

# *Androsace alpina* (L.) Lam.

Primulaceae

**Syn.:** *A. apennina* A.Huet ex Nyman, *A. glacialis* (Hegetschw.) Hoppe, *A. tirolensis* Wettst., *Aretia alpina* L.

**Description:** Perennial herbs, 1–3 cm tall, mat-forming, hairy, leaves in numerous basal rosettes, lanceolate, flowers pink, or white, with yellow throat, 7–9 mm across, single, sessile.

**Distribution:** Europe (Alps).

**Habitat:** Screes, moraines, moist stony slopes, snowbeds.



Milan Kottlínek

Root collar with a diameter of 1–1.2 mm. Xylem to bark ratio 1:3. Rings distinct and indistinct. Maximal 8 annual rings. Analyzed: 3 individuals.

## Xylem

### Transverse section

Diffuse-porous. Ring boundaries, if present, marked by slightly tangentially arranged earlywood vessels with a diameter of 8–15 µm. Vessels lignified, thin- to thick-walled, solitary or in radial rows. Vessel outline angular. Fibers absent. Parenchyma pervasive, unlignified. Vascular bundles remaining. Crystals absent.

### Tangential section

Rays 4–8-seriate, confluent with the axial tissue.

### Radial section

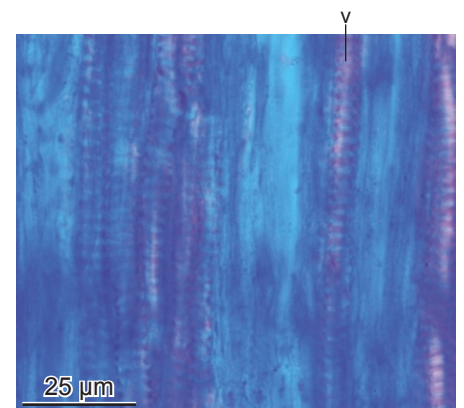
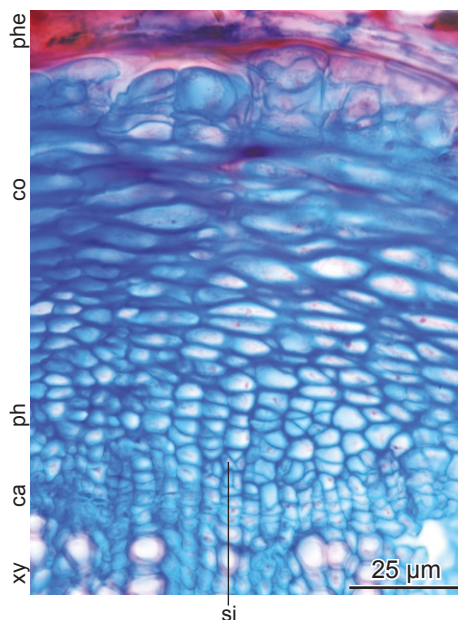
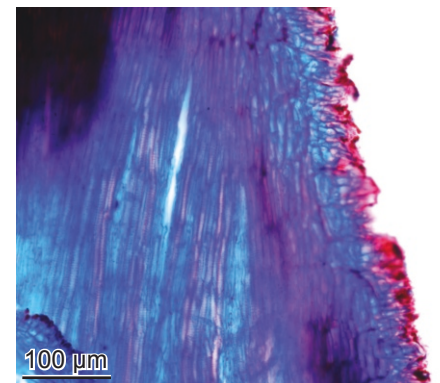
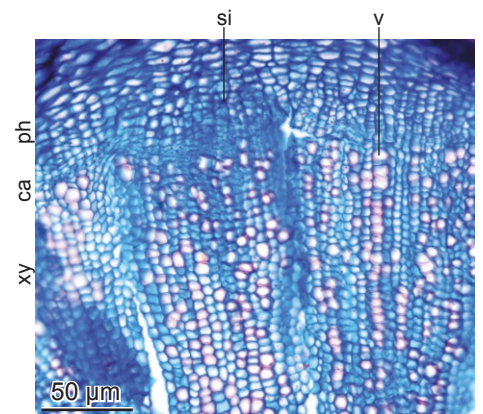
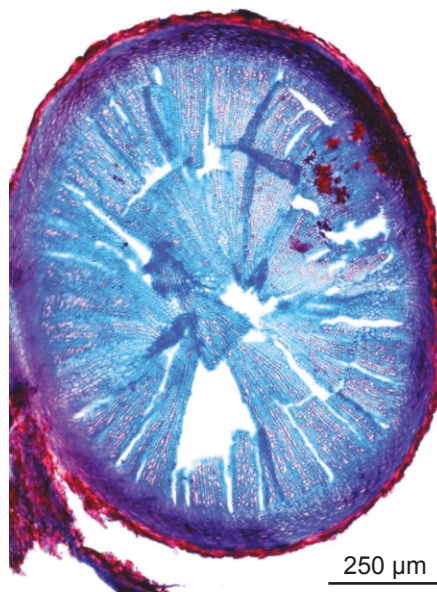
Perforation plates simple. Intervessel pits scalariform. Vessel length 40–50 µm. Ray cells upright.

## Bark

Sieve elements in small, irregularly distributed groups. Sclerenchyma and crystals absent. Phellem consisting of few rows of thin-walled, rectangular cells.

## Pith

No slide available.



Features according to IAWA and Crivellaro and Schweingruber 2015

Xylem 1 - 2 - 5 - 9 - 9.1 - 12 - 13 - 20.1 - 40.1 - 50.2 - 52.1 - 53.2 - 60.1 - 79.1 - 98 - 100.1 - 100.2 - 105

# Androsace lactea L.

Primulaceae

**Description:** Perennial herbs, 5–15 cm tall, loosely caespitose, subglabrous, leaves in basal rosettes, linear; flowers white, with yellow throat, 8–12 mm across, in 1–6-flowered umbels.

**Distribution:** Europe (Jura Mts., Alps, Carpathians, Balkans).

**Habitat:** Rocks, open grasslands; on limestone.



Petr Koucky

Root collar with a diameter of 0.8–1 mm. Xylem to bark ratio 1:2. Rings distinct and indistinct. Maximal 4 annual rings. Analyzed: 3 individuals.

