

Exercise Guide (theoretical part)

Plant systematics



Based on:

- www.plantsystematics.org/reveal/ - University of Maryland;
- <https://faculty.unlv.edu/landau> - University of Nevada, Las Vegas;
- <https://montana.plant-life.org> ;
- <https://thenaturopathicherbalist.com/> - Botanical medicine for the medicinal students
- www.library.illinois.edu/vex/toxic/comlist.htm - Poisonous plants
- www.biblio.com/.../poisonous-plants-pennsylvania/ - Poisonous Plants of Pennsylvania - by Robert J Hill
- <http://www.botanical.com/botanical/mgmh/comindx.html> - A Modern Herbal - by Mrs. M. Grieve

Land Plants - main groups

Embryophytes: The Land Plants						
Nonvascular Plants "Bryophytes"			Vascular Plants			
Liverworts	Hornworts	Mosses	Seedless Plants		Seed Plants	
			Lycophytes	Pterophytes	Gymno-sperms	Angio-sperms
			Club Mosses	Whisk Ferns		
			Quillworts	Horsetails		
Spike Mosses	Ferns					

SEEDLESS NONVASCULAR PLANTS

- Include mosses, liverworts, and hornworts
- Lack vascular tissue (xylem & phloem) to carry water & food
- Have a Sporophyte & Gametophyte stage known as alternation of generations
- Gametophyte is dominant stage
- Reproduce by spores

Division *Bryophyta* - Mosses

- Small, nonvascular land plants
- No true roots, stems, or leaves and conductive tissues - simple "rhizoids" for water absorption, but practically no water conducting tissue
- Grow on moist areas (brick walls, as thick mats on forest floors, and on the shaded side of trees)
- Some can survive periodic dry spells & revive when H₂O becomes available
- Must grow close together and require H₂O to complete their life cycle
- Mosses alternate between a haploid (n) gametophyte stage & a diploid (2n) sporophyte stage - called alternation of generations
- Gametophytes are photosynthetic & have root-like rhizoids
- Gametophyte is the dominant generation in the moss's life cycle
- *Sexual reproduction:*
 - The haploid gametophyte stage contains half of the chromosome number & produces gametes (sperm & egg) - into sex organs (Gametangia) - Antheridium (male) & Archegonium (female)
 - Fertilization can occur only after rain when the Gametophyte is covered with water
 - Sperms swim to the egg, following a chemical trail released by the egg
 - A zygote (fertilized egg) is formed and after mitosis becomes a Sporophyte (Diploid sporophyte)
 - Sporophyte of a moss is smaller than, & attached to the Gametophyte .
- Sporophyte lacks chlorophyll & depends on the photosynthetic gametophyte for food

- Sporophyte has a long, slender stalk topped with a capsule - forms haploid (n) spores by meiosis
- spores are spread by air currents, but sex cells must swim from one plant to another
- Haploid spores germinate into juvenile plants called protonema
- Protonema begins the Gametophyte generation
- *Asexual reproduction*
- includes fragmentation or gemmae
- Pieces of a Gametophyte can break off & form new moss plants (fragmentation)
- Gemmae are tiny, cup shaped structures on the Gametophytes
- Raindrops separate gemmae from the parent plant so that they can spread & form new Gametophytes

Main species: *Leucobrium glaucum*, *Bryum argenteum*, *Hypnum cupressiforme*, *Funaria hygrometrica*, *Polytrichum juniperinum*

Division *Hepatophyta (Hepaticophyta)* - Liverworts

- Nonvascular land plants
- Have simple "rhizoids" for water absorption, but practically no water conducting tissue
- Undergo alternation of generations with Sporophyte attached to Gametophyte
- Gametophytes are green & leafy and are the dominant generation
- Need abundant water for fertilization
- Reproduce by spores and propagules
- Grow on moist rocks or soil
- Reproduce asexually by gemmae and by growing new branches
- spores spread by air currents, but sex cells must swim from one plant to another

Main species: *Marchantia polymorpha* - common liverwort

Division *Anthocerophyta* - Hornworts

- Small, nonvascular land plants
- Gametophyte leafy - like liverworts
- Archegonia & antheridia form inside the plant
- After fertilization, zygotes develop into long, horn-shaped Sporophytes
- Horn-shaped Sporophytes are capable of photosynthesis, so not completely dependent on Gametophyte

Main species: *Anthoceros agrestis*

SEEDLESS VASCULAR PLANTS

- Include 2 unranked groups: Lycophytes & Pterophytes
- Lycophytes group includes club mosses, quillworts, and spike mosses
- Pterophytes group includes whisk ferns, horsetails, and ferns
- Have specialized vascular tissues (xylem & phloem) to transport H₂O, food, etc.
- Have a Sporophyte & Gametophyte stage known as alternation of generations
- Sporophyte is the dominant stage
- Reproduce by spores

LYCOPHYTES (UNRANKED GROUP)

Class *Lycopodiopsida* - Clubmosses

***Lycopodiaceae* Family** - The Clubmoss Family

Genus *Lycopodium* - Clubmoss

***Selaginellaceae* Family** - The Spikemoss Family

Genus *Selaginella* - Spikemoss

***Isoetaceae* Family** - The Quillwort Family

Genus *Isoetes* - Quillwort

- dominant sporophyte (real plant) and a small free-living gametophyte

- spores, produced by meiosis in sporangia, and gametes, produced by gametophytes in gametangia (antheridia and archegonia).
- leaves called microphylls
- produces spores by meiosis in sporangia, often clustered in strobilus structures at the stem apex
- homosporous (produce only one type of spore) and heterosporous (produce two types of spores) species
- forms strobilus - a cluster of modified leaves (sporophylls) that bear sporangia.
- Sometimes strobilus structures look like cones.
- Lycopodium species are homosporous, and each spore will grow into a bisexual gametophyte, Selaginella species are heterosporous.

Main genera:

Genus *Lycopodium* – *Lycopodium clavatum* - Common clubmoss

Genus *Selaginella* - *Selaginella helvetica* - Swiss spikemoss

Genus *Isoetes* - *Isoetes lacustris* - Lake quillwort

PTEROPHYTES (UNRANKED GROUP)

Division *Equisetophyta* - Horsetails

- long underground rhizome
- stems - 2 types: spring unchlorophyllous (brown) unbranched stem with strobilus; during the summer a chlorophyllous stem develops, branched and separated in segments
- Stems and branches are longitudinally furrowed, hard, rough, tough, hollow and ridged (with sometimes 3 but usually 6 - 40 ridges); stem coated with abrasive silicates
- Leaves - greatly reduced in scales, and usually non-photosynthetic, arranged in whorls, 6-12 in number, fused into nodal sheaths.

