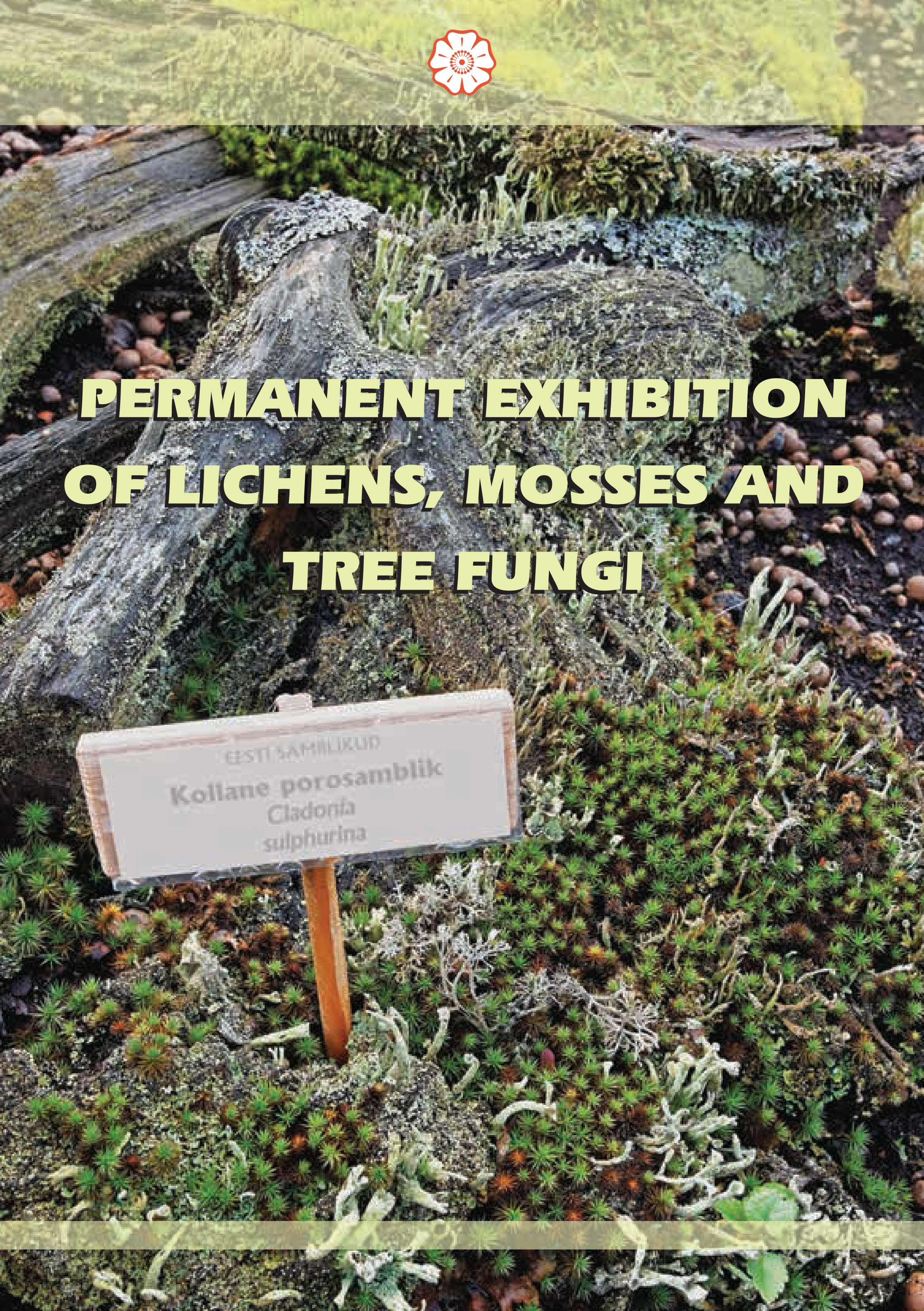
PERMANENT EXHIBITION OF LICHENS, MOSSES AND TREE FUNGI



Permanent exhibition of lichens, mosses and tree fungi.

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INTRODUCTION

At the end of 1997, Ivi Eenmaa, then Mayor of Tallinn, proposed that Freedom Square be remodeled. The goal was to remove the car park from the square and to transform it into a recreation and pedestrian area. In the summer of 1998, the city government spent nearly two million EEK on decorating Freedom Square by adding potted plants and painting flowers on the asphalt. The summer of 1999 saw the new city government restore the Freedom Square car park, and the wooden plant containers were brought to Tallinn Botanic Garden. Some of the boxes were used for planting summer flowers, while others were used to exhibit Estonia's most common species of lichens, mosses and tree fungi as recommended by Taimi Piin-Aaspõllu, Curator of Tallinn Botanic Garden Herbarium (photo 1). By the autumn of 2009, the containers used in the permanent exhibition were dismantled because they had become decrepit over the course of a decade of use and were in the way of the construction of a new greenhouse.
In ten years, an estimated several hundred thousand visitors had seen the permanent exhibition that was open during the snow-free days throughout the year. Experts agree that the permanent exhibition is the only one of its kind in the world.

