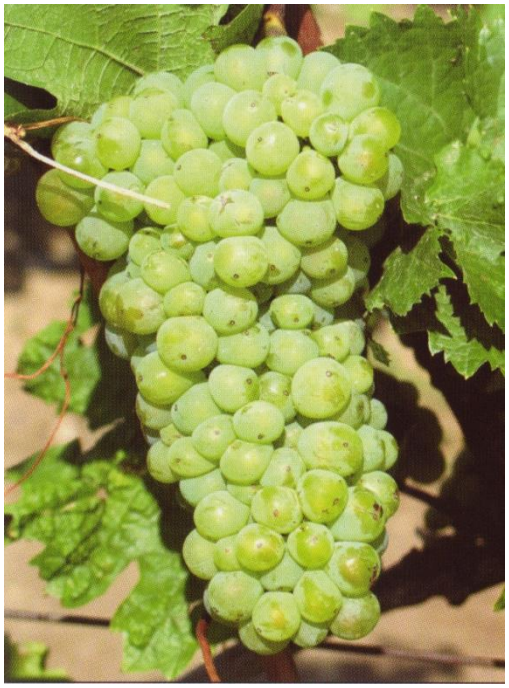
- Main axis
- Lateral axes



Třapina, (stopka, třapina, stopečka, poduška)