## Xylem

### Transverse section

Diffuse-porous. Ring boundaries, if present, marked by slightly tangentially arranged earlywood vessels with a diameter of 8–15 µm. Vessels poorly lignified, thick-walled, solitary or in short radial rows. Vessel outline angular. Fibers absent. Parenchyma pervasive, unlignified. Vascular bundles remaining. Crystals absent.

### Tangential section

Rays 4–8-seriate, confluent with the axial tissue.

### Radial section

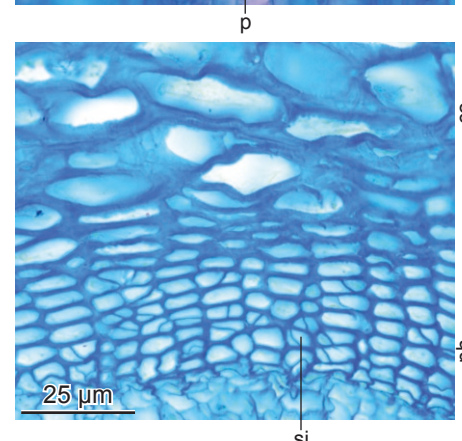
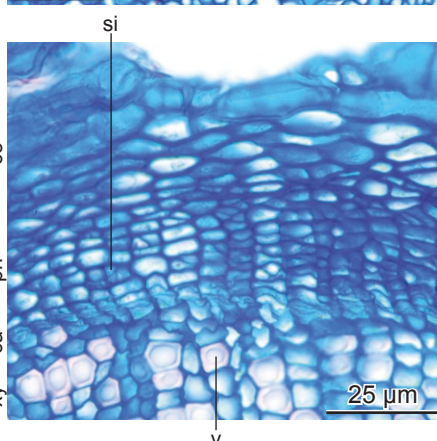
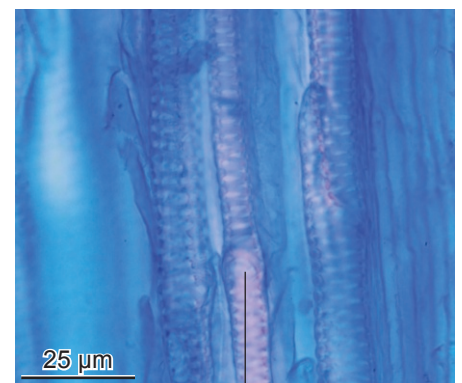
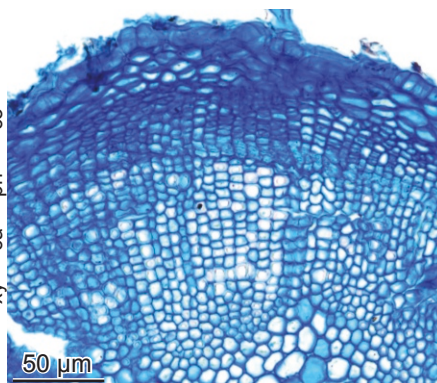
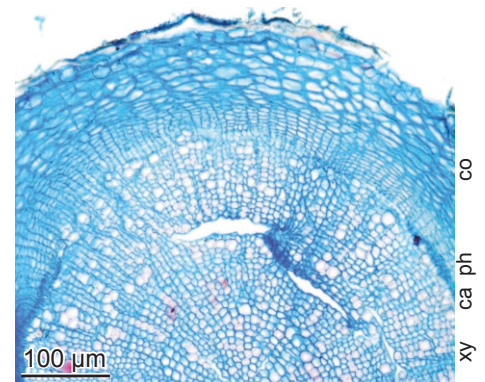
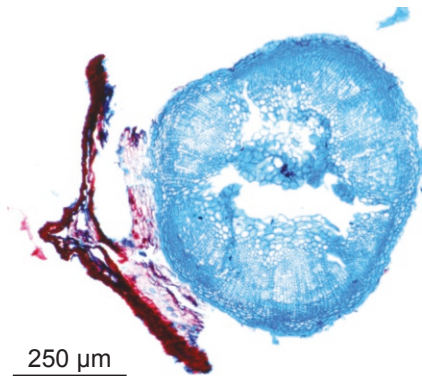
Perforation plates simple. Intervessel pits scalariform. Vessel length 80–100 µm. Ray cells upright.

## Bark

Phloem uniform or sieve elements in small, irregularly distributed groups. Sclerenchyma and crystals absent. Phellem consisting of few rows of rectangular cells.

## Pith

Round to polygonal.



Features according to IAWA and Crivellaro and Schweingruber 2015

Xylem 1 - 2 - 5 - 9 - 9.1 - 12 - 13 - 22 - 39.1 - 39.2 - 40.1 - 50.2 - 52.1 - 53.2 - 60.1 - 79.1 - 89.2 - 98 - 100.1 - 100.2 - 105

# *Androsace obtusifolia* All.

Primulaceae

**Syn.:** *A. aretioides* (Gaudin) Hegetschw.,  
*A. brevifolia* Vill., *A. lachenalii* C.C.Gmel.

**Description:** Perennial herbs, 2–10 cm tall, loosely caespitose, tomentose, leaves in basal rosettes, oblong to oblanceolate, flowers white, or pinkish, with yellow throat, 6–9 mm across, in 1–7-flowered umbels.

**Distribution:** Europe (Alps, Apennines, Sudetes, Carpathians, Balkans).

**Habitat:** Rocks, alpine grasslands and pastures.



Hugh Knott, [www.zermtatflora.net](http://www.zermtatflora.net)

Root collar with a diameter of 1–1.5 mm. Xylem to bark ratio 1:2. Rings indistinct. Analyzed: 3 individuals.