Photo 1. Permanent exhibition of lichens, mosses and tree fungi in Tallinn Botanic Garden in autumn 2009.

Lichens, mosses and fungi are all relatively resistant to extreme weather conditions, which makes it possible to exhibit them outdoors all year round. Despite this, the items of the permanent exhibition are repeatedly renewed in the spring and summer months, since both bright sunlight and strong wind and rain damage their appearance. In addition to the Estonian and Latin names of the lichens, mosses and tree fungi, the permanent exhibition also includes introductory texts that explain the differences between these organism groups as well as their use as remedies and as effective biomonitors of atmospheric quality. Epiphytic lichens on tree trunks are good indicators of air pollution (figure 1).

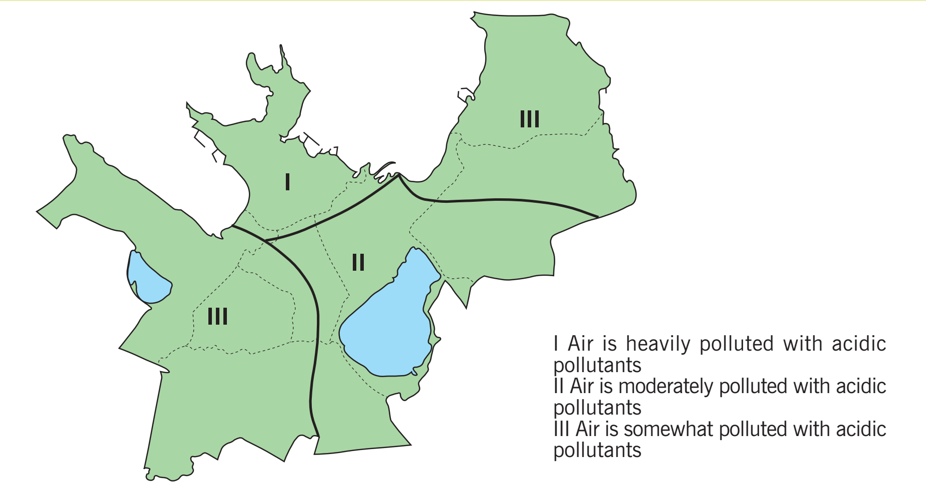

Figure 1. Lichenoindicative map of air pollution in Tallinn.

Ground mosses such as Schreber's feathermoss (*Pleurozium schreberi*) and Stair-step Moss (*Hylocomium splendens*), on the other hand, are used to measure atmospheric heavy metal (cadmium, chromium, copper, nickel, iron, lead, zinc, vanadium) deposition (photo 2, figure 2).

Photo 2. Schreber's Feathermoss (*Pleurozium schreberi*) and Stair-step Moss (*Hylocomium splendens*).

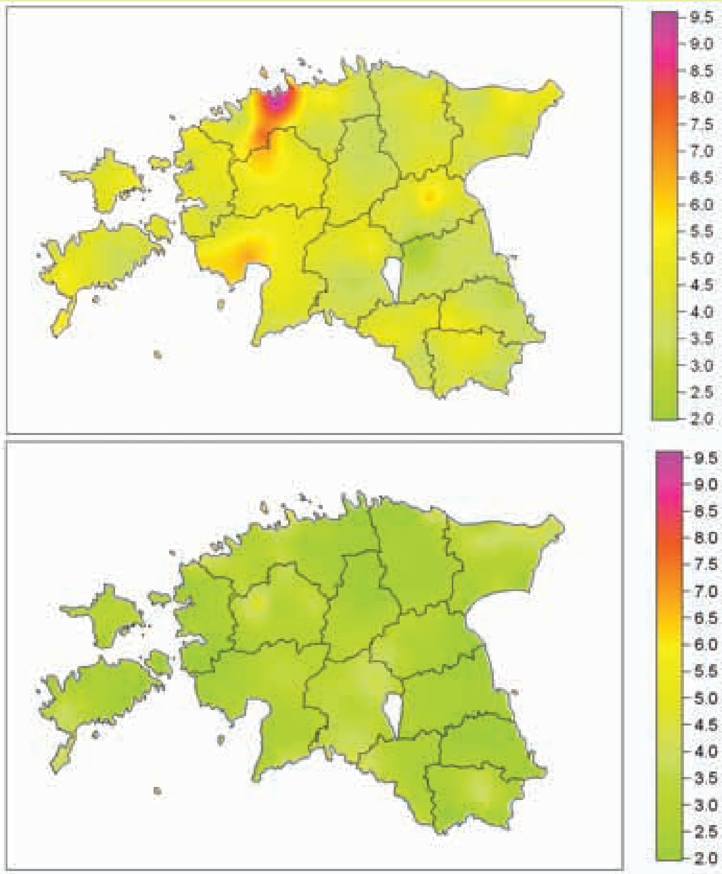

Figure 2. The distribution of moss lead (Pb) content (μg/g) in Estonia in 2000/2001 (above) and 2005/2006 (below).

