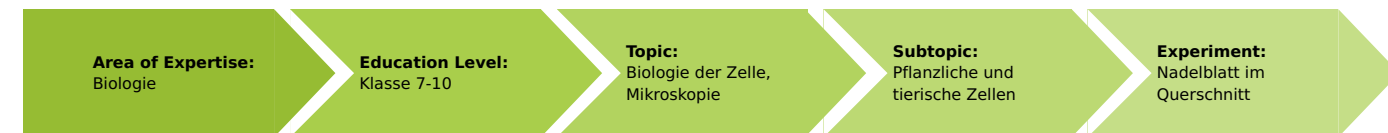


Cross-section of a coniferous (gymnosperm) leaf - adaption to arid conditions (Item No.: P1442101)

Curricular Relevance



Difficulty



Easy

Preparation Time



10 Minutes

Execution Time



30 Minutes

Recommended Group Size



1 Student

Additional Requirements:

- Pine needle (*Pinus spec.*)
- Water

Experiment Variations:

Keywords:

Task and equipment

Information for teachers

Information

Some trees do not possess large deciduous leaves, instead they have green needle-shaped (acicular) leaves. Due to the reduction of their surface, these leaves are well adjusted to arid conditions. In addition, they are mostly covered by a layer of wax (cuticula) and the stomatal pores are sunk deep into the tissue.

Information on obtaining materials

The leaves from almost any pine species (*Pinus spec.*) can be used for preparation. We find them in forests, parks, or gardens. Other representatives of the *Pinacea* family do not possess the equifacial leaves desired. For example, firs (*Abies spec.*) possess bifacial leaves.

Information on coniferous (gymnosperm) leaves

Depending on the arrangement of the tissues, we distinguish various leaf types. Bifacial leaves whose abaxial and adaxial sides differ from each other (dorsiventral) were studied in another experiment. Bifacial leaves whose abaxial and adaxial sides are almost identical (equifacial) are found, for example, among the *Pinaceae*.

The development of needle-like (acicular) leaves is explicable as an adaptation to dry locations (xeromorphism). In regions where winter frost prevails and no water is supplied on account of frozen soils many deciduous trees shed their leaves and are thus protected against drying out. The evergreen acicular conifers are adapted to these conditions in a different way. The surface-dependent evaporation capacity is extremely reduced (almost round cross-section) so that a period of draught can be survived.



Safety measures

- Attention! Count the number of scalpel blades at the end of lessons in order to prevent accidents that also might occur afterwards!

- Carmine acetic acid is highly corrosive!
- Put on protective glasses!

Hazard- and Precautionary-Statements

Methyl green:

- H314: Causes severe skin burns and eye damage.
H351: Suspected of causing cancer.
H411: Toxic to aquatic life with long lasting effects.
P273: Avoid release to the environment.
P280: Wear protective gloves/protective clothing/eye protection/face protection.
P301 + P330 + P331: IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P309 + P310: IF exposed or if you feel unwell: Call a POISON CENTER or doctor/physician.

Ethanol:

- H225: Highly flammable liquid and vapour.
P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

Carmine acetic acid:

- H314: Causes severe skin burns and eye damage.
P280: Wear protective gloves/protective clothing/eye protection/face protection.
P260: Do not breathe vapour.
P301 + P330 + P331: IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P302 + P352: IF ON SKIN: Wash with plenty of soap and water.
P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P309 + P310: IF exposed or if you feel unwell: Immediately call a POISON CENTER or doctor/physician.

ad 1: Staining preparation

The finished sections should be placed in microscopy solution immediately in order to prevent them from drying up. Preparations for staining should be made for this reason. Staining techniques with which the students are already familiar should be applied. Apart from the solutions indicated (Methyl Green and carmine acetic acid), staining with safranin or phloroglucine solution is also feasible. Should no staining agent be available, at least ethanol should be added to the microscopy fluid.

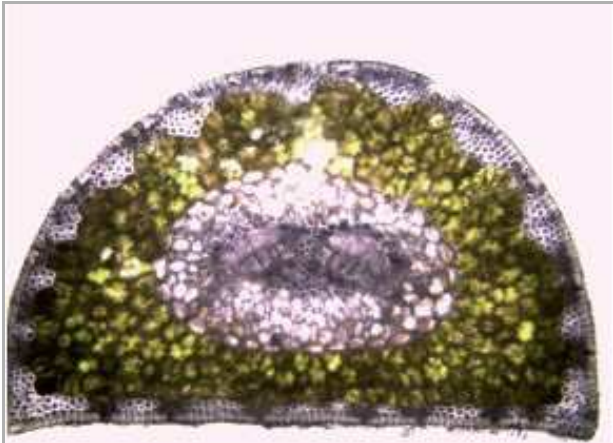
ad 2: Slide preparation

A sharp tool is to be used. It is therefore recommended to use a new scalpel blade.