Grape cluster



AURELIUS

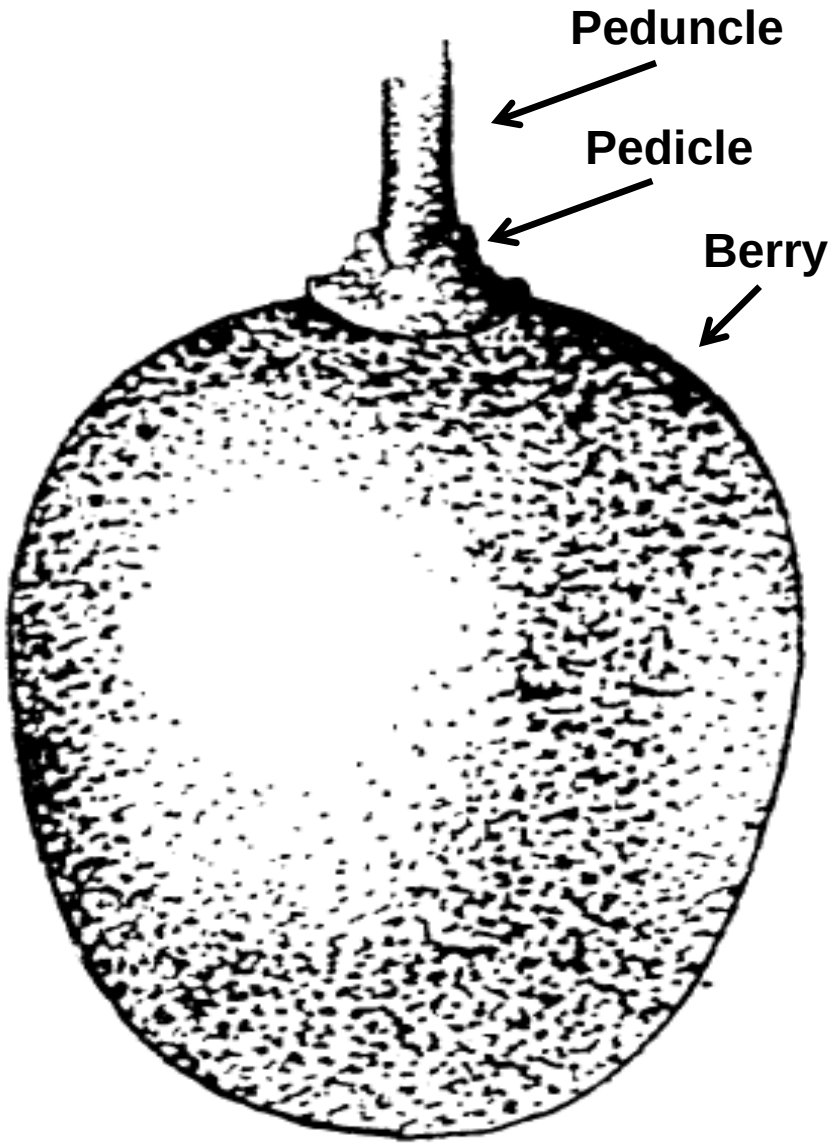
PORTUGAL

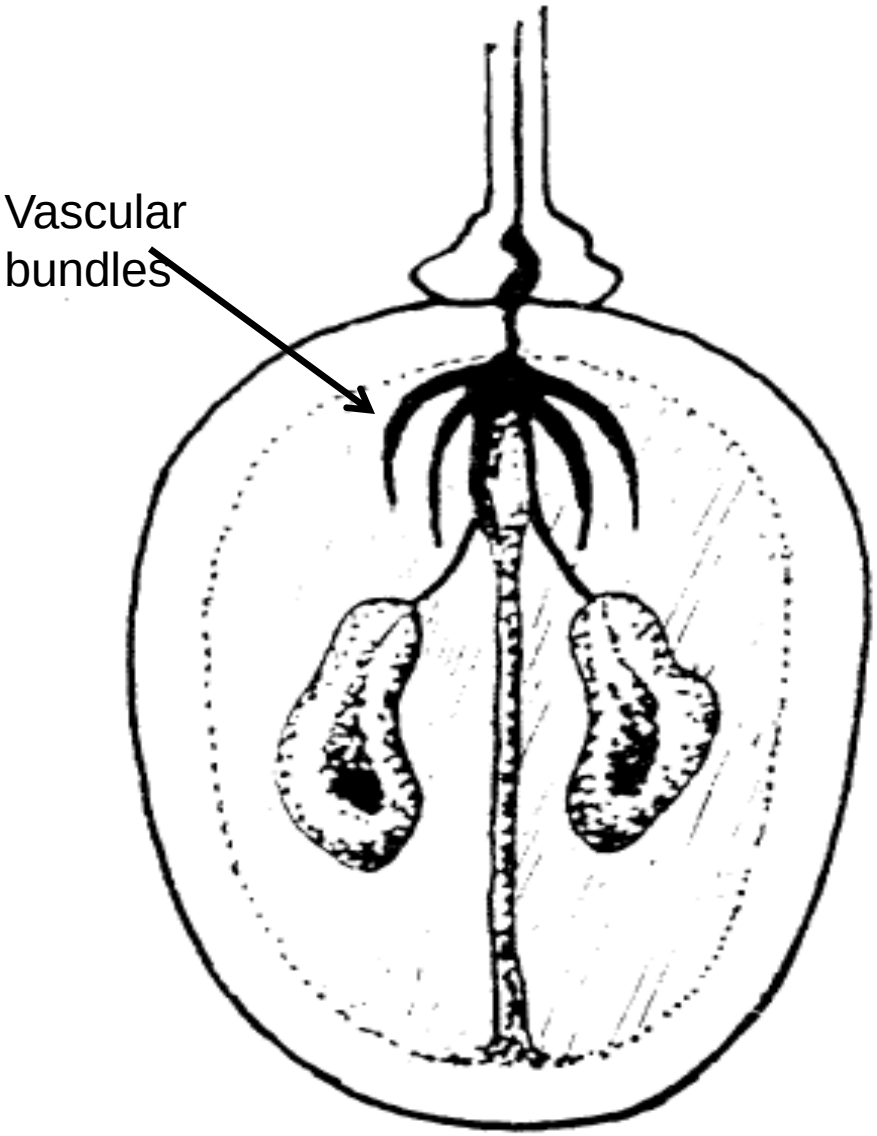
VITRA

Berries

- Various shapes, sizes and colours
- Skin: Firm, elastic, various thickness, waxed coating
- Flesh may be juicy, crunchy or firm
- There may be lenticels and a bump from a dried style on the berry surface

Bobule, svazky cévní, semena





j) Seeds (pips): Differ in sizes, shapes and length, maximum potential of 4 seeds