The items of the permanent exhibition have been collected and identified by lichenologists Taimi Piin-Aaspõllu and Siiri Liiv, bryologist Leiti Kannukene, and amateur mycologist Sulev Järve. The student worksheets regarding the permanent exhibition have been compiled by Merlyn Pajur, Specialist of the Tallinn Botanic Garden Herbarium.

LICHENS

Lichens are organisms that belong to the kingdom Fungi but are often confused with mosses that belong to the kingdom Plantae. Lichens are one of the forms of symbiosis between a fungus and another organism and are scientifically viewed as a method of nutrition for fungi. The body of the lichens, or **thallus**, consists mostly of fungal hyphae (the **mycobiont**) that form around green algae and/or blue-green algae which are also known as cyanobacteria (the photosynthetic component or **photobiont**). The photobiont "feeds" both itself as well as the fungal component of the lichen. The mycobiont, on the other hand, provides a suitable living environment for the photobiont, protecting it from competing organisms as well as excess moisture and dryness.

Lichens are undemanding composite organisms that grow very slowly (their average growth rate is 0.1-0.7 mm per year) but live long (between 1,000 and 4,500 years old in arctic-alpine regions) and can grow in harsh conditions. Lichens can be found in tropical rainforests as well as habitats that offer fewer nutrients, such as the snow line in alpine regions, the tundra, or the desert. In these areas, lichens are often the pioneers of plant cover and prepare the soil for the growth of other types of vegetation.

Lichens grow on very different substrates: trees or other living plants (epiphytic lichens), rocks (epilithic lichens), the ground (epigeic lichens), wood (epixylic lichens), but also on glass and horns if such materials have been left on the ground in a forest for a long enough period of time.

The thallus of the lichens is reminiscent of a plant, rather than of the mushrooms you can see in the forest in autumn. Based on their appearance, lichens are divided into foliose, fruticose and crustose lichens. These primary growth forms are not always separated by clear boundaries, since one lichen can belong to different growth forms during the course of its life. The body of the lichens is the thallus and it can have a wide variety of colours and shapes, but unlike in the case of most mosses, it has not separated into a stalk and leaves. Thus, lichens lack leaves, stems and roots. Unlike mosses, lichens are rarely green and tend to have a thallus that is white, yellow, brown, grey, or black. However, the colour of the thallus changes upon becoming wet. The colour of the thallus comes from the pigments contained in the fungal filaments in the surface layer of the lichen.

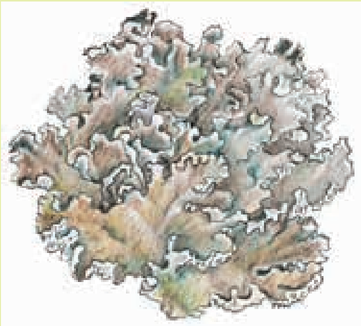

Figure 3. Dog lichen (*Peltigera canina*).

Figure 4. Northern reindeer lichen (*Cladina stellaris*).

Figure 5. Cartilage lichen (*Ramalina fraxinea*).

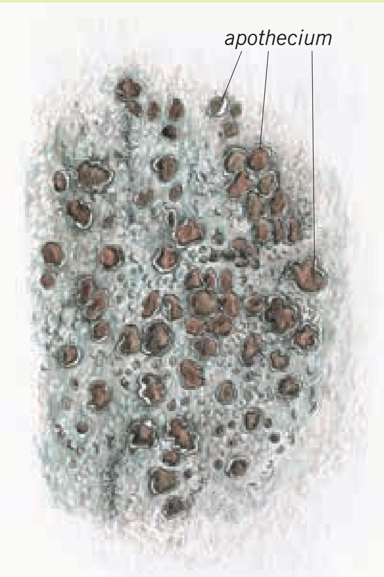

Figure 6. Rim lichen (*Lecanora allophana*).

Foliose lichens have a thallus shaped like a leaf or disc, which is divided into lobes at the edges (figure 3, photo 3). Foliose lichens are attached to the substrate with rhizines consisting of bunches of fungal hyphae.
Fruticose lichens resemble small shrubs on the ground (figure 4) or hang like beards from tree branches (figure 5, photo 4). Foliose lichens and fruticose lichens are macrolichens.
Crustose lichens or microlichens grow as an even smooth or grainy crust (figure 6). Their small thallus is usually so firmly attached to the substrate that it is impossible to remove crustose lichens without damaging them.
There are 20,000 species of lichens known in the world, more than 1,000 of which grow in Estonia. Microlichens make up nearly 700 of the lichen species growing in Estonia, with the remainder being macrolichens.
The internal structure of lichens can be viewed with a microscope. In order to do this, a thin crosswise slice must be cut from the lichen thallus. The different layers of the thallus will be visible on this cross-section (figure 7). The outer layer, or cortex, consists of densely interwoven fungal hyphae. Beneath the upper layer is a layer consiting of algae and the core layer, or medulla, which consists of loosely interwoven fungal hyphae. The lower cortex also consists solely of fungal hyphae.
The chemical composition of lichens is very interesting due to the so-called lichen substances. Nearly 500 of such substances have been identified, some of which have only been discovered in lichens. The occurrence of certain lichen substances is often characteristic of only one species of lichen. The traditional uses of lichens in medicine, the colouring of yarn and fabrics, and as a fragrant composition in perfumery are all based on some species of lichen containing certain lichen substances. The best known medicinal lichen is Iceland moss (*Cetraria islandica*), which is used for treating cough and pulmonary problems (photo 5). Usnic acid, known for its antibiotic properties, is extracted from beard lichen and tree lichen (genera *Usnea* and *Evernia*) and used in curing burns and other slow-healing wounds as well as gynecological illnesses.