- Strobilus - cone-like structures at the tips of some stems (sporangiohores), bear spores
- Sporophyte is the dominant stage & a real plant

BAS (Bio - active substances): silicates, saponins, resins, alkaloids - paustine, nicotine, tannins, organic acids - oxalic acids , bitter and resinous substances

Action and use: diuretic, enhance heart activity and strengthen the circulatory, antimicrobial and anti-inflammatory action, inflammation of the urinary tract, against kidney stones and for bladder treatment, edema of cardiac or renal origin, hemostatic action. Poisonous!

Main species: *Equisetum arvense* - Common horsetail

E. telmateia - Great horsetail

E. hyemale - Rough horsetail

**Equisetum arvense* L. - Common horsetail

POISONOUS PARTS: All parts, green and dried, can be toxic. Hay, containing 20% or more of *E. arvense* causes poisoning symptoms in horses in 2-5 weeks.

SYMPTOMS: Toxicosis is similar to bracken poisoning. Appetite remains normal until near the end of the illness in *Equisetum* poisoning, whereas it is lost early in bracken poisoning. Ataxia, difficulty in turning, and the body wasting away followed by general weakening are early signs. In later stages animals may become constipated and the muscles rigid. Pulse rate increases and weakens, and the extremities become cold. The cornea of the eye may become opaque. Before death, the animal becomes calm and comatose. If poisoning is discovered early, the toxic plants removed from the diet, and proper nutrition given, animals can recover rapidly.

Horses are not infrequently affected by *E. arvense*. In advanced cases when a horse "goes down" and cannot arise, the animal becomes nervous, making frantic attempts to stand. When a poisoned horse is exercised it will tremble and become muscularly exhausted. Cattle are not readily affected by *E. arvense*. In experiments with cattle, the only result was marked worsening in the general condition of the animal over a forty-day period.

POISONOUS PRINCIPLES: The enzyme thiaminase is responsible for poisoning in non-ruminants. The previously suspected silica, aconitic acid, palmitic acid,

nicotine, methoxypridine, equisitine, palustrine, and dimethyl sulfide components are not of themselves toxic enough to produce poisoning. However, they may complicate the toxicosis. The toxic agent for ruminants is unknown and generally not fatal.

Division *Psilotophyta* - Whisk Ferns

- small herbaceous plants with fernlike habitus
- stem with primitive dichotomous type of branching- forks into equal halves.
- No true roots, stems, or leaves
- Has a horizontal, underground stems called rhizomes
- Root-like structures called rhizoids, anchor plant
- vascular tissue is organized into a poorly developed central cylinder in the stem
- Reproduce by spores & vegetatively from rhizomes

Only 2 living genera: *Psilotum* and *Tmesipteris*

Main species: *Psilotum nudum* - Skeleton fork fern

Division *Pteridophyta* - True Ferns

- The largest group of living seedless vascular plants
- Live in moist habitats
- Perennial herbs with short, thick, brown rhizome and numerous thin roots
- Alternates between dominant Sporophyte stage (real plant) & Gametophyte stage (includes in spores)
- Leaves are called fronds - double pinnate & are attached by a stem-like petiole
- Produces spores on the underside of leaves

Main species: *Polypodium vulgare* - Common polypody

Pteridium aquilinum - Bracken (eagle) fern

Dryopteris filix-mas - Male fern

Adiantum capillus-veneris - Venus-hair fern (female fern)

Osmunda regalis - Royal fern

BAS: essential oils, fatty acids, resins, bitter and resinous substances

Action and use: against tapeworms, skin rashes, eczema. Poisonous!

**Pteridium aquilinum* (L.) Kuhn - Bracken fern; brake fern

POISONOUS PARTS: The entire plant is poisonous in a fresh or dried condition; dead fronds apparently are not harmful.

SYMPTOMS: Horses (and monogastric animals) show anorexia, bradycardia, and incoordination. The animal may crouch with feet apart and back and neck arched. With severe signs there is tachycardia; death occurs with clonic spasms. In ruminants (sheep and cattle) one can see a rough coat, listless attitude, and mucous nasal and oral discharges (possibly bloody) about one week before the serious symptoms occur. In acute cases, an elevated temperature appears. Also there is anorexia and blood in excreta. In a prolonged illness, emaciation, hematuria, and rarely icterus can be observed. In young cattle, there is edematous swelling in the neck region with difficult breathing and death.

POISONOUS PRINCIPLES: The enzyme thiaminase is suspected in horses. In ruminants the agent of toxicosis is not known but causes hypoplasia or aplasia of hematopoietic tissue.

CONFUSED TAXA: This is the only fern that produces tall, large, coarse fronds from forking, extensively creeping rhizomes.

SPECIES OF ANIMAL AFFECTED: Horses, cattle, sheep, and possibly swine are susceptible.

OF INTEREST: It may take one to three months after ingestion for signs or symptoms to be manifest in thiamine-deficient animals. Six pounds per day for one month will poison a horse. Cattle fed hay with 50% bracken for 30-80 days will be poisoned; more is needed to poison sheep. Other ferns known or suspected to be poisonous include sensitive fern (*Onoclea sensibilis* L.), which

may produce nervous disorders (horses) and the male fern (*Dryopteris filix mas* (L.) Schott.), which is suspected to contain thiaminase.

SEED VASCULAR PLANTS

Division *Spermatophyta* - Spermatophytes

- best adapted to the conditions of the *terrestrial environment*
- fertilization of the egg becomes in female reproductive organism
- development of the embryo continues into the female organism until seed formation s
- Reproduces by seeds
- sexual reproduction is completely independent of the aquatic environment
- Can be woody or herbaceous
- Gametophyte highly reduced and is dependent on sporophyte
- Divided in two groups (unranked category)

GYMNOSPERMS - with “naked” seeds

- Always woody
- Shrubs or Trees
- Have cones, no flowers

ANGIOSPERMS - Flowering plants

- Woody or herbaceous
- Extremely variable in size
- Forms flowers, seeds & fruits

GYMNOSPERMS

- Conductive tissue includes tracheids
- Form two types of cones - male & female - gymnosperms “inflorescence”
- on the upper surfaces of a cone scales seeds are exposed
- Pollination is carried out by the wind

- leaves are needle-like or scale-like - fall gradually - that is why they look evergreen
- produce seeds that are not protected within an ovary

Main groups:

- **Division *Cycadophyta* - The Cycads**
- **Division *Ginkgophyta* - The Ginkgo**
- **Division *Gnetophyta* - The Gnetophytes**
- **Division *Pinophyta* - The Conifers**

Division *Cycadophyta* - The Cycads

- Dominated earth when dinosaurs lived, but only about 100 species are alive today & are endangered
- Most are slow growing, palm-like plants found mostly in tropical areas
- All cycads bear cones, which are made up of seed bearing leaves (sporophylls)
- They have large compound leaves, a short thick trunk, and are dioecious (either male or female plant)
- Cycads bear naked seeds