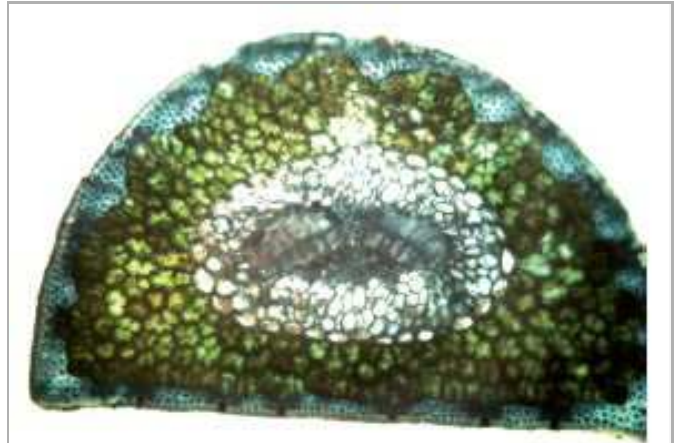
ad 3: Microscopy

The students will easily recognize that

- the epidermis surrounds the leaf uniformly,
- epidermis cells are thickened,
- the cross-sectioned assimilation parenchyma is not identifiable as palisade tissue (they are arranged longitudinally like palisades and appear round or angular in the section),
- the central vascular cylinder with two vascular bundles are located in the center of the acicular leaf.



Pinus spec. (100x), without stain



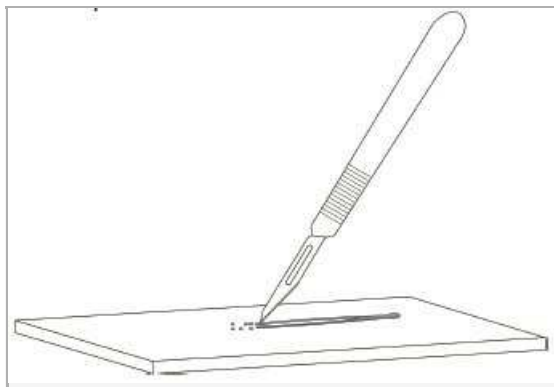
Pinus spec. (100x), stained with methyl green

Cross-section of a coniferous (gymnosperm) leaf - adaption to arid conditions (Item No.: P1442101)

Task and equipment

Task

Compare the cross-section of a coniferous leaf with the cross-section of a regular leaf from a deciduous plant!



Equipment

Position No.	Material	Order No.	Quantity
1	Euromex BioBlue BB.4250 microscope	EUR-BB-4250	1
2	Microscopic slides, 50 pcs	64691-00	1
3	Cover glasses 18x18 mm, 50 pcs.	64685-00	1
4	Beaker, low form, plastic, 100 ml	36011-01	1
5	Dropping pipette with bulb, 10pcs	47131-01	1
6	Tweezers, straight, pointed, 120mm	64607-00	1
7	Scalpel holder	64615-00	1
8	Scalpel blades, rounded tip, 10 off	64615-02	1
9	Chemicals set for TESS advanced Microscopy	13290-10	1

Set-up and procedure

Hazards

- The blades of the scalpel are very sharp! Their removal from the aluminum foil and the sections made with them must proceed with great caution.
- Carmine acetic acid is highly corrosive!
- Put on protective glasses!



Information

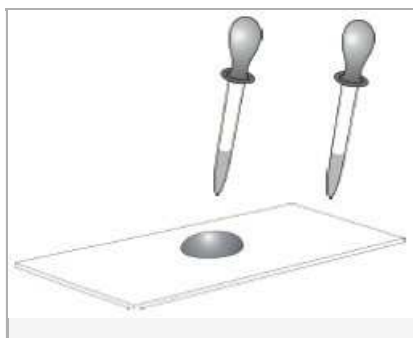
Some trees do not possess large deciduous leaves, instead they have green needle-shaped (acicular) leaves. Due to the reduction of their surface, these leaves are well adjusted to arid conditions. In addition, they are mostly covered by a layer of wax (cuticula) and the stomatal pores are sunk deep into the tissue.

Set-up

1. Staining preparation

The cross-sections of a coniferous leaf are especially interesting when stained. Prepare two different staining methods.

- Pipette two drops of Methyl Green OR two drops of carmine acetic acid onto a slide.
- Add one drop of ethanol.



2. Preparation of the specimen

Making cross-sections of a needle-shaped (acicular) leaf is rather difficult. As the leaf is very hard you will need a very sharp tool!

The sections often turn out too thick and then cannot be used. You will have to make many sections in order to obtain suitable ones.

Procedure:

- Place the leaf on a hard substrate (slide).
- Cut off thin sections with the scalpel.



- The thin sections are placed directly into the drop (stain) on the slide using forceps.

3. Microscopy

- View the specimen under the microscope at lowest and intermediate powers.
- Describe the arrangement of the palisade tissue in the report.
- With some luck you will be able to recognize stomatal pores.
- Compare the structure of the needle-shaped leaf with the structure of a deciduous leaf or make a drawing to show the differences.

Report: Cross-section of a coniferous (gymnosperm) leaf - adaption to arid conditions

Result - Observations

Describe the arrangement of the palisade tissue.

Evaluation - Question 1

Compare the structure of the needle-shaped leaf with the structure of a deciduous leaf.