## Xylem

### Transverse section

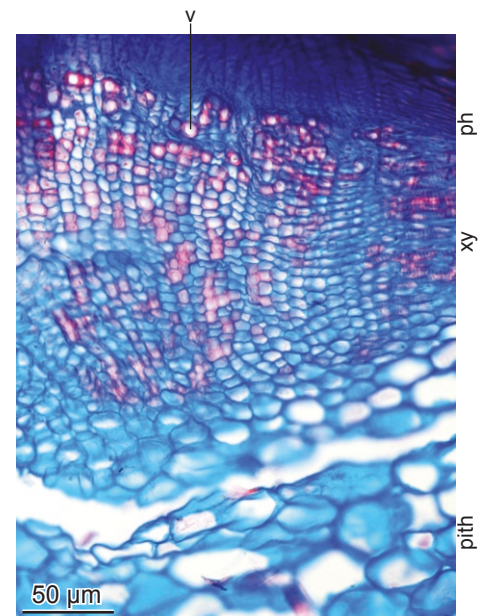
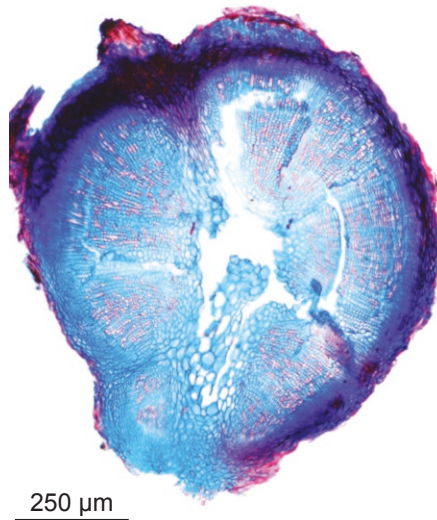
Vessel diameter 8–15  $\mu\text{m}$ . Vessels lignified, thick-walled, solitary or in short radial rows. Vessel outline angular. Fibers absent. Parenchyma pervasive, unlignified. Vascular bundles remaining. Crystals absent.

### Tangential section

Rays 4–8-seriate, confluent with the axial tissue.

### Radial section

Perforation plates simple. Intervessel pits scalariform. Vessel length 50–80  $\mu\text{m}$ . Ray cells upright.

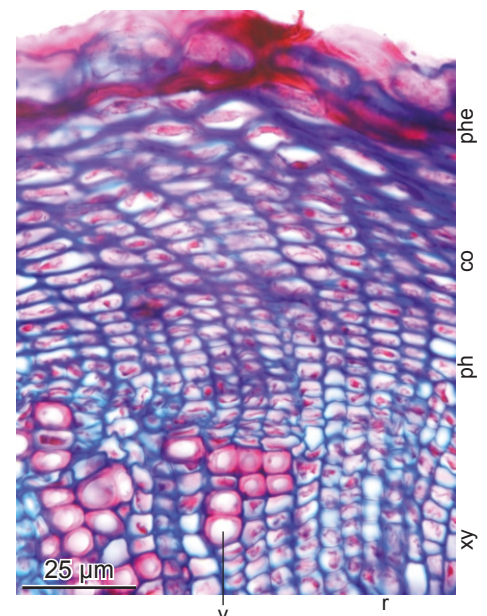
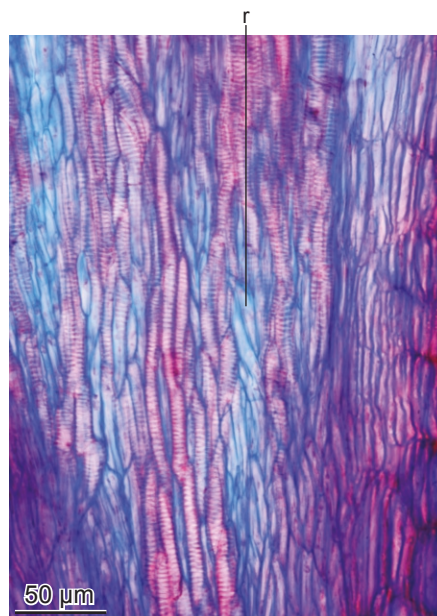


## Bark

Phloem uniform. Sclerenchyma and crystals absent. Phellem consisting of few rows of rectangular cells.

## Pith

Round to polygonal.



Features according to IAWA and Crivellaro and Schweingruber 2015

Xylem 2 - 9 - 9.1 - 12 - 13 - 22 - 39.1 - 40.1 - 50.2 - 52.1 - 52.2 - 60.1 - 79.1 - 98 - 100.1 - 100.2 - 105

# *Androsace septentrionalis* L.

Primulaceae

**Syn.:** *A. acaulis* Duby, *A. lactiflora* Kar. & Kir., *A. linearis* Graham, *A. multiflora* Lam., *A. pinetorum* Greene, *A. subumbellata* Small, *Primula pinetorum* (Greene) Derganc, *P. septentrionalis* (L.) Kuntze

**Description:** Annuals, 1–20 cm tall, sparsely hairy, scapes 1–5, erect, leaves in single rosette, oblanceolate to spatulate, margins sparsely dentate, flowers white, ca. 3 mm across, in 5–20-flowered umbels.

**Distribution:** Circumboreal-polar.

**Habitat:** Open areas in grasslands with sandy, or gravelly soil, shrubs, forests, alpine and arctic tundra.



CC BY 2.0, Andrey Zharikh

Rhizome with a diameter of 0.8 mm. Xylem to bark ratio 2:1. Rings distinct. Maximal 2 rings. Mean ring width 0.15 mm. Analyzed: 1 individual.

## Xylem

### Transverse section

Diffuse-porous. Ring boundaries indistinctly marked by the occurrence of latewood vessels with a diameter of 10  $\mu\text{m}$  and earlywood vessels with a diameter of 15–20  $\mu\text{m}$ . Vessel outline angular. Vessels lignified, solitary. Fibers absent. Parenchyma pervasive. Crystals absent.

### Tangential section

Rays absent.