- Ventral side of the pip is pushed inward and has two lengthwise slots with a seed commissure in between
- Dorsal side of the pip is convex and has a point of rupture at the end
- Seeds are pear-shaped
- Current trends for table grape varieties: Seedless parthenocarpic fruits (berries), or grapes with easily separable seeds

Chemical composition of berries

- Weight portions of the berry
  - Flesh (83 – 91%)
  - Skin (7 – 11 %)
  - Seeds (2 – 6 %)

Sugars:

- Mostly in vacuoles of the flesh cells; few sugars occur in the skin
  - Glucose and fructose
  - Traces: Arabinoses, xyloses, ribose, etc. (Not metabolized by yeasts = not important)
  - Sucrose – in certain American-European hybrids
  - Ripe fruits: 14-25 % sugars, max. 250 g/L, i.e. max. 14.7 % of alcohol; physical-chemical restrictions; increase is conditioned by water evaporation

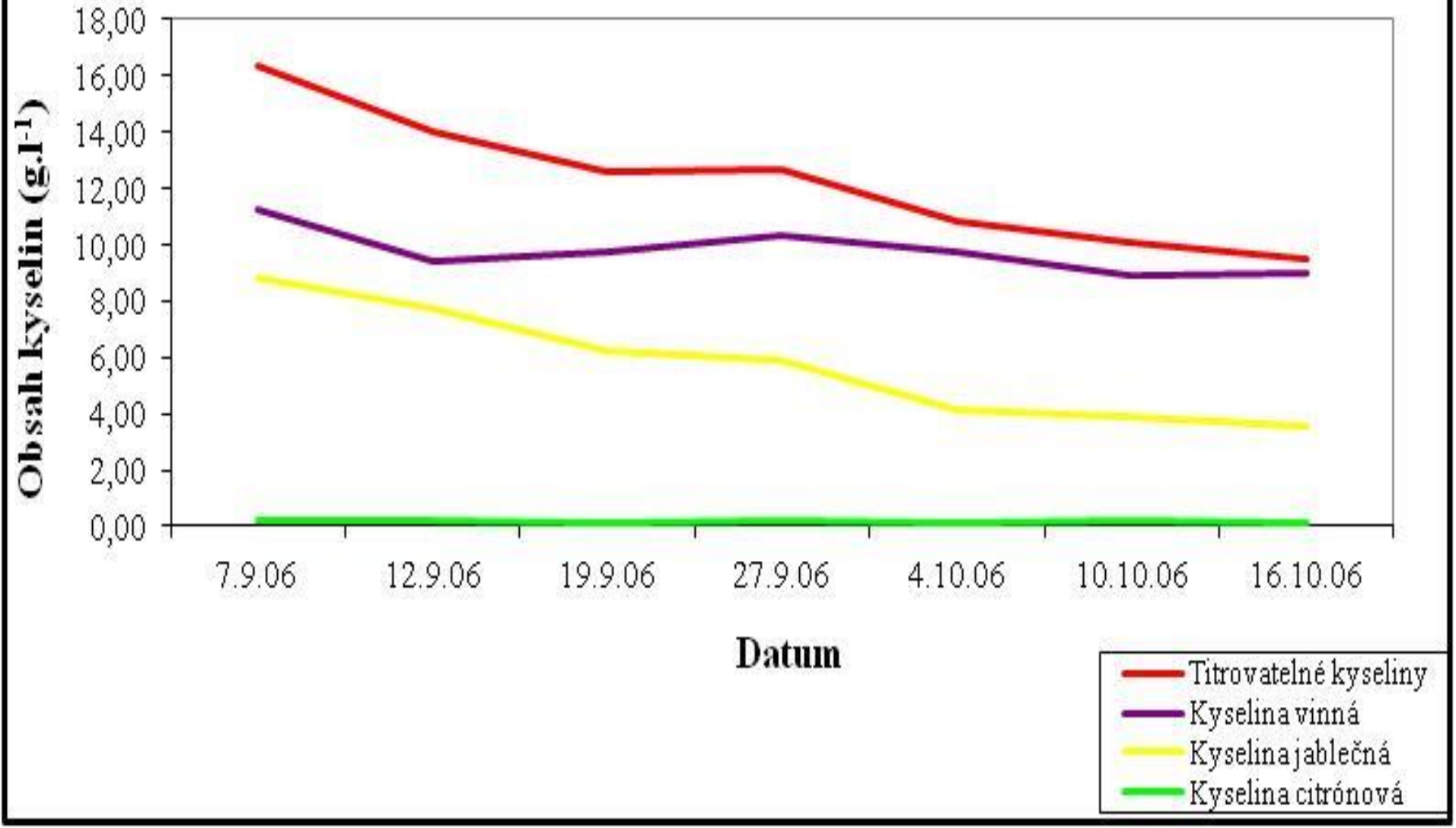
American-European hybrids: Bago, Elisabeth, Charvát, Otelo