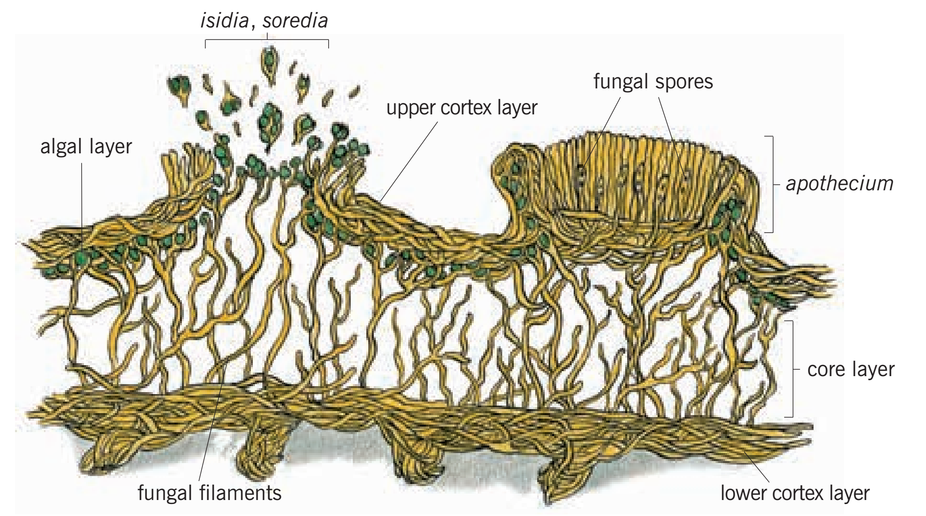

Figure 7. Cross-section of a lichen thallus.

Lichens **reproduce** both asexually, by vegetative reproduction, as well as sexually through spore dispersal. Vegetative reproduction takes place through pieces of the thallus or special reproductive structures — isidia and soredia (figure 7). All of these structures contain both the mycobiont and the photobiont.

Photo 3. Cockleshell lichen (*Hypocenomyce scalaris*).

Photo 4. Tree moss (*Pseudevernia furfuracea*).

However, a large number of lichens only reproduce sexually through spores that are generated in spore-producing bodies, such as apothecia, which are located on the thallus (figures 6 and 7). Spore-based reproduction only involves the mycobiont and not the photobiont. Even lichenologists are not entirely certain as to how the mycobiont and photobiont end up combining in suitable growing areas in the case of this type of reproduction.

Photo 5. Iceland moss (*Cetraria islandica*).

MOSSES

There are approximately 23,000 species of **mosses** known in the world, 578 of which grow in Estonia. The permanent exhibition features Estonia's most common and easily recognisable species of forest, meadow, and fen mosses as well as the species commonly seen on rocks, tree trunks, and decaying wood.
Mosses are mostly small plants varying between a few millimetres and twenty centimetres in height. Only the largest of mosses have stems that grow up to 0.5 m high. The largest moss species belong to the family *Polytrichaceae*. The height of the stem of the common haircap moss (*Polytrichum commune*), a member of Estonia's moss flora, is 0.3-0.4 m. The stem of the common water moss willow moss (*Fontinalis antipyretica*) can grow to be almost as high. These are two of the largest species of moss found in Estonia.
Mosses do not have roots and instead of them have rhizoids, water-absorbing outgrowths of the stem (or thallus), to attach themselves to the substrate. In the case of some species, such as the ribbed bog moss (*Aulacomnium palustre*), the stem is covered with rhizoids resembling felt. At the same time, peat moss stems lack rhizoids and stay upright only by leaning on each other. Mosses do not have the capacity for retaining water in their tissues and they dry out completely during precipitation-free periods. In order to sustain their access to water, mosses have adapted in several ways, such as growing tightly together and forming mat-like or cushion-like colonies. Mosses are predominantly green. Grey mosses can be found in habitats that have plenty of light. Hairy or colourless (hyaline) leaf tips and papillose leaves help the mosses growing in such conditions to disperse the strong light and give the plants a grey colour.

Figure 8. Stair-step moss (*Hylocomium splendens*) grows as "stairs".

Most mosses are perennial plants. They grow towards the tip of the stem or the edge of the thallus, while the lower part decays constantly. The green phase of the moss life cycle usually lasts for three years. It is easy to determine the age of mosses using the example of the stair-step moss (*Hylocomium splendens*), which grows in forests. Stair-step moss grows in "stairs", forming only one step of the stairs in a given year (figure 8).
Mosses are spore-bearing plants and reproduce through spores that form in capsules. The capsule develops on an archegonium after the ovum has been fertisilised and attaches itself to the archegonium with a seta or a thick stem. After ripening, the capsule opens. The small, light spores emerge from the capsule and are spread by wind or water. The spores can stay in the soil for years. When suitable conditions present themselves, the spore develops into a germ rhizoid, which is the source for new plants. Mosses often also reproduce through broken-

off tips of the stalk and branches as well as vegetative structures called gemmae. Bryophytes belong to three divisions: hornworts (*Anthocerophyta*), liverworts (*Marchantiophyta*), and mosses (*Bryophyta*). The exhibition comprises mosses from the latter two divisions.