### Radial section

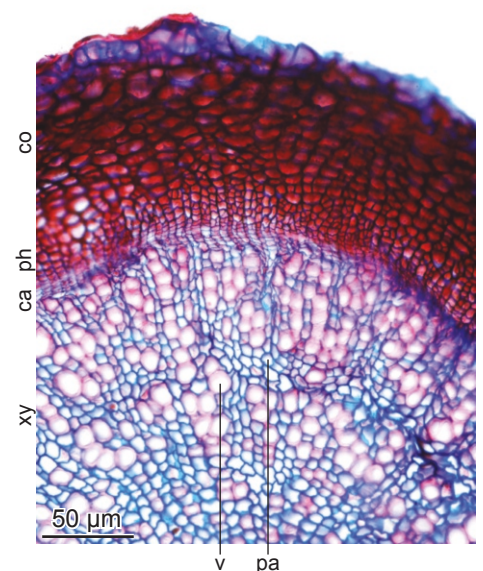
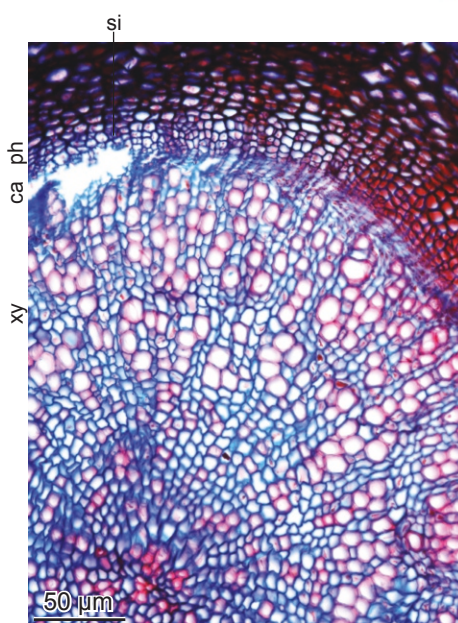
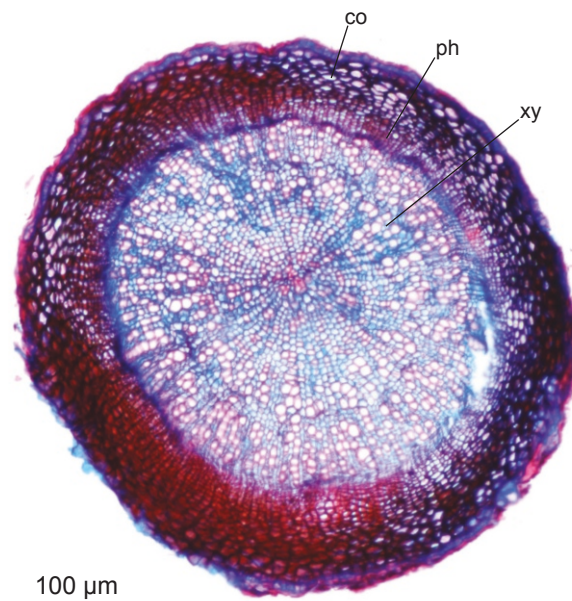
Perforation plates simple. Intervessel pits round. Vessel length 40–60  $\mu\text{m}$ . Ray cells upright.

## Bark

Sieve elements in small groups. Sclerenchyma absent. Outer cortex with large cells containing dark-staining substances. Inner cortex consisting of small parenchyma cells.

## Pith

No slide available.



Features according to IAWA and Crivellaro and Schweingruber 2015

Xylem 1 - 5 - 9 - 12 - 13 - 40.1 - 50.2 - 52.2 - 60.1 - 79.1

# *Androsace vandellii* (Turra) Chiov.

Primulaceae

**Description:** Perennial herbs, 2–5 cm tall, mat-forming, silver-grey tomentose, leaves in basal rosettes, linear, spatulate, or elliptic, flowers white, with yellow throat, 5–8 mm across, in 1–3-flowered umbels.

**Distribution:** Europe (Alps, Apennines, Pyrenees, Sierra Nevada), N Africa (Atlas).

**Habitat:** Rock crevices and fissures; on siliceous bedrock.



Leo Julien

Root collar with a diameter of 2.5 mm. Xylem to bark ratio 1:4. Rings distinct. Maximal 15 annual rings. Analyzed: 1 individual.

## Xylem

### Transverse section

Diffuse-porous. Ring boundaries marked by slightly tangentially arranged earlywood vessels with a diameter of 10–18  $\mu\text{m}$ . Vessels lignified, thin- to thick-walled, solitary. Vessel outline angular. Fibers absent. Parenchyma pervasive, unlignified. Vascular bundles remaining. Crystals absent.

### Tangential section

Rays 4–8-seriate, confluent with the axial tissue

### Radial section

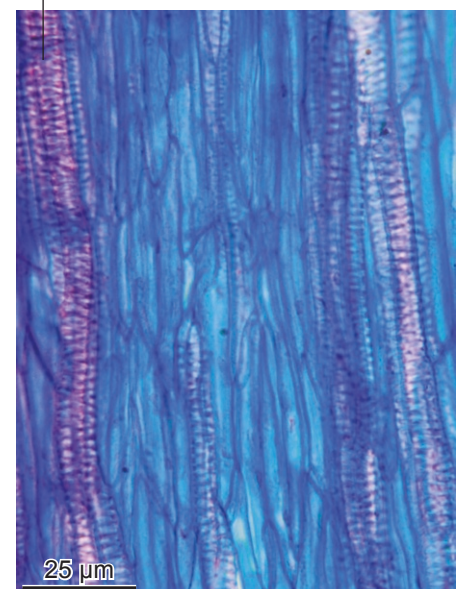
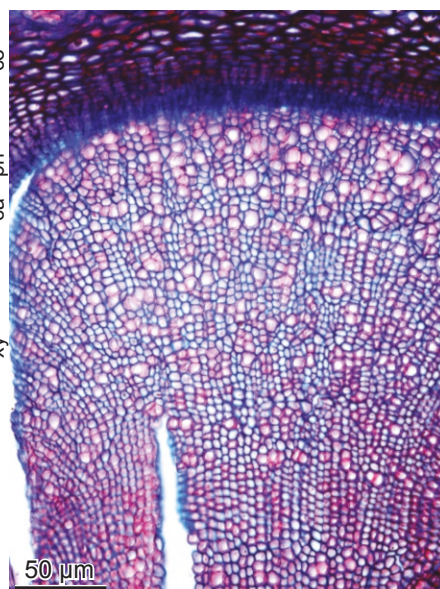
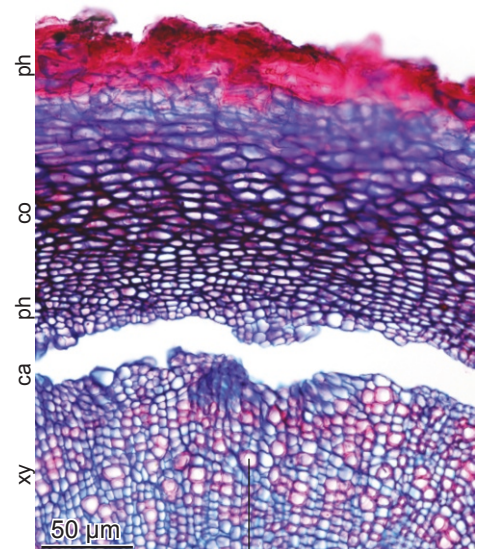
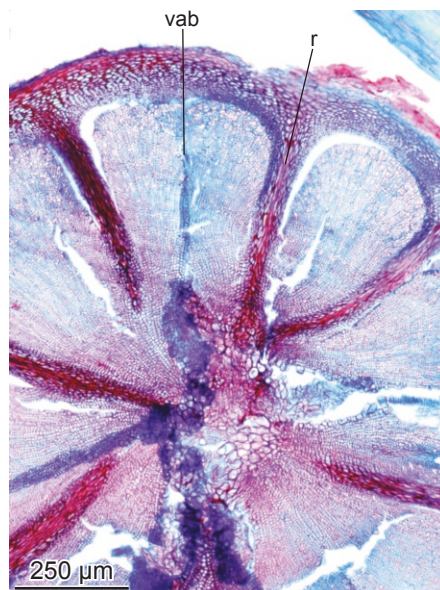
Perforation plates simple. Intervessel pits scalariform. Vessel length 60–80  $\mu\text{m}$ . Ray cells upright.