- Fruity flavour (raspberry), versatile varieties
- Bago variety is grown in South Moravia
  - Good for must and grape concentrates
  - Not for wine production
    - Anthocyanins slowly decompose, and methanol is produced instead of ethanol
    - Consumption of the wine caused lower intelligence in the Southern Moravia in past

Acids:

- Majority: tartaric acid and malic acid
- Unripe berries: citric acid, glycol acid, succinic acid, oxalic acid
  - Tartaric acid: Sour, sharp flavour
  - Malic acid: The so called green flavour – sharp, coarse, unripe tones
  - Oxidization of malic acid produces glucose and fructose, source of energy

Změny obsahu organických kyselin a titrovatelných kyselin u odrůdy Ryzlink rýnský



Nitrogen compounds:

- 100-1,200 mg/L of must
- Amino acids, protein, N in ammonium form
- Affect yeast, aromas production in wine, amino acids = precursors of aromas - smell
- Warm and dry weather: More protein, problems with fermentation, protein turbidity

Minerals:

- Affect organoleptic properties of wine
  - Smell, flavour, colour, overall flavour
- Ca
- P (low amount of P reduces fermentation processes)
- K
- Mg
- Na
- Fe
- Cu
- Mn

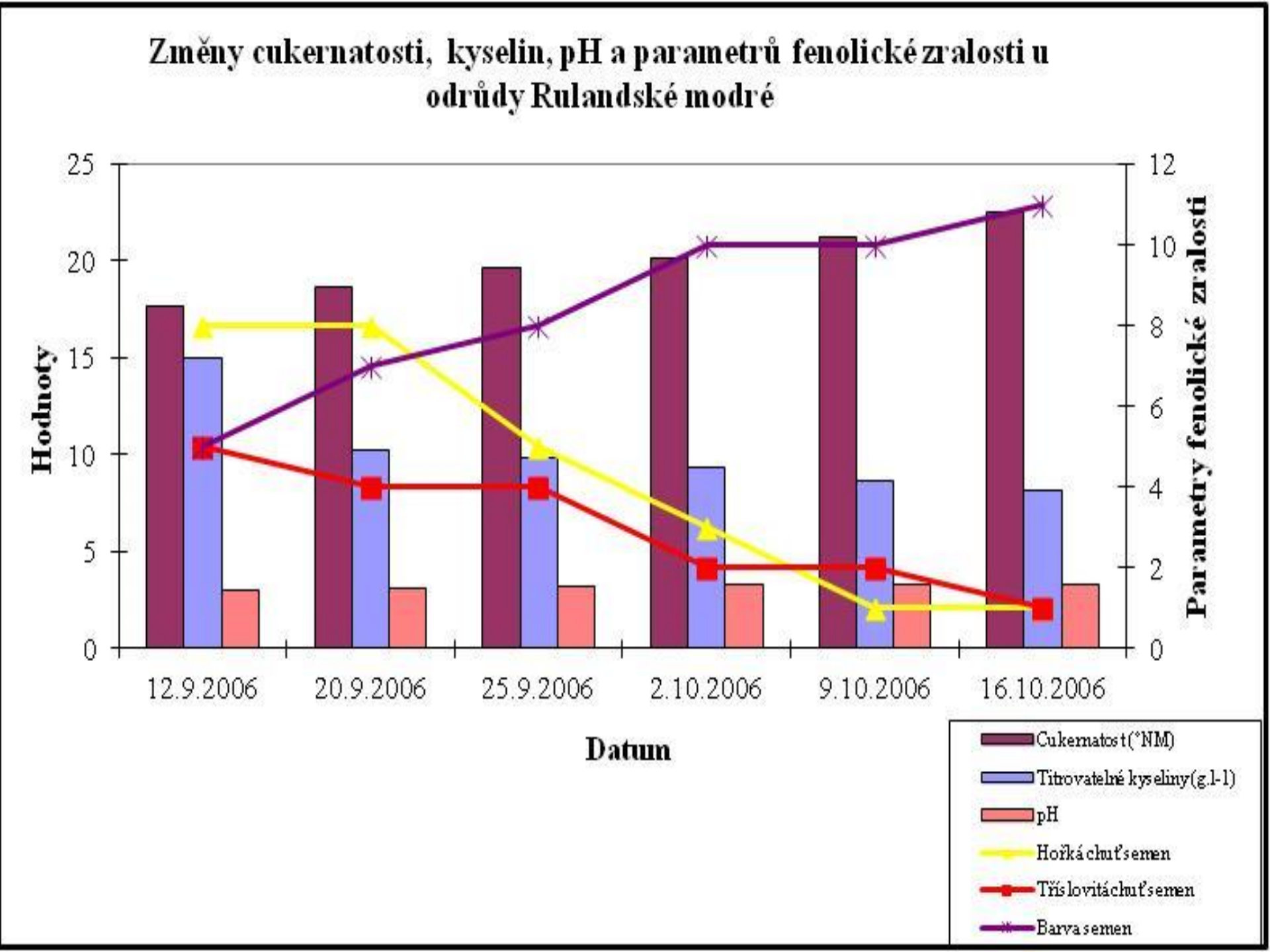
Phenolics

- Responsible for colour, bitter and tannin nature of the wine, antioxidation properties
- Anthocyanin colorants
- Tannins

Aromas

- Monoterpenes
- Carotenoids
- Norisoprenoids
- Methoxypyrazines
- Thiols

- Mucilage
- Pectins
- Vitamins (B, C)


Změny cukernatosti, kyselin, pH a parametrů fenolické zralosti u odrůdy Rulandské modré
Hodnoty
Parametry fenolické zralosti
Datum
12.9.2006
20.9.2006
25.9.2006
2.10.2006
9.10.2006
16.10.2006
Cukernatost (°NM)
Titrovatelné kyseliny (g.l-1)
pH
Hořká chuť semen
Třísloviná chuť semen
Barva semen