The body of **liverworts** (**hepatics**) is a flat thallus consisting of several layers of cells or is separated into a flat stalk and leaf-shaped lobes (leafy liverworts). **Common liverwort** (*Marchantia polymorpha*) has a thallus-based structure (figure 9). Its thallus is forked, has wavy edges, and its colour is green with a darker line often running down the middle of the lobe. The lobes can be up to 10 centimetres long.

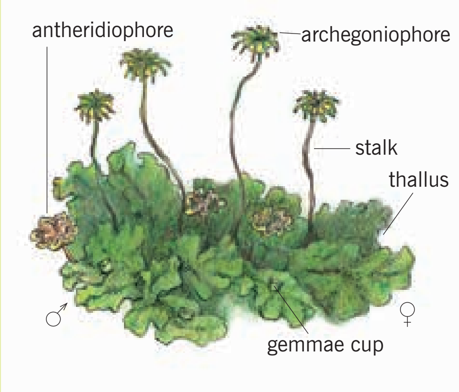

Figure 9. Common liverwort (*Marchantia polymorpha*).

Like most species of moss, common liverwort is dioecious, i.e. has male and female plants. Disc-shaped antheridiophores, carriers of antheridia, the male plants' sexual reproductive organs, are attached to the surface of the thallus with a stalk that varies between 1-3 cm in length. Archegonia, the reproductive organs of female plants, are contained in archegoniophores — radiating outgrowths that are attached to the thallus with a stalk that is up to 6 cm long. The surface of the thallus has small cup-shaped reservoirs that contain disc-shaped gemmae. The thallus is firmly attached to the ground with rhizoids located on its underside. Common liverwort grows on damp surfaces, hearths, and banks of ditches, as well as flower beds where it can form a thick cover and be a bothersome weed. Common liverwort bears an external resemblance to great scented liverwort (*Conocephalum conicum*), which prefers damp and shady habitats. Unlike common liverwort, the surface of the great scented liverwort thallus is marked with hexagonal divisions which have light spots in their centres, marking the location of the stoma. Great scented liverwort also does not have gemmae cups on its thallus.

Greater featherwort (*Plagiochila asplenioides*), the largest exhibited species of leafy liverworts, is a dark green forest moss with a recumbent stem covered in rhizoids and erect shoots up to 10 cm in height and 8 mm in width. Smaller species of leafy liverworts include even scalewort (*Radula complanata*), which has a shoot just 2.5 mm in diameter. Due to its bright green colour, the even scalewort thallus clinging to tree trunks and branches and occasionally also rocks is clearly noticeable.

Mosses are bryophytes that have stems and leaves. The stems may be straight or forked. The position of the stems in relation to the substrate is upright, trailing or rising. The leaves of mosses do not have petioles and are attached to the stem by the base of the leaf. The leaves on the stem and the branches can have a different shape and size, although they are never lobed.

Most species have leaves that are a single cell layer thick. The reproductive organs (antheridia, archegonia) grow either at the tip of the stem (acrocarps) or on the stem in the axils of the leaves (pleurocarps). The capsule is attached to the plant

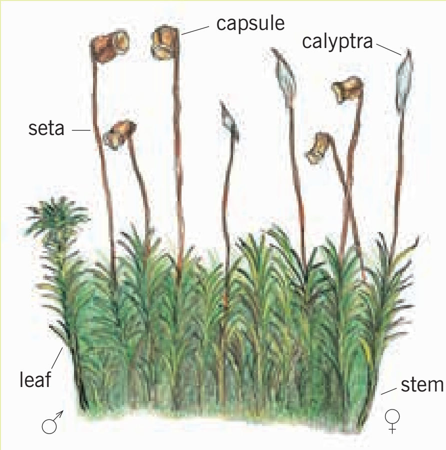

Figure 10. Juniper haircap moss (*Polytrichum juniperinum*).

with a seta. The shape and size of the capsule varies greatly and it can be globular as well as tubular. **Juniper haircap moss** (*Polytrichum juniperinum*) even has an angular capsule (figure 10). The capsule is covered by a cap, which separates when the spores are mature. The young spore capsules of juniper haircap moss are almost completely covered by a whitish, hairy calyptra. The topmost leaves of male plants (upper leaves) that surround the antheridia are somewhat larger and can have a different colour. The leaves on the lower part of the stem (lower leaves) are smaller than the true leaves. The lower end of the juniper haircap moss stem is sparsely covered by rhizoids, while in the case of the very similar strict haircap moss (*P. strictum*), the base of the stem is covered by a woolly tomentum of rhizoids. The tips of the leaves of the smallest species of haircap moss, bristly haircap (*P. piliferum*), are colourless.