## Bark

Phloem uniform or sieve elements in small groups. Sclerenchyma and crystals absent. Phellem consisting of few rows of irregularly formed cells.

## Pith

Polygonal.



Features according to IAWA and Crivellaro and Schweingruber 2015

Xylem 1 - 5 - 9 - 12 - 13 - 20.1 - 40.1 - 50.2 - 52.1 - 52.2 - 60.1 - 79.1 - 99 - 100.1 - 100.2 - 105

*Douglasia ochotensis* (Willd. ex Roem. & Schult.)  
Primulaceae Hultén

**Syn.:** *Androsace ochotensis* Willd. ex Roem. & Schult., *A. arctica* Cham. & Schtdl., *A. tschuktschorum* Knuth, *D. ochotensis* subsp. *arctica* (Cham. & Schtdl.) Á. Löve & D. Löve, *Primula arctica* (Cham. & Schtdl.) Kuntze

**Description:** Perennial herbs, 1–5 cm tall, mat-forming, glabrous to hairy, stems prostrate, densely covered with old withered leaves, leaves in rosettes, recurved, linear to lanceolate, flowers pink, 4–12 mm across, single on 5–15 mm long scapes.

**Distribution:** NE Asia, NW North America.

**Habitat:** Rocky places in tundra, stony slopes.



Kirsten Andersen & Lars Hansen, alpines.dk

Root collar with a diameter of 1–2.5 mm. Xylem to bark ratio 1:3. Rings distinct. Maximal 10 annual rings. Analyzed: 3 individuals.

**Xylem**

*Transverse section*

Diffuse-porous. Ring boundaries marked by slightly tangentially arranged earlywood vessels with a diameter of 15–20 µm. Vessels poorly lignified, thin- to thick-walled, solitary. Vessel outline angular. Fibers absent. Parenchyma pervasive, unligified. Crystals absent.

*Tangential section*

Rays absent.

*Radial section*

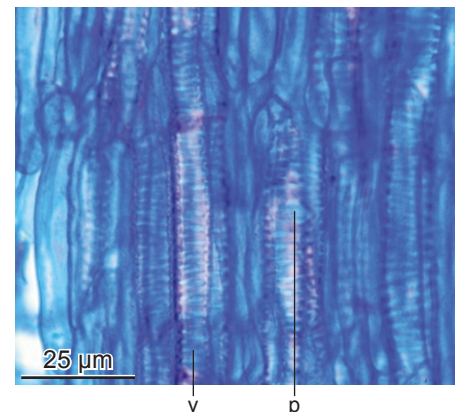
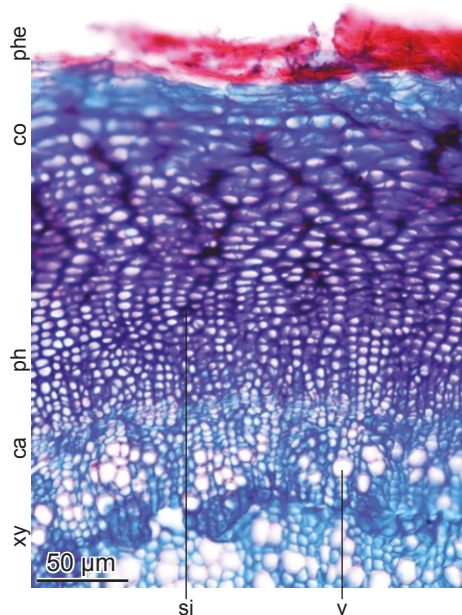
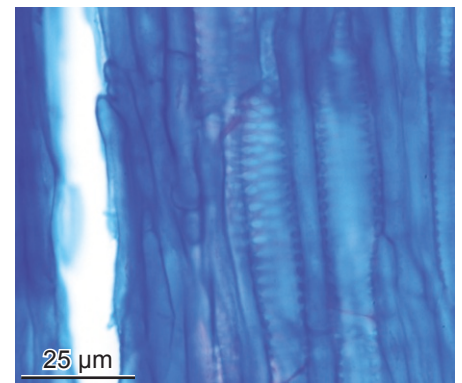
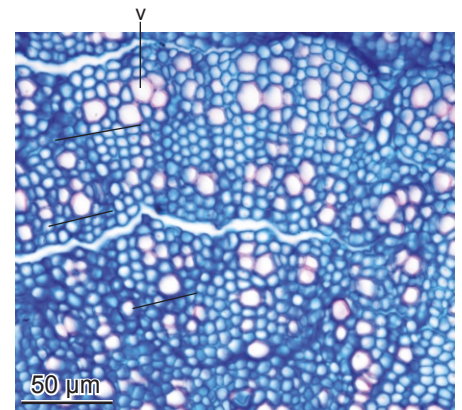
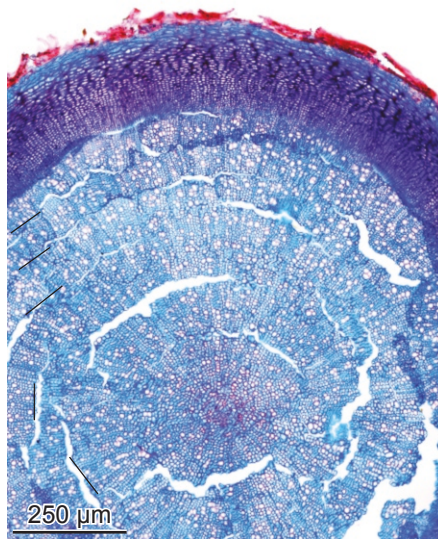
Perforation plates simple. Intervessel pits scalariform. Vessel length 80–100 µm.