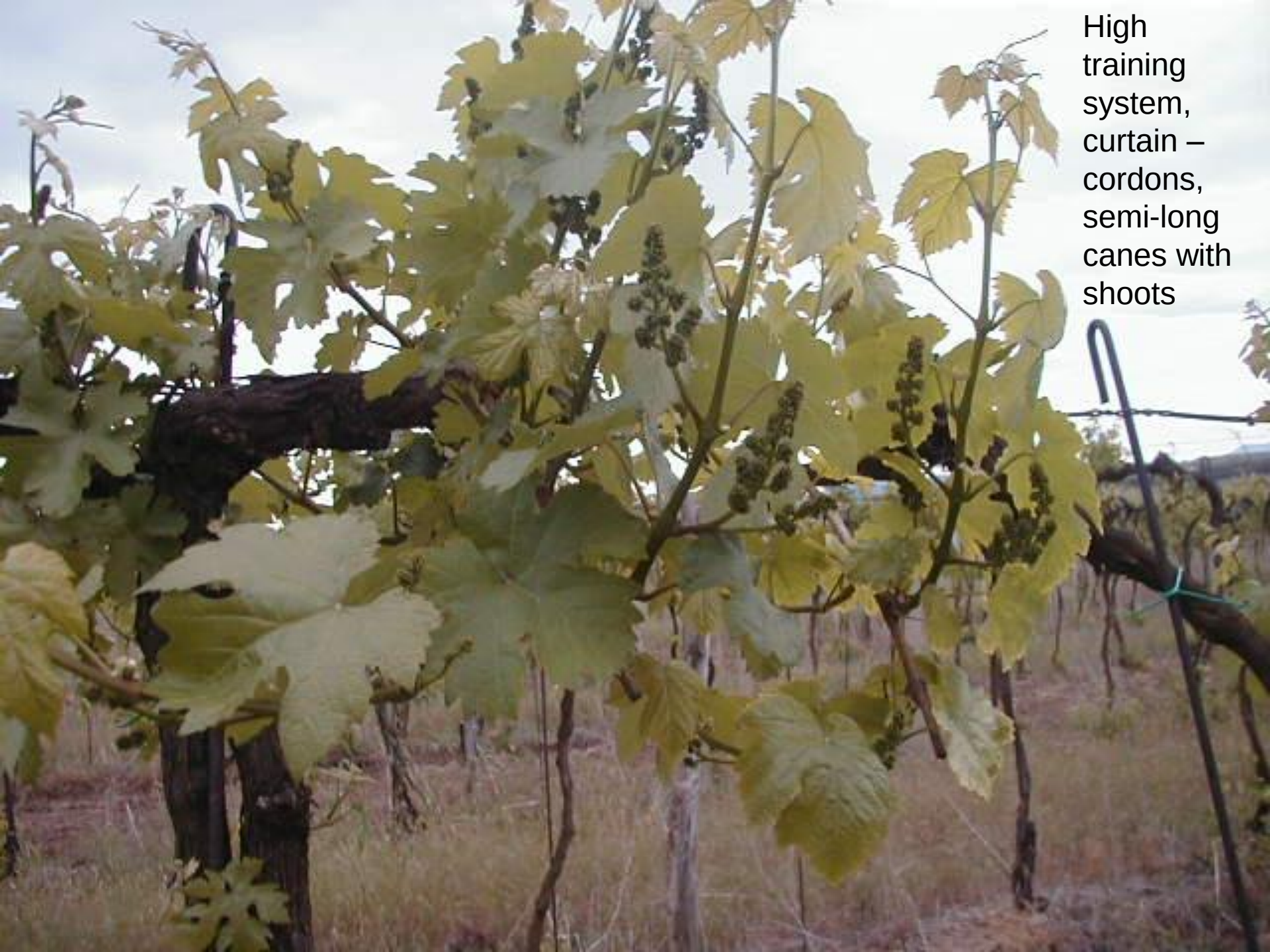
Trunk, a high training system


High training system – a simple curtain
Medium training system – the so called Rhine-Hessen training system

Rootstock production vineyards, tendone training system (Bratislavské and Chmelnicové training systems)