Division *Ginkgophyta* - The Ginkgo

- Ginkgoes were common in the Mesozoic period, but today only one species of ginkgo remains - *Ginkgo biloba*
- Ginkgo trees have distinctive fan shaped leaves & are dioecious (each tree is either male or female but not both)
- Commonly planted as an ornamental tree
- Deciduous dioecious species with plum-shaped, fleshy seeds with a foul odor

Main species: *Ginkgo biloba* - ginkgo

BAS: flavonoids, terpenes - ginkgolides and bilobalides

Action and use: stimulates blood circulation and blood supply, improves brain blood flow, improves the functioning of the central nervous system

Division *Gnetophyta* - The Gnetophytes

Gnetophyta is a plant division containing only 3 genera: *Welwitschia*, *Gnetum*, *Ephedra* and approximately 80 species. It isn't known when plants in

this division first evolved, but somewhere between 140 and 250 mya. Although gnetophytes are gymnosperms, with no true flowers or fruits, they have some features in common with flowering plants:

- Vessel elements in the vascular system are not seen in other gymnosperms
- Both *Welwitschia* and some *Gnetum* species are pollinated by insects
- Flower like structures on male cones of *Welwitschia*
- Nectar - produced on the tip of the cones rather than in a flower

All gnetophytes are evergreen and woody, and could be trees, vines or in the case of *Welwitschia*, difficult to classify. These plants have not been studied much and it is tricky trying to find out information about them. For example, although they are mostly considered dioecious (male and female cones on separate plants) all three genera sometimes produce bisexual cones, containing both stamen and ovules, but it isn't really understood why, or if these cones can then reproduce.

Main species: *Ephedra distachya* - Ephedra - a bush, with unisexual flowers on separate plants, photosynthetic leaves and scale- like leaves.

BAS: resinous and tanning substances, alkaloids - ephedrine, pseudoephedrine, norephedrine

Action and use: increases blood pressure, loosen bronchial muscle, neurostimulant

Division *Pinophyta* - The Conifers

- cone-bearing seed plants with vascular tissue
- woody plants with secondary growth - include vascular cambium & cambium
- conifer wood - with tracheids
- trees and shrubs - evergreen (fall down from 2 to 6 years)
- wood of conifers is known as softwood
- leaves: needle - like & scale-like, arranged spirally or in whorls
- dominantly monoecious, wind-pollinated
- form seeds in protective cone - strobilus
- seeds are not protected into fruits - they are naked
- survivors of Permian - Triassic extinction event
- dominant land plants of the Mesozoic era
- 8 families, 68 genera, and 629 living species (1998)

Main families:

***Pinaceae* - The Pine Family**

Genus *Abies* - *Abies alba* - Silver fir

Genus *Pinus* - *Pinus nigra* - Austrian pine (black pine), *Pinus sylvestris* - Scotch pine

Genus *Cedrus* - *C. atlantica* - Atlas cedar

Pine toxicity: Substantial intake of pine needles for several days is associated with abortions. Abortion is common in the last trimester of pregnancy often accompanied by edema of the udder and vulva of the females. Abortions are characterized by weak uterine contractions, occasional incomplete cervical dilatation, excessive mucous discharge, birth of a small, weak calf and retained fetal membranes. Complications subsequent to abortion are frequent and include septic metritis, agalactia, rumen stasis and death. Occasionally, cows die from an apparent toxicosis induced by the pine needles; death may be due to toxins other than isocupressic acid.

***Cupressaceae* - The Cypress family**

Genus *Cupressus* - *C. sempervirens* - Mediterranean cypress

Genus *Juniperus* - *J. communis* - Common juniper

BAS: resins, essential oils (30%), fatty oils, tannins, alkaloids, vit. C, K, group B

Action and use: anti-inflammatory, expectorant and vasodilating action; for the treatment of lung diseases - tuberculosis, bronchitis, pneumonia, pleurisy; diseases of the urinary system; strengthens the immune system; favors the nervous and cardiovascular systems; antidot action; antimicrobial, expectorant, anti-viral, analgesic; inside use - turpentine oil

***Taxaceae* - The Yew Family**

Taxus bacata - Common yew

BAS: alkaloids - taxin, cyanogenic glycoside, volatile oil - Poisonous!

Action and use: harmful for animals & humans - symptoms include trembling staggering, coldness, weak pulse and collapse. Poison is not destroyed when the plant dies, the seed is highly toxic.

Angiosperms (Division *Magnoliophyta*)

Flowering plants

Introduction

The **flowering plants** (**Angiosperms**), also known as **Angiospermae** or **Magnoliophyta**, are the most diverse group of land plants, with about 350,000 species. Like Gymnosperms, Angiosperms are seed-producing plants - they are distinguished from Gymnosperms by characteristics including flowers, endosperm within the seeds, and the production of fruits that contain the seeds. Etymologically, angiosperm means a plant that produces seeds within an enclosure, in other words, a fruiting plant. The term "angiosperm" comes from the Greek composite word (angeion-, "case" or "casing", and sperma, "seed") meaning "enclosed seeds", after the enclosed condition of the seeds.

The botanical term "Angiosperm", was coined in the form Angiospermae by Paul Hermann in 1690, as the name of one of the primary divisions of the plant kingdom. This included flowering plants possessing seeds enclosed in capsules, distinguished from his Gymnospermae, or flowering plants with achenial or schizo-carpic fruits, the whole fruit or each of its pieces being here regarded as a seed and naked. The term and its antonym were maintained by Carl Linnaeus with the same sense, but with restricted application, in the names of the orders of his class Didynamia.

In 1851, Hofmeister discovered the changes occurring in the embryo-sac of flowering plants, and determined the correct relationships of these to the Cryptogamia. This fixed the position of Gymnosperms as a class distinct from Dicotyledons, and the term Angiosperm then gradually came to be accepted as the suitable designation for the whole of the flowering plants other than Gymnosperms, including the classes of Dicotyledons and Monocotyledons. This is the sense in which the term is used today.

The most popular descriptive name was Angiospermae (Angiosperms), with Anthophyta ("flowering plants") as a second choice. These names are not linked to any rank. The Engler system uses the name Angiospermae, at the assigned rank of subdivision. The Reveal system treated flowering plants as subdivision Magnoliophytina (Frohne & U. Jensen ex Reveal, *Phytologia* 79: 70 1996), but later split it to *Magnoliopsida*, *Liliopsida*, and *Rosopsida*. The Takhtajan system and Cronquist system treat this group at the rank of division, leading to the name Magnoliophyta (from the family name Magnoliaceae).

!!!The Cronquist system, proposed by Arthur Cronquist in 1968 and published in its full form in 1981, is still widely used!!!!

A consensus about how the flowering plants should be arranged has recently begun to emerge through the work of the Angiosperm Phylogeny Group (APG), which published an influential reclassification of the

angiosperms in 1998. Updates incorporating more recent research were published as APG II in 2003 and as APG III in 2009.