**Bark**

Phloem uniform. Sclerenchyma and crystals absent. Phellem consisting of few rows of rectangular cells.

**Pith**

No slide available.



Features according to IAWA and Crivellaro and Schweingruber 2015  
Xylem 1 - 5 - 9 - 12 - 13 - 20 - 40.1 - 50.2 - 52.1 - 52.2 - 60.1 - 79.1 - 117

# *Primula auricula* L.

Primulaceae

**Syn.:** *Aretia auriculata* (L.) Link, *Auricula lutea* (Vill.) Opiz, *Auricula-ursi auricula* (L.) Soják

**Description:** Perennial herbs, 5–20 cm tall, leaves all basal, glabrous, obovate to orbicular; leathery, margins entire to sparsely dentate, flowers yellow, 6–10 mm long, in 3–30-flowered umbels on erect tomentose scapes.

**Distribution:** Europe (Alps, Jura Mts., Apennines, Carpathians, Balkans).

**Habitat:** Rocks, rock crevices, screes, alpine grasslands; on limestone.



Petr Kouřtecký

Rhizome with a diameter of 4–8 mm. Stem segregated. Rings indistinct. Analyzed: 3 individuals.

## Xylem

*Transverse section*

Single concentric vascular bundles or root initials embedded in a parenchymatic tissue. Bundles surrounded by 1–2 layers of thin-walled, tangentially enlarged cells. Vessel diameter 5–10  $\mu\text{m}$ . Vessels lignified, thin- to thick-walled, solitary. Vessel outline angular. Fibers absent. Parenchyma pervasive, unligified. Crystals absent. Rhizome surrounded by a phellem consisting of rectangular to irregularly formed cells.

*Tangential section*

Rays absent.

*Radial section*

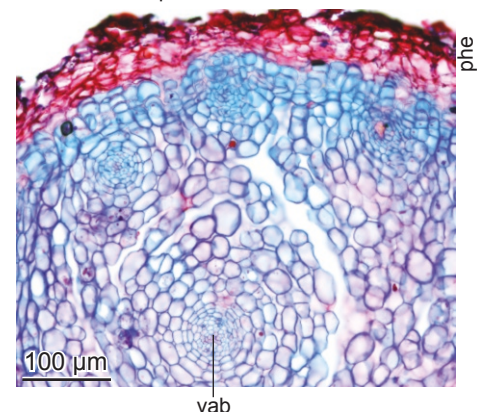
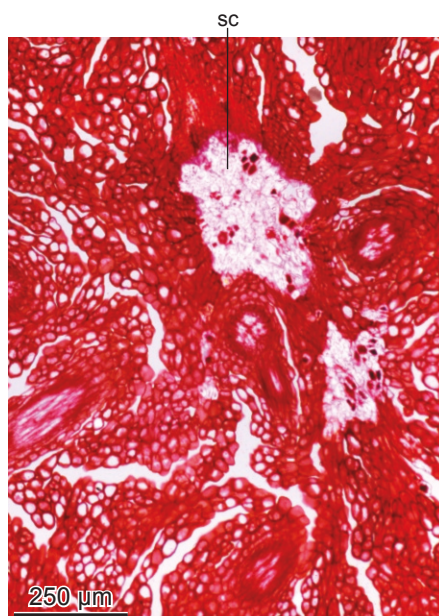
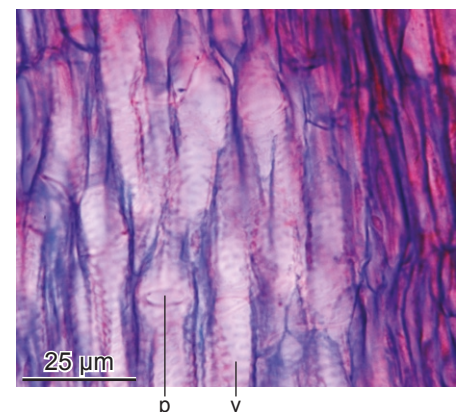
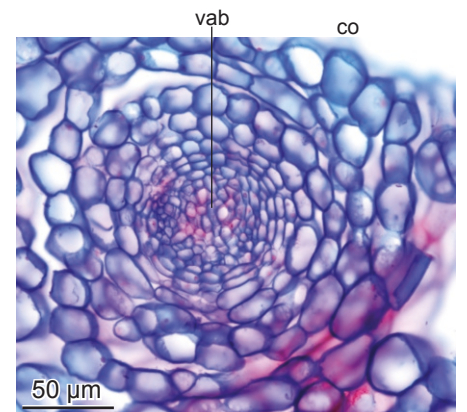
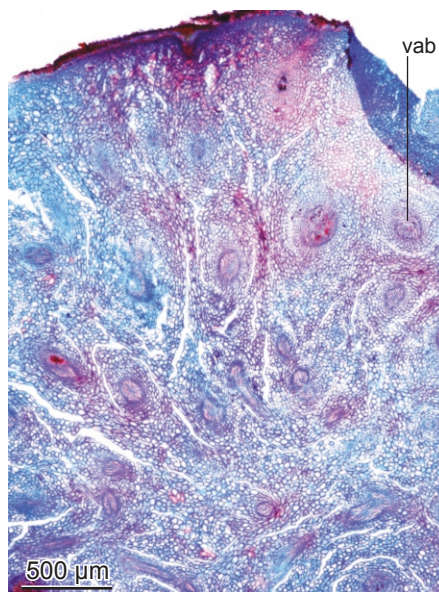
Perforation plates simple. Intervessel pits round to horizontally enlarged. Vessel length 40–50  $\mu\text{m}$ .

## Bark

Phloem uniform. Groups of sclereids occurring in the cortex and mainly in the center of the rhizome. Crystals absent. Phellem consisting of a few rows of rectangular cells.