The forest mosses on display include Schreber's feathermoss (*Pleurozium schreberi*), stair-step moss (*Hylocomium splendens*), dicranum moss and undulate dicranium moss (*Dicranum scoparium, D. polysetum*), and shaggy moss (*Rhytidiadelphus triquetrus*). The stem of Schreber's feathermoss is brown and clearly visible between the sparse leaves. **Schreber's feathermoss** and **stair-step moss** often grow together in the moss layer of dry coniferous forests (photo 2). **Dicranum moss,** which grows on the ground, decaying wood and tree trunks, has sickle-shaped leaves and the base of its stem is red (photo 6). The leaves of undulate dicranum moss are transversely undulate. The leaves of **shaggy moss** are bunched together at the top of the stem, forming a sort of tuft (photo 7).

Photo 6. Dicranum moss (*Dicranum scoparium*) on down timber.

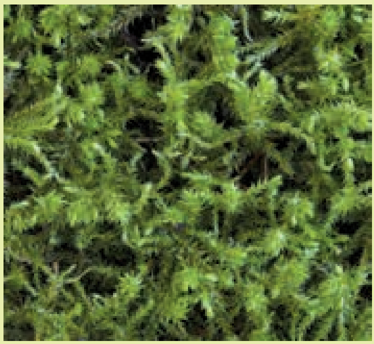

Photo 7. Shaggy moss (*Rhytidiadelphus triquetrus*).

Photo 8. Cypress-leaved plait-moss (*Hypnum cupressiforme*).

A very common (epiphytic) species of moss growing on bushes and trees is **cypress-leaved plait-moss** (*Hypnum cupressiforme*). The stems of cypress-leaved plait-moss cling against the substrate and are branched in an irregular, feathery fashion. The leaves are attached to the stem in two rows and their sickle-shaped tips are turned towards the substrate (the plant resembles a braid). The hanging branches are often long and thin (photo 8).

The largest species of moss that grows on tree trunks is squirrel-tail moss (*Leucodon sciuroides*). Squirrel-tail moss covers the trunks of old deciduous trees as a dull, dark green padding, often from the foot of the tree to its crown. Its branches are 5 cm long and when they dry, their tips turn upwards. Squirrel-tail moss is common on trees growing in parks and on boulevards in areas with clean air (it functions as an air pollution indicator species). *Pylaisia polyantha*, on the other hand, is a species that is very tolerant of air pollution and grows on trees in parks, boulevards located in cities, and in industrial areas. The carpet of *Pylaisia polyantha* creeping along tree trunks has a silky sheen when dry and the tips of its short branches are turned upwards.

Widespread meadow mosses featured in the exhibition include square goose neck moss (*Rhytidiadelphus squarrosus*). Square goose neck moss grows in mesophile grasslands, parks, and the grass in green areas. The tips of its leaves are turned downwards and when looked at from above, the uppermost leaves seem to form a small blossom. **Tree climacium moss** (*Climacium dendroides*) can be found in shady places and has upright stems growing out of its underground stem (rhizome). Since the branches are converged at the top of the stem, the moss resembles a small tree (figure 11).

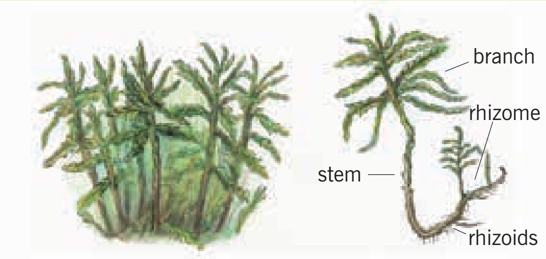

Figure 11. Tree climacium moss (*Climacium dendroides*).

The thin stems of **ditrichum moss** (*Ditrichum flexicaule*) that dominate dry alvar grasslands (juniper shrubs) are covered densely by brown rhizoids that combine the stems into a thick, dark green turf (photo 9).

Ciliate hedwigia moss (*Hedwigia ciliata*) is a common species of moss that grows on rocks. Due to the fact that its leaf tips are colourless, the tips of its branches and stems assume a whitish colour when the plant dries (photo 10).

Photo 9. Ditrichum moss (*Ditrichum flexicaule*) side and top-down views.

Photo 10. Ciliate hedwigia moss (*Hedwigia ciliata*) on a glacial boulder.

Pointed spear-moss (*Calliergonella cuspidata*) is common in paludifying grasslands and stagnant water swamps. While its leaves are straight and have dull edges, they cling close to the tips of the stem and the branches (forming a sharp tip).

Stagnant water swamps are dominated by intermediate hook moss (*Drepanocladus cossonii*) — a red or brownish moss with sickle-shaped leaves.

The most common genus of mosses in Estonia comprises 37 species of **peat mosses** (*Sphagnum*). Branches are attached in clusters to the upright peat moss stem, which does not fork (figure 12). The stem leaves and branch leaves of the plant have a different structure. The blade of the leaf consists of wide, empty cells (hyalocysts) and narrow cells that are located between the wide cells and contain chlorophyll (chlorocysts). Hyalocysts give a whitish colour to many of the species and their function is to conserve water. The empty cells in the stem have the same function. The young, short branches located at the top of the peat moss stem form a capitulum. Small globular or elliptical dark brown or black capsules can be seen above the capitulum.