Traditionally, the flowering plants are divided into two groups, which in the Cronquist system are called *Magnoliopsida* (at the rank of class, formed from the family name *Magnoliaceae*) and *Liliopsida* (at the rank of class, formed from the family name *Liliaceae*).

Other descriptive names allowed by the ICBN include Dicotyledones (Dicotyledoneae = Dicotyledons = plural Dicots), and Monocotyledones (Monocotyledoneae = Monocotyledons = plural Monocots). Recent studies - as by the APG, show that the monocots form a monophyletic group (clade - ancestral species and all its descendants) but that the dicots do not (they are paraphyletic - include an ancestor but not all of its descendants). Nevertheless, the majority of dicot species do form a monophyletic group, called the eudicots or tricolpates.

Distinguished characteristics of Dicots vs Monocots

The vast majority of dicots, however, form a monophyletic group (one that does include all the descendants) called the eudicots or tricolpates. Eudicots comprise about 75 percent of all angiosperm species (Drinnan et al. 1994, Soltis & Soltis 2004). It is generally accepted that monocotyledons evolved from within the dicotyledons.

From a diagnostic point of view, the number of cotyledons used to distinguish dicots and monocots is neither a particularly handy (as they are only present for a very short period in a plant's life), nor totally reliable character.

Aside from cotyledon number, other broad differences have been noted between monocots and dicots, although these have proven to be differences primarily between monocots and eudicots. The traditionally listed differences between monocotyledons and dicotyledons are as follows:

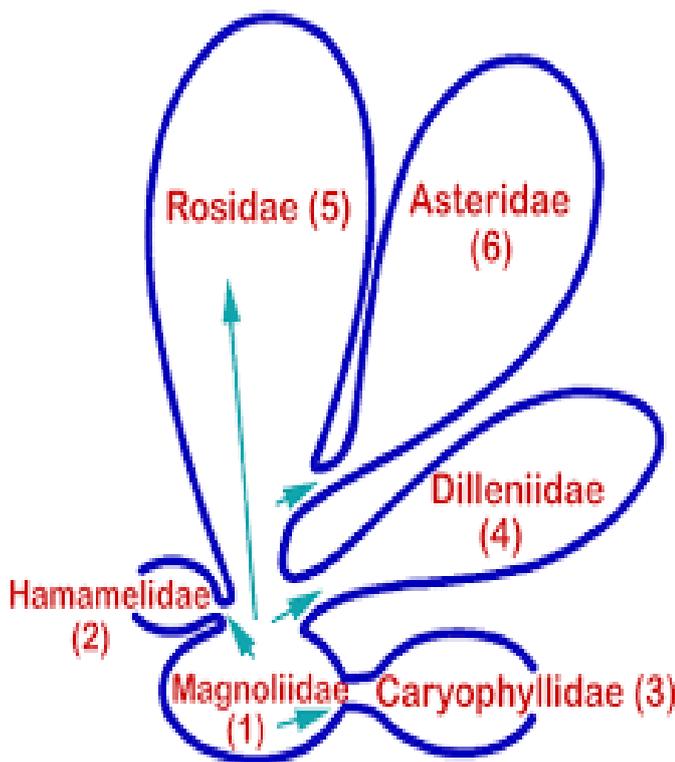
- Flowers: In monocots, flowers are trimerous (number of flower parts in a whorl in threes), while in dicots the flowers are tetramerous or pentamerous (flower parts are in multiples of fours or fives).
- Pollen: In monocots, pollen has one furrow or pore, while dicots have three.
- Seeds: In monocots, the embryo has one cotyledon, while the embryo of the dicot has two.
- Secondary growth: In monocots, stems rarely show secondary growth; in dicots, stems frequently have secondary growth.

- Stems: In monocots, vascular bundles in the stem are scattered; in dicots, they are arranged in a ring.

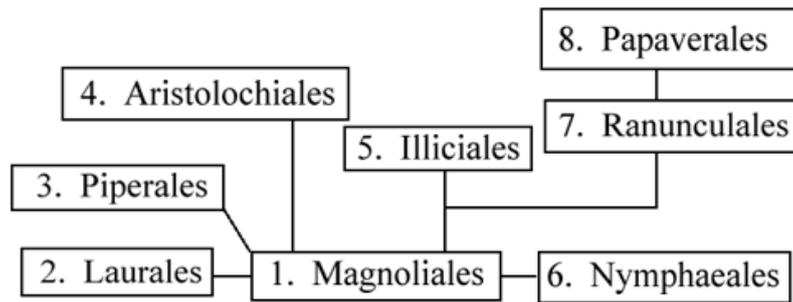
- Roots: In monocots, roots are adventitious (developing on a part other than the radical, such as on stems and leaves); in dicots, they develop from the radicle (primary root and its lateral roots).

- Leaves: In monocots, the major leaf veins are parallel, while in dicots they are reticulate.

This is a broad sketch only, not invariably applicable, as there are a number of exceptions. Many early-diverging dicot groups have "monocot" characteristics such as scattered vascular bundles, trimerous flowers, and non-tricolpate pollen. In addition, some monocots have "dicot" characteristics such as reticulated leaf veins. When monocots are compared to eudicots, the differences are more concrete.



Class *Magnoliopsida* (Dicots) - structure: main Subclasses (by Cronquist, 1981)



SUBCLASS MAGNOLIIDAE

They have a number of unspecialized features (they are "low tech" plants)
= mark the family as primitive on the evolutionary scale:

- 8 orders, 32 families, 11 000 species
- many primitive traits - tracheids, essential - oil cells
- Floral parts - spirally arranged - indefinite number of free carpels, stamens, petals & sepals
- perianth - differentiated or not to calyx and corolla
- Anemophylic and entomophylic flowers
- Main bioactive substances - isoquinoline alkaloids - bind to protein receptors of neurones and impede or promote neurotransmissions

Magnoliaceae - The Magnolia Family

- contains 250 species, including many handsome, fragrant-flowering trees and shrubs
- simple leaves
- an elongated conelike floral axis with flowers that have six tepals, many spirally floral parts
- the fruits is conelike
- the flowers are bisexual and are borne on branch tips - they have parts not distinctly differentiated into sepals and petals
- have are simple vessels - tracheids in the wood

Main species:

Magnolia grandiflora - Southern magnolia

Liriodendron tulipifera - tulip poplar

Schisandra chinensis - five flavor berry

BAS: essential oils, vit. A&C, fat oils, microelements : copper, iron, zinc, silicon, manganese, nickel and sulfur, titanium, molybdenum, silver

Action and use: antibacterial, anti-inflammatory, tonic, immunostimulant

Lauraceae - The Laurel Family

- comprises over 3000 species of flowering plants in over 50 genera worldwide. They occur mainly in warm temperate and tropical regions, especially Southeast Asia and South America. They are evergreen trees in habit.
- Leaves are simple, spirally arranged or opposite, leathery.
- Inflorescences are racemose or in clusters. The flowers are small, bisexual, actinomorphic, trimerous (two rows of 3 tepals), stamens are typically in 4 whorls. The ovary is superior.
- fruits are baccate or drupaceous - one-seeded fleshy fruit with a hard layer, the endocarp, surrounding the seed. However, the endocarp is very thin, so the fruit resembles to one-seeded berry.