## Pith

Center consisting of a group of thick-walled sclereids. Sclereids are characteristic for genera *Soldanella* and *Primula*.



Features according to IAWA and Crivellaro and Schweingruber 2015

Xylem 2 - 9 - 12 - 13 - 22 - 40.1 - 50.2 - 52.1 - 52.1 - 60.1 - 79.1 - 99.1 - 117

# *Primula integrifolia* L.

Primulaceae

**Syn.:** *Aretia integrifolia* (L.) Link, *Auricula integrifolia* (L.) Spach, *Auricula-ursi integrifolia* (L.) Soják

**Description:** Perennial herbs, 2–5 cm tall, glandular hairy, leaves in basal rosettes, oblanceolate to obovate, leathery, margins entire, flowers pink, or lilac, 15–25 mm across, in 1–2-flowered umbels on erect scapes.

**Distribution:** Europe (Alps, Pyrenees).

**Habitat:** Alpine grasslands, snowbeds, streamsides.



Adrian Möhl

Rhizome with a diameter of 2–3 mm. Stem segregated. Rings indistinct. Analyzed: 2 individuals.

## Xylem

### Transverse section

Single concentric vascular bundles or root or shoot initials embedded in a parenchymatic tissue. Bundles surrounded by 1–2 layers of thin-walled, tangentially enlarged cells. Vessel diameter 5–10 μm. Vessels lignified, thin- to thick-walled, solitary. Vessel outline angular. Fibers absent. Parenchyma pervasive, unlignified. Crystals absent. Rhizome surrounded by a phellem consisting of rectangular to irregularly formed cells.

### Tangential section

Rays absent.

### Radial section

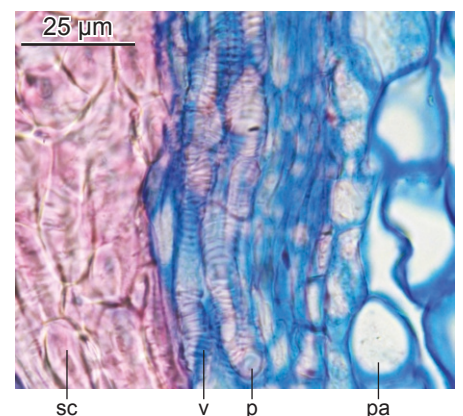
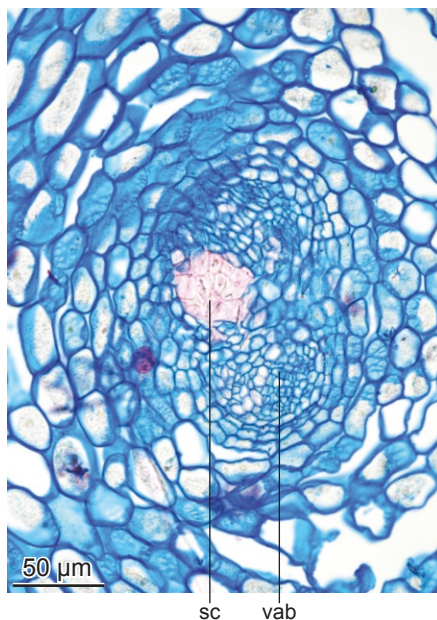
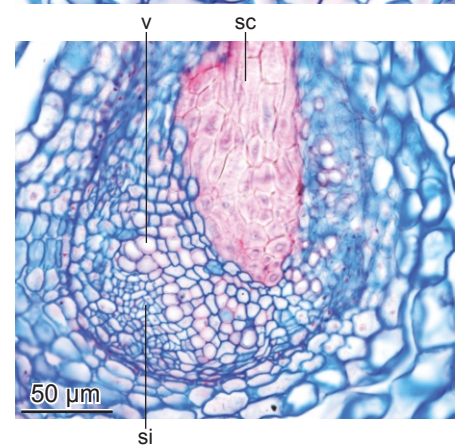
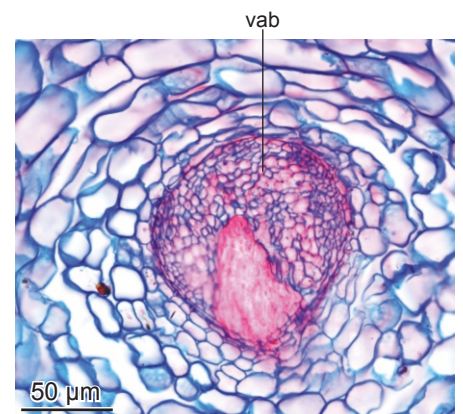
Perforation plates simple. Intervessel pits scalariform. Vessel length 40–50 μm.

## Bark

Phloem uniform. Groups of sclereids in the center of root/shoot initials. Crystals absent. Phellem of older parts of rhizomes consisting of few rows of rectangular cells.

## Pith

Center consisting of a group of thick-walled sclereids. Sclereids are characteristic for genera *Soldanella* and *Primula*.



Features according to IAWA and Crivellaro and Schweingruber 2015

Xylem 2 - 12 - 13 - 20 - 40.1 - 50.2 - 52.1 - 52.1 - 60.1 - 79.1 - 99 - 105 - 117



# *Primula minima* L.

Primulaceae

**Syn.:** *Aretia minima* (L.) Link, *Auricula-ursi minima* (L.) Soják, *Kablikia minima* (L.) Opiz

**Description:** Perennial herbs, 1–4 cm tall, glabrous, leaves in basal rosettes, cuneate, leathery, shiny, margins sharply dentate, flowers 15–25 mm across, usually single.

**Distribution:** Europe (Alps, Sudetes, Carpathians, Balkans).

**Habitat:** Rocks, rock crevices, exposed alpine slopes.



Petr Koutecky

Rhizome with a diameter of 2–2.5 mm. Stem segregated. Rings indistinct. Analyzed: 2 individuals.

## Xylem

### Transverse section

Single concentric vascular bundles or root or shoot initials embedded in a parenchymatic tissue. Bundles surrounded by 1–2 layers of thin-walled, tangentially enlarged cells. Vessel diameter 5–10  $\mu\text{m}$ . Vessels thin- to thick-walled, solitary. Vessel outline angular. Fibers absent. Parenchyma pervasive, unligified. Crystals absent. Rhizome surrounded by a phellem, consisting of rectangular to irregularly formed cells.

### Tangential section

Rays absent.

### Radial section

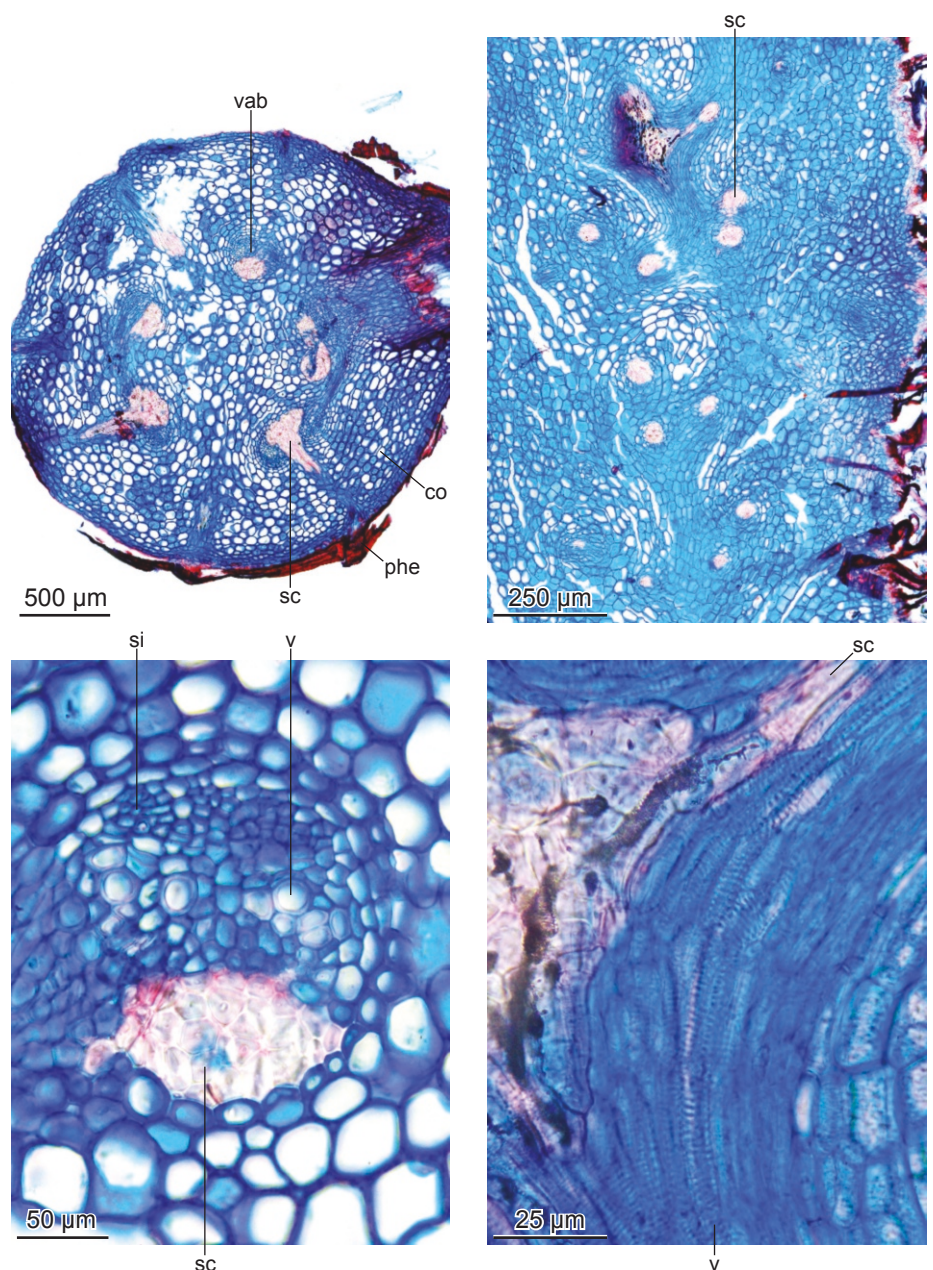
Perforation plates simple. Intervessel pits scalariform. Vessel length 40–50  $\mu\text{m}$ .

## Bark

Phloem uniform. Groups of sclereids occurring within the root/shoot initials. Crystals absent. Phellem occurring partially on older parts of rhizomes, consisting of few rows of rectangular cells. Sclereids are characteristic for genera *Soldanella* and *Primula*.

## Pith

Pith of the whole stem not existing.



Features according to IAWA and Crivellaro and Schweingruber 2015

Xylem 2 - 9 - 12 - 13 - 20 - 40.1 - 39.1 - 50.2 - 52.1 - 52.1 - 60.1 - 79.1 - 99.1 - 117

# *Primula parryi* A. Gray

Primulaceae

**Syn.:** *P. mucronata* Greene

**Description:** Perennial herbs, 15–50 cm tall, rhizomatous, glandular hairy, stinking, leaves broadly lanceolate, or oblanceolate to oblong-obovate, fleshy, margins almost entire, or remotely denticulate, flowers pink, or magenta, 2–3 cm across, in 3–25-flowered umbels.

**Distribution:** W North America (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming).

**Habitat:** Snow-melt areas, streamsides, subalpine bogs, waterfall ledges, wetlands.



Steve O'Kane

Rhizome with a diameter of 9 mm. Xylem to bark ratio 1:1. Rings indistinct. Analyzed: 1 individual.

## Xylem

*Transverse section*

Vessel diameter 15–25 μm. Vessel outline round. Vessels lignified, solitary and in short radial multiples. Fibers absent. Parenchyma pervasive. Shape of vascular bundles remaining over several years.

*Tangential section*

Rays absent.

*Radial section*

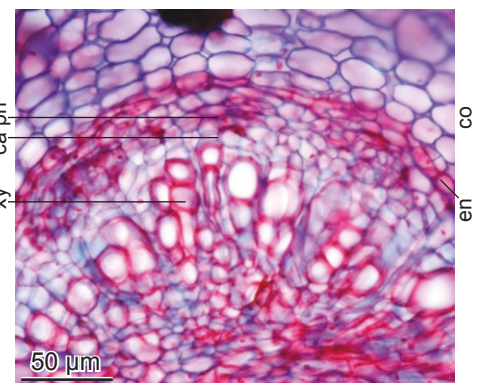