Young vineyards - May

Cover plants in interrows, suckers must be removed



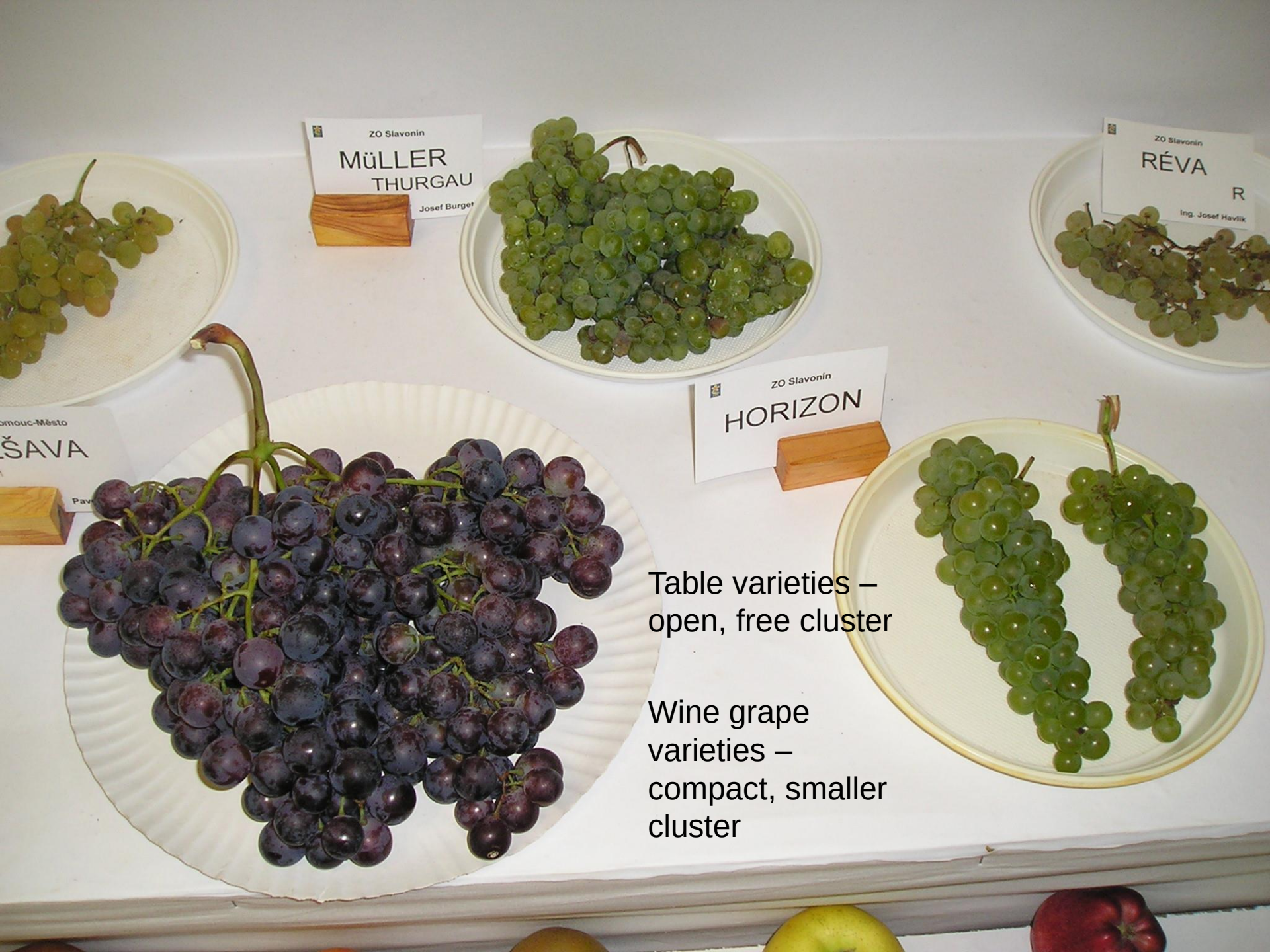
High training system, curtain – cordons, semi-long canes with shoots


Veltlínské zelené
Sauvignon


Aurora
ZO Krnov-Chomýž
Olšava
ZO Krnov-Chomýž
Favorit
ZO Krnov-Chomýž
Augustovskyj
ZO Krnov-Chomýž
Holand
ZO Krnov-Chomýž
Sieger
ZO Krnov-Chomýž
Schuller
Přasličák Miroslav
ZO Krnov-Chomýž
Panonia
Kincze
ZO Krnov-Chomýž
Julskij
Biser
ZO Krnov-Chomýž
Krystal
ZO Krnov-Chomýž
Kodrjanka
ZO Krnov-Chomýž
Horizon
ZO Krnov-Chomýž
Jalovenskyj
ustojčivyj
Přasličák Miroslav
ZO Krnov-Chomýž
Lipno
ZO Krnov-Chomýž
BO 21
ZO Krnov-Chomýž
Nero


ZO Olomouc-město
MODRÝ
PORTUGAL
ZO Litovel
FRANKOVKA
ZO Litovel
FRANKOVKA
Josef Dvořák
ZO Bělkovice-Lašťany
KIŠ MIŠ

White wine varieties, red wine varieties, red varieties for red wine production - red varieties, colorants in the skin Eonin


ZO Slavonín
MüLLER
THURGAU
Josef Burget
ZO Slavonín
RÉVA
R
Ing. Josef Havlík
ZO Slavonín
HORIZON
Table varieties – open, free cluster
Wine grape varieties – compact, smaller cluster