Main species:

Laurus nobilis - True laurel

Cinnamomum zeylanicum - True cinnamon tree

Persea gratissima - Avocado

BAS: volatile oils, lignanes, terpenes, mucilage, phenylpropanoids – safrole - cytotoxic and neuroactive

Action and use: diuretic and astringent effect, affects skin rashes, resulting in contact with other toxic plants

Avocado toxicity: Fresh and dried leaves, bark, skin, and seeds are toxic to cattle, goats, horses, rabbits, birds, and fish. Severe mastitis may result in lactating goats fed 20g leaves/kg body weight. Doses of 30g leaves/kg body weight or more can cause edema and cardiomyopathy.

At lower doses, non-infectious mastitis is seen with a 75% decrease in milk production and watery, cheesy, curdled milk. Higher doses can cause edema of the head and neck leading to upper respiratory distress in horses. Colic is occasionally seen.

Piperaceae - The Piper Family

- contains roughly 3,600 currently accepted species in 13 genera. Members of the *Piperaceae* may be small trees, shrubs, or herbs. The distribution of this group is best described as pantropical.
- Leaves are simple with entire margins, and are positioned at the base of the plant or along the stem, and can be alternate, opposite, or whorled in arrangement.
- Stipules are usually present, as are petioles. Inflorescences (in spikes form) are terminal, opposite the leaves, or located in the axils. Flowers are bisexual, with no perianth, each flower is subtended by a peltate bract.
- Fruits are drupelike, with a single seed per fruit.

Main species:

Piper nigrum - Black Pepper

BAS: piperidine alkaloids (piperine, chavitsin), essential oils

Action and use: anticonvulsant, irritates mucous membranes and increases the secretion of gastric glands, increases blood circulation, reduces pain, in larger amounts - hepatotoxic effect, Stimulates ovulation, strengthens the liver and spleen, restores libido.

***Myristicaceae* - The Nutmeg family**

- consists of about 20 genera, with about 440 species of trees and shrubs, found in tropical areas across the world.
- leaves are glossy, dark green, simple, evergreen, and leathery.
- flowers are usually small and feature either only three petals or no petals at all. The flowers cluster and emit a pungent odor. The flowers are typically greenish, whitish, or yellowish hue. The female flowers have no staminodes. The male flowers lack a gynoecium.
- fruit is fleshy to non-fleshy (leathery), and contains a single seed. The fruits are typically quite large and, in almost all the species, the fruits break spontaneously when mature (dehiscent fruits).

Main species:

Myristica fragrans - Nutmeg

BAS: Indole alkaloids - with narcotic and carminative properties : myristicine - similar in action to noradrenalin

Action and use: antifungal and antimicrobial activity, causes delirium, with hallucinogenic properties

***Ranunculaceae* - The Buttercup (crowfoot) family**

On Latin *rānunculus* means "little frog", which somewhat coincides with wetland habitats which they prefer.

- numbers about 1700 species in about 60 genera, distributed worldwide. Ranunculaceae are mostly herbaceous annuals or perennials, but some are woody climbers (such as *Clematis*).
- leaves are simple, compound or lobed, typically alternate, or occasionally opposite or even whorled.
- Most members of the family have bisexual flowers. The sepals and petals are generally free (unfused) and typically four or five in number. Buttercups are considered as a "simple", because the floral parts- the petals, sepals, stamens and pistils - are all of an indefinite number and separate from one another. Also, the stamens and pistils are spirally inserted in a cone-like receptacle, although it is often very small to see. For the purposes of identification, the most accurate pattern to look for is the multiple simple pistils at the center of the flower , and the hooked tips on the pistils. Flowers may be solitary, but are frequently found aggregated in cymes, panicles, or spikes.

- The fruit is most commonly an achene (e.g. *Ranunculus*, *Clematis*) or a follicle (e.g. *Helleborus*, *Nigella*).

Main species:

Adonis vernalis - Spring pheasant's eye

Anemone ranunculoides - Yellow wood anemone

Aconitum napellus - Monk's-hood

Consolida regalis - Forking Larkspur

Helleborus odorus - Hellebores

Ranunculus sceleratus - Celery-leaved buttercup

BAS: aconitine type alkaloids - aconitine, elatine, delphinine - cause descending paralysis of all organs, essential oils with a sharp odor and pungent taste; isoquinolone alkaloid - berberine; cardiac glycosides - of a bufadienolide type including helleborin, helleborein and hellebrin - the last with strophanthidin - like action and has been used as a cardiostimulant.

Action and use: terpenoid alkaloids - depress the central nervous system; they are often used for nervous disorders, antispasmodic and sedative. Some of these plants can be cautiously used internally as heart and respiratory sedatives, antiseptic .

- Monk's-hood - defined as a “plant arsenic” - causing poisoning with descending paralysis, the main bio-active substance of *Ranunculaceae* Family - alkaloid aconitine, interacts with the voltage-gated sodium ion channels.
- In the muscles, aconitine potentiates contractions. It increases the permeability of the smooth muscle membrane to sodium ions, increasing calcium ion availability and, therefore, muscular contraction.
- In the neurons, aconitine depolarizes both the presynaptic and postsynaptic membranes by opening voltage-gated sodium ion channels.
- Spring pheasant's eye (*Adonis vernalis*) - contained cardiac glycosides - soothes nervous system, accelerates the activities of cardiac system, antagonist of cocaine
- Buttercup poisoning causes cows to give less milk and may cause the milk to be bitter and red tinted. Severe poisoning brings on colic and diarrhea, with black foul-odored feces, nervousness, twitching of the ears and lips, difficult breathing, and eventually convulsions. The symptoms shown by horses and sheep are similar, but poisoned sheep are likely to fall suddenly. Pigs suspected of tall-buttercup poisoning have shown paralysis but not much digestive disorder.

***Berberidaceae* - The Barberry family**

Worldwide, there are about 15 genera and 570 species in the traditional Barberry family. Generally, *Berberis* includes spiny shrubs with simple, deciduous leaves, while *Mahonia* includes evergreen plants and shrubs with pinnate leaves consisting of 5 to 15 leaflets with spines along the edges.

- The plants of the family have evergreen, holly-like leaves and flower parts in multiples of three. The inner bark is a brilliant yellow, due to the presence of an intensely bitter berberine alkaloid.

- The small yellow flowers are clustered together in racemes and mature into purplish, sour berries. Members of this family may have 2 or 3 small bracts masquerading as sepals on the back of a flower, but otherwise there are typically 6 true sepals and 6 petals, often appearing in series of 3 each. The ovary is positioned superior and consists of 2 to 3 united carpels (syncarpous) forming a single chamber.
- It matures as a sour berry

Main species: *Berberis vulgaris* - European barberry

Mahonia aquifolium - Oregon grape

BAS: isoquinoline alkaloids - berberine (in large quantities in the root - make it yellow) , mucilage, tannins, organic acids

Action and use: poisonous and healing: antibacterial, antifungal, anti-inflammatory, antioxidant and diuretic properties.

***Papaveraceae* - The Poppy Family**

- Distributed worldwide, there are 26 genera and 200 species, most are herbs, but there are a few shrubs and small trees in warm climates.
- The leaves are alternate and they often have milky sap in the stems.
- The poppies have flowers that are regular and bisexual, with 2 to 3 separate sepals and either 4, 8, or 12 separate petals (sometimes 6), plus numerous stamens. The ovary is positioned superior and consists of 2 or more united carpels (syncarpous) forming a single chamber.
- It matures as a capsule containing many small seeds.

Main species: *Papaver rhoeas* - common poppy

Papaver somniferum - opium poppy

Chelidonium majus - greater celandine

Chelidonium majus - greater celandine

BAS: acrid latex sap, isoquinoline (opium) alkaloids - morphine, noscapine, papaverine, thebaine; indole alkaloids

Action and use: Narcotics depress the central nervous system, causing sedation and relief from the feeling of pain (local analgesics); indole alkaloids - cause nervous disorders in cattle; codeine - against cough; papaverine - for the treatment of hypertension

***Aristolochiaceae* - The Birthwort family**

- Worldwide, there are 7 genera, representing about 400 species.
- Our members of this family have either regular or irregular, bisexual flowers with 3 united sepals, no petals, and typically 12 stamens (6 to 36 possible). The ovary is positioned inferior and consists of 6 (sometimes 4) united carpels (syncarpous) with the partition walls present, forming an equal number of chambers.
- It matures as a capsule form with numerous seeds.

Main species: *Asarum europaeum* - European wild ginger

Aristolochia clematitis - (European) Birthwort

BAS: volatile & essential oils, flavonoids, tannins, organic acids: aristolochic acid - nephrotoxic for human and animals, isoquinoline alkaloids, phytosterols

Action and use: Immunostimulant, relaxes uterine muscles, strengthens heart contractions, counteracts snake poisoning, lowers blood pressure, diuretic; causes abortion to pregnant women and animals. Caution is advised!

Subclass *HAMAMELIDIDAE*

11 orders; 24 families; 3400 species

- associated with wind pollination or anemophily
- unisexual (imperfect) flowers with taxa either monoecious or dioecious
- perianth reduced, weakly developed or absent (apetalous)
- Forms inflorescences with numerous, small (reduced), often apetalous flowers with the most specialized type of catkin or ament.

Order *Fagales*

Order *Juglandales*

Order *Urticales*

Order *Fagales*

Betulaceae - The Birch family

- Worldwide, there are 6 genera and approximately 150 species in this family, including filberts (also called hazelnuts) of the genus *Corylus*, which produces edible nuts.

- The simple leaves are alternate, singly or doubly serrate, feather-veined, petiolate and stipulate. They often appear in pairs, but these pairs are really borne on spur-like, two-leaved, lateral branchlets.

- The flowers are monoecious, opening with or before the leaves and borne once fully grown these leaves are usually 3-6 millimetres (0.12–0.24 in) long on three-flowered clusters in the axils of the scales of drooping or erect catkins or aments. Staminate aments are pendulous, clustered or solitary in the axils of the last leaves of the branch of the year or near the ends of the short lateral branchlets of the year. They form in early autumn and remain rigid during the winter. The scales of the staminate aments when mature are broadly ovate, rounded, yellow or orange color below the middle, dark chestnut brown at apex. Each scale bears two bractlets and three sterile flowers, each flower consisting of a sessile, membranaceous, usually two-lobed, calyx. The pistillate aments are erect or pendulous, solitary; terminal on the two-leaved lateral spur-like branchlets of the year. The pistillate scales are oblong-ovate, three-lobed, pale yellow green often tinged with red, becoming brown at maturity. These scales bear two or three fertile flowers, each flower consisting of a naked ovary. The ovary is compressed, two-celled, and crowned with two slender styles; the ovule is solitary. Each scale bears a single small, winged nut that is oval, with two persistent stigmas at the apex.

- The fruit is a small samara or single-seeded nut, although the wings may be obscure in some species. Bioactive ingredients are found on the leaves and the bark.

Main genera:

Betula - Birch

Corylus - Hazels

Carpinus - Hornbeam

Alnus - Alder

BAS: bitter substances, glycosides, tannins, lots of vitamin C, tannic acid, essential oils, saponnins

Action and use: astringent and diuretic ; for treatment of infections of the urinary tract that affect the kidney, bladder, ureters, and urethra. It is also used as a diuretic to increase urine output; for “Spring cures” for “purifying the blood”. Must be added teaspoon baking soda to alkaline the potion!!

***Fagaceae* - The Beech family**

- Worldwide, there are 8 genera and approximately 900 species in the family. Members of the Beech family are trees or shrubs, either deciduous or evergreen.
- The leaves are simple, alternate and often, but not always, lobed .
- The flowers are typically unisexual, with both male and female flowers appearing on the same plant (monoecious). Staminate (male) flowers have 4 to 6 sepals, no petals and 4 to 40 stamens. The pistillate (female) flowers have 4 to 6 sepals and no petals. The ovary is positioned inferior and consists of 3 (sometimes 6) united carpels (syncarpous) forming a single chamber.
- Usually only one ovule is fertilized; it matures as a nut, usually attached to a scaly or spiny cap formed of numerous small, overlapping bracts.

Main species:

Fagus sylvatica - Common beech

Fagus orientalis - Oriental (Eastern beech)

Quercus frainetto - Hungarian (Italian) oak

Quercus dalechampii - Dalechamps oak

Quercus petraea - Sessile oak

Quercus robur - Pedunculate oak

Quercus suber - Cork oak

Castanea sativa - Sweet Chestnut

BAS: hydrolysable tannins

Action and use: astringent and diuretic.

Oak poisoning: Tannins are naturally occurring plant polyphenols. Their main characteristic is that they bind and precipitate proteins. They can have a significant influence on the nutritive value of foods eaten by humans and animals because they are able to bind carbohydrates and proteins. Oaks contain hydrolyzable tannins which are esterified with phenolic groups, such as gallic acid to form gallotannins. Such tannins are hydrolyzed by microbes

and under acid conditions to release phenolic acids (gallic acid, pyrogallol, resorcinol) which are then absorbed. Both leaves and acorns, especially sprouted acorns, contain the toxin and toxicity is not diminished by freezing or drying. Oak poisoning is most common in cattle and calves, much less so in sheep and horses.

Early signs of poisoning are anorexia, dullness, ruminal atony and constipation. Feces may be dark, solid and covered with a film of mucus, but can become black with a tarry or fluid consistency as a result of hemorrhagic enteritis. Poisoned animals become weak and prostrate 3-7 days after exposure and mortality may be high. Icterus, hematuria, dehydration, polyuria, and hyposthenuria are often present in advanced stages of the disease. Pregnant animals may abort.

Order Juglandales

***Juglandaceae* - The Walnut Family**

- Worldwide, there are about 6 genera and 60 species, mostly walnuts.
- Members of the Walnut family are resinous, aromatic trees with alternate, pinnately divided leaves. The glandular dots beneath the leaves help to identify this family.
 - The flowers are unisexual, with male and female flowers appearing on the same trees (monoecious). The male flowers are borne in catkins, with 3 to 6 (sometimes 0) sepals, no petals, and 3 to 40 stamens (sometimes 100). Female flowers have 4 sepals and no petals. The pistil is syncarpous with 2 to 3 carpels fused together to make a single-chambered ovary
 - The fruit is a single hard-shelled nut enclosed in a husk.

Main species:

Juglans regia - Persian walnut

Juglans nigra - Eastern black walnut

Carya illinoensis - Sweet pecan

BAS: quinones juglone and plumbagin, glycosides, caffeic acid, kaempferol, tannins, ellagic acid; trace minerals - iron, zinc, sodium, phosphorus, and magnesium, fat oils.

Action and use: disinfectant, appetite exciting; tonic the nervous system, treatment to skin infections, diarrhea, vaginal discharge, menstrual problems, inflamed gums

Order Urticales

***Urticaceae* - The Nettle Family**

- Members of the Stinging Nettle family are herbs with hairy and occasionally squarish stems.
- Leaves is a simple, usually opposite. The leaves and stems are very hairy with nonstinging hairs, and in most subspecies, also bear many stinging hairs

(trichomes) whose tips come off when touched, transforming the hair into a needle that can inject several chemicals: acetylcholine, histamine, 5 - HT (serotonin), moroidin, and formic acid. This mixture of chemical compounds causes a painful sting or paresthesia from which the species derives one of its common names, stinging nettle, as well as the colloquial names burn nettle, burn weed, and burn hazel.

- The greenish or brownish flowers are mostly unisexual with male and female flowers on the same or different plants. They are with 4 or 5 sepals, no petals and 4 to 5 stamens. The ovary is positioned superior and has only one carpel (unicarpellate).
- Fruit is a dry seed, called an achene. Worldwide, there are 45 genera and 550 species.

Main species:

Urtica dioica - Stinging nettle

Urtica urens - Nettle

BAS: vitamin C, vitamin B complex, vitamin K, vitamin PP , trace minerals - iron, calcium, magnesium, and calcium,

Action and use: diuretic, antispasmodic, expectorant; for treatment of asthma, anemia, stomach inflammation, painful muscles and joints, eczema, arthritis, gout, and anemia, urinary tract infections, hay fever

***Cannabaceae* - The Hemp Family**

- Herbs, annual or perennial, erect or twining, dioecious or sometimes monoecious, often with cystoliths (a hard calcium carbonate structure at the base of a hair). Stems furrowed or winged. Stipules free.
- Leaves alternate or opposite, palmately lobed or compound, sometimes simple.
- Male inflorescences form bracteate cymes - male flowers are pedicellate; in type 5, free; petals absent. Female inflorescences are cymes much reduced in *Cannabis*. Female flowers are sessile; calyx appressed to ovary, membranous; petals absent.
- Fruit an achene.

Part of Dichotomous key for genera *Humulus* and *Cannabis*:

1a. Plants twining; stem with 6 ridges or wings; leaves opposite, palmately lobed or sometimes simple; stems, branchlets, and petioles with rigid 2-armed stalked hairs; female inflorescences pendent, conelike 1. *Humulus*

1b. Plants erect; stems furrowed but without 6 ridges or wings; leaves alternate or opposite on basal parts of plants, pinnately compound; stems, branchlets, and petioles scabrous but without rigid 2-armed stalked hairs; female inflorescences erect, not conelike ..2. *Cannabis*

Leaves and stems have an elongated secretory cells with latex and rubber as secondary metabolites (laticifer) and cystoliths (crystals of calcium carbonate) , that make the plant parts hard and rough.

Stem apices of the female plant include resin with anesthetic properties - hashish. By drying and grinding flowers of the Indian hemp, the product obtained is - marijuana.

Main species:

Cannabis sativa - Common hemp

Cannabis sativa subsp. Indica - Indica hemp

Humulus lupulus - Common Hop

Hemp: seed - rich of omega 3 and omega 6 unsaturated fatty acids, vitamins C, E, B complex; leaves - contain psychotropic phenolic terpenoids (alkaloids = cannabinoids (60 number and more). **Poisonous!!** Poisoning is characterized by euphoria, sensitivity increasing, appetite and libido too, exacerbation of light sensitivity that change later with panic, fear, hallucinations. Chronic use leads to passivity and apathy.

Hop: Female bracts include resins, essential oils - with sedative, analgesic, diuretic effect; in veterinary - for treatment of hydrops (a condition in the fetus characterized by accumulation of fluids, or edema).

***Moraceae* - The Mulberry Family**

- A family of 40 genera and about 1,000 species of mostly trees and shrubs, except hemp and hops. The main feature of the family is the presence of milky latex sap, formed at the stage of embryo.
- leaves are alternate or opposite, simple
- flowers are small, unisexual, and usually tightly clustered, with male and female flowers appearing on the same or different trees. Male flowers have 4 (sometimes 0) sepals, no petals and 4 stamens. Female flowers have 4 (sometimes 0) sepals and no petals. The ovary is positioned superior or inferior and consists of usually 2 (rarely 3) united carpels, as indicated by the same number of styles. One carpel is usually aborted, forming a single chamber.
- In species with tightly clustered flowers, the fruits merge together as a single mass, creating a false fruit known as an "aggregate" or "multiple." Flowers borne in the hollow end of a branch, and later swell around the developing seeds to become the fig fruit, called a "syconium." Other members of the family produce a nut or a drupe (a fleshy fruit with a stony seed).
- Worldwide, there are about 53 genera and 1,500 species in the family. About 800 species are *Ficus*, including figs, the banyan tree, the Indian rubber tree, and the bodhi tree, where the Buddha became enlightened. Breadfruit and jackfruit belong to genus *Artocarpus*. Other cultivated genera (mostly tropical) include *Antiaris*, *Brosimum*, *Cecropia*, *Chlorophora*, *Cudrania*, *Coussapoa*, *Dorstenia*, *Musanga*, and *Treculia*.

Main species:

Morus alba - White Mulberry
Morus nigra - Black mulberry
Ficus carica - common fig
Ficus elastica - Rubber bush
Ficus bengalensis - Indian banyan tree
Arctocarpus altilis - Breadfruit
Maclura pomifera - Osage orange
Antiaris toxicaria - upas tree - Poisonous!!

BAS: sugars, organic acids, vitamins and trace elements, tannins

Action and use: astringent action, against anemia, for treatment of mental illness, dysentery.

Toxic species - rich of alkaloids and cardiac glucosydes (cardenolides) - with nerve paralytic effect similar to curare.

SUBCLASS CARYOPHYLLIDAE

- Mostly herbaceous plants
- 3 orders, 14 families, 11 000 species
- Flowers - regular, unisexual or bisexual
- Seed - without endosperm
- The main evolutionary lineage - adaptation to different land life conditions - deserts, salty soils and sands, disturbed by human activity habitats - succulents, halophytes, nitrophilous and ruderal species
- Flowers - with sepals and petals, in type 5 (4), or reduced perianth
- Triterpenoid saponins – common chemical weapon

- **Order Caryophyllales**
- **Order Polygonales**
- **Order Plumbaginales**

Order Caryophyllales

Caryophyllaceae - The Carnation family

- about 80 genera and 2,000 species - mostly herbaceous
- Leaves are usually positioned opposite on the stems, but sometimes whorled
- Flowers are regular, bisexual, by 5 (4) type - 5 sepals and 5 petals. The sepals can be united or separate. Sometimes sepals and petals are joined, forming a tube with teeth. The stamens (rarely 3 or 4) form one or two whorls.
- The ovary is positioned superior and consists of 2 to 5 (rarely 1) united carpels (syncarpous) forming a single chamber.
- Fruit - a dry capsule with numerous seeds and opens by valves at the top

Main species:

Agrostemma githago - corn- cockle
Saponaria officinalis -common soapwort

Stellaria media - chickweed

BAS: triterpenoid saponins, vitamins,

Action and use: anti-inflammatory, regenerative effect on injury of the mucous membranes and skin.

Chenopodiaceae - The Goosefoot family

- Consists of 100 genera and 1500 species of annual or perennial, halophyte, and succulent herbs, which are ubiquitously distributed in dry regions and coastal areas. *Chenopodiaceae* and *Amaranthaceae* have evolved side by side with the *Phytolaccaceae* and form a special group of small - flowered *Caryophyllales*.
- leaves are thick, waxy, alternate or rarely opposite, simple and without stipules and often 3 - lobed like a ‘foot of a goose’, from which the name derives.
- flowers are very small, unisexual or hermaphrodite, and actinomorphic. The perianth comprises of 3-5 imbricate sepals often accrescent (continuing to grow after flowering) in fruits
- fruits are small nuts

Main species:

Chenopodium album - Common lambsquarters

Beta vulgaris - Beet

Spinacia oleracea - Common spinach

Halophytes:

Salicornia sp. - Glasswort

Sueda maritima - common seablite

Salsola vermiculata - Mediterranean saltwort

BAS: triterpenoid saponins, oxalic acid and quite often free nitrate, monoterpene ascaridol - to expel roundworms; indole alkaloids - antihypertensive property.

Action and use: antiseptic and anti-inflammatory

* Belongs to the group of nitrate-accumulating weeds - in the rumen nitrate is reduced to nitrite which is the ultimate toxin. As a salt, nitrate is toxic for ruminants at 0.5 g/kg (single oral dose). Forages containing > 0.2% nitrate and water containing > 1000 ppm are potentially toxic. Plants can accumulate 3 to 4% nitrate under appropriate conditions. Nitrate is not very toxic for monogastrics since it is not efficiently reduced to nitrite. However, nitrite is toxic for monogastrics. Unlike cyanide, nitrate does not volatilize and therefore dried forages are toxic. The iron in hemoglobin is oxidized from ferrous to ferric iron. This results in the formation of methemoglobin. Methemoglobin has significantly reduced oxygen carrying capacity.

Order Polygonales

Polygonaceae - The Smartweed family

The name refers to the many swollen nodes the stems of some species have. It is derived from Greek; *poly* means many and *goni* means knee or joint.

- Worldwide, there are about 40 genera and 800 species.
- consists mostly of herbs and some trees, shrubs, and vines, often with swollen nodes on the stems at the place of leaf petioles ("many knees" = swollen nodes of the stems)
- The leaves are simple, alternately arranged along the stem, and the stipules are usually united into a sheath that surrounds the stem at the base of the leaf petiole - ochrea
- The inflorescences are generally cymes or racemes, and the individual flowers are bisexual with a superior ovary consisting of three united carpels at the base of which there is a single ovule.
- Fruit is a nutlet - the sepals often become thickened and enlarged around the developing fruit

Main species:

Rheum officinale - Chinese rhubarb

Rumex acetosa - Sorrel

Rumex acetosella - Sheep's sorrel

Polygonum aviculare - Common knotgrass

Persicaria hydropiper - Water-pepper

Bistorta major - Common bistort

Fagopyrum esculentum - Garden buckwheat

BAS: anthraquinone glycosides - rein, aloemodine, emodine - depending on concentrations act constipate or purgative; tannins, essential oils - adstringent action; oxalic acid, phytosterols.

Action and use: astringent, diuretic; overdose causes stomach disorders and poisoning, accompanied by blood in the urine, treatment of inflammation of the oral mucosa, gastroenteritis, peptic ulcer disease.

Garden buckwheat - causes condition, named fagopyrism - increased skin sensitivity to sunlight - and accompanied with bladder and redness.

***Amaranthaceae* - The Amaranth family**

- Consists of 70 genera and 800 species - mainly herbs
- Leaves are simple, without stipules, alternate or opposite, serrate or entire.
- The flowers are very small, without petals, packed in spikes, racemes or panicles. The perianth consist of few free and very thin sepals facing a few stamens, the ovary is superior
- Fruits are urticles and capsules

BAS: large quantities of crude proteins, amino acids, unsaturated fatty acids, **gluten free!!!**

Action and use: astringent, diaphoretic, diuretic, stimulant, tonic

Helps in cases in: problems with circulatory system - bleeding (especially intestinal) haemoptysis; digestive system - diarrhea, dysentery, gastroenteritis; respiratory system - sores in the mouth and throat

Main species:

Amaranthus viridis - Slender amaranth

Amaranthus retroflexus - Red-root amaranth

Amaranthus palmeri - Careles sweed

* *Amaranthus* species - Pigweed - as weed plants accumulate nitrate to potentially toxic concentrations, which transform hemoglobin to methemoglobin. Methemoglobin has significantly reduced oxygen carrying capacity.