Peat mosses are the main constituent of peat. Peat is used as fuel and a substrate in gardening. It has also been used as an antiseptic bandaging material in the past. Mosses have been used for sealing buildings, filling pillows and mattresses and, to a lesser degree, in folk medicine for curing various diseases.

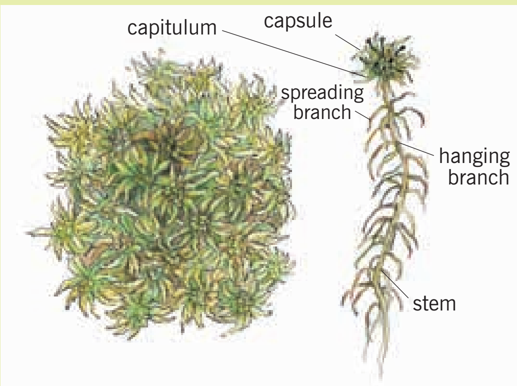

Figure 12. Peat moss (*Sphagnum*).

TREE FUNGI

According to the estimates of different scientists specialising in the study of fungi (mycologists), there are 57,000-300,000 species of fungi in the world. Approximately 5,500 species have been found and identified in Estonia to date.

A simplified division of the kingdom Fungi separates the species into **macrofungi** and **microfungi**. The first category comprises the so-called higher fungi that produce the easily visible fruiting bodies (which are occasionally quite large): russula, porcini, polypores, etc. Microfungi are defined as fungi whose fruiting bodies can usually only be seen with the help of a magnifying glass and identified with a microscope: yeast fungi, mildews, etc.

Although humans as well as many animals mainly value the culinary properties of fungi, their ecological significance is far greater. Firstly, fungi are irreplaceable as decomposers of organic plant substances. It is mainly thanks to fungi that herbs as well as fallen leaves, branches and trunks are transformed into compounds that can be used as food by, for example, soil microbes, insects and, eventually, the next generation of plants.

Secondly, fungi help plants access mineral nutrients and water in the soil, receiving the organic compositions necessary for replenishing their energy supply in return. This symbiosis between the roots of a plant and the mycelium is called a **mycorrhiza**. There are few woody plants in Estonia that would be able to cope without the help of fungi. At the same time, the fungi that form mycorrhizal associations could not live without trees. Such fungi also include our most common edible mushrooms (milk-caps, russulae, porcini).

Dozens of different types of fungi have adapted to live in symbiosis with trees (figure 13). Mycorrhizal fungi are connected to thin tree roots and their fruiting bodies grow at a distance, near the trunk of the tree. **Tree fungi** live in dead or living wood and form their fruiting bodies on the trunk of a tree or on the root collar near the ground.

The rotting of growing trees as well as stumps and down timber is primarily caused by a fungus group called **polypores** (pore fungi). 211 species of polypores have been found in Estonia and most of the tree fungi collected for the permanent exhibition belong to this group.

Figure 13. Trees are home to edible mushrooms as well as tree fungi.

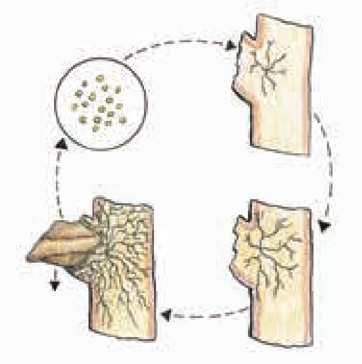

Figure 14. The circle of life of polypores from the spore to the formation of the fruiting body.

Figure 15. Tinder fungus caps on a birch trunk.

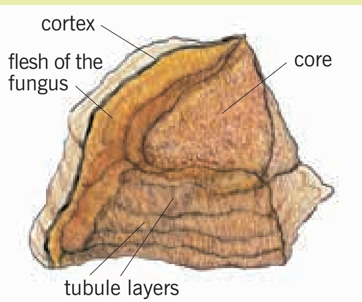

Figure 16. Cross-section of the fruiting body of the tinder fungus.

Typical specimens of the polypores form a tough fruiting body (a cap) on the surface of the tree. The lower side of the cap is covered with narrow vertical **tubes** (less often lamellae or fibres), which host the developing **spores**. Spores are single-cell structures which mature and fall out of the tubes primarily during spring and autumn when the weather is more humid. During suitable periods, a medium-sized fruiting body dryad`s saddle can “produce” up to 75,000,000,000 spores per day. Although the spores are spread across hundreds of kilometers by currents of air and fall everywhere, only a few of them find a suitable substrate (e.g. a dried stub of a branch or a trunk wound caused by wild animals). The spores that stick to a tree germinate **hyphae,** which consist of long tubular cells (figure 14). When the hypha penetrates the wood, it excretes enzymes that make the substances in wood cell walls soluble so that they are absorbed into the hypha, thus feeding the fungus and decomposing the wood. As the hyphae grow, branch out and intertwine, they form a mycelium inside the wood. The hidden and almost unnoticeable development of the mycelium takes years, until **fruiting bodies** appear on the tree trunk (mostly on the spot where the fungus penetrated the tree). The fruiting bodies consist of tightly intertwined hyphae and are annual or perennial, depending on the species of fungus.

Dozens of fungi that grow on trees have been collected for the permanent exhibition, preferably together with their substrates. The tree stumps show how different species of fungi decompose wood. The most common Estonian shelf fungi with perennial fruiting bodies are exhibited throughout the year, while fungi with annual fruiting bodies are added to the exhibition in the summer and autumn. Many of the fruiting bodies are large and beautiful but can only be preserved for a couple of weeks as exhibits.

The tinder that was used to light fires thousands of years before the invention of matches is what probably gave its name to one of our most common tree fungus. **Tinder fungus** (*Fomes fomentarius*) mainly grows on dead birch trunks (figure 15), forming a hard hoof-shaped cap that is up to 25 cm in width. In the cross-section of an old tinder fungus fruiting body (figure 16), the cap is covered by a hard cortex under which there is a dense layer composed of the cotton-like flesh of the fungus. A marble-like core forms at the place where the fungus is attached to the tree. A new thin layer of tubes grows on the underside of the fungus each year. The fruiting body in the figure is five years old.

Red banded polypore (*Fomitopsis pinicola*) is another very common and easily recognisable fungus. Its semicircular caps with ocher stripes can be found in the forest, most often on the stumps of spruce trees (photo 11), pines, and alders as well as on down timber. The brown rot caused by red banded polypore decomposes wood into small, cube-shaped pieces that become soil later on and create a favourable environment for the growth of a new forest generation.

Photo 11. Red banded polypore (*Fomitopsis pinicola*) on a spruce stump.

The species belonging to the genus ***Heterobasidion*** are most dangerous in industrial forests due to the fact that they cause root, stub and trunk rot to our most important coniferous trees and inflict large financial losses on forest owners. Butt-rot fungus (*H. parviporum*) is usually found on Norway spruce, while annosum root rot (*H. annosum*) is common in pines but sometimes also manifests itself on spruces as well as silver birches and downy birches. In the case of spruces, the fungus causes a rot to develop at the base of the trunk and in the roots, ruining the timber produced from the tree. The mycelium spreads from the roots of the diseased tree or stump to healthy trees through connecting roots. Trees often break from a height of one or two metres (photo 12) or fall down together with their roots. The fruiting bodies are small caps that have off-white undersides and light chocolate brown surfaces and usually grow on the roots of spruces that have been felled by storms. You might have to crawl between the roots to find them. There have been attempts to use another fungus, *Phlebiopsis gigantea*, to combat butt-rot fungus. When freshly sawn, spruce stumps are

Photo 12. Spruce infected with and felled by butt-rot fungus (*Heterobasidion parviporum*).

Photo 13. The fruiting body of honey fungus (*Armillaria* sp.) on the trunk of a dried alder.

Photo 14. Honey fungus (*Armillaria* sp.) forms glowing rhizomorphs under the tree bark.

treated with a prepatation containing *Phlebiopsis gigantea* spores, the latter fungus starts growing on the stumps and protects them from butt-rot fungus infection. **Honey fungus** (*Armillaria* sp.) has a stipe and cap like a "regular mushroom" and his toadstools grows on tree stumps or in the cracks of tree bark from late summer until the weather becomes cold, forming bush-like clusters (photo 13).
Honey fungus is common throughout the world and can infect almost any type of woody plant of any age. It is one of the most dangerous causes for root rot in

Photo 15. A developing sulfur shelf (*Laetiporus sulphureus*) fruiting body on the trunk of a white willow.

Photo 16. A full-grown sulphur shelf (*Laetiporus sulphureus*) fruiting body on the trunk of a white willow.

Estonia besides the species of the genus *Heterobasidion.* Removing the bark from an infected dried or felled tree will reveal a characteristic network of shiny black rhizomorphs (photo 14).

The most colourful species of fungi grow on trees in parks and the showiest of them is **sulfur shelf** (*Laetiporus sulphureus*), which grows on old white willows or oaks. Its bright fruiting bodies ranging in colour from lemon yellow to reddish orange (photos 15 and 16) consist of thin caps that are merged with each other and appear on trees in the middle of summer.

Dryad's saddle (*Polyporus squamosus*) is a fungus commonly found on trees in parks. In late spring and early summer, we see its flat caps that become thicker towards the base on the stumps of deciduous trees as well as live trees — mainly maples, ashes and elms (photo 17). The surfaces of the light caps are covered with concentric circles of brown scales.

Park trees are often broken by **brittle cinder** (*Kretzschmaria deusta*) whose black, bumpy stromata containing tiny fruiting bodies grow on the root collars of trees. It is relatively difficult to find these formations in the grass. In the summer, light grey sporangia grow on top of and next to the stromata (photo 18).

Photo 17. Dryad's saddle (*Polyporus squamosus*) hats on the trunk of a horse chestnut.

Photo 18. The sporangia of brittle cinder (*Kretzschmaria deusta*) are as big as a hand.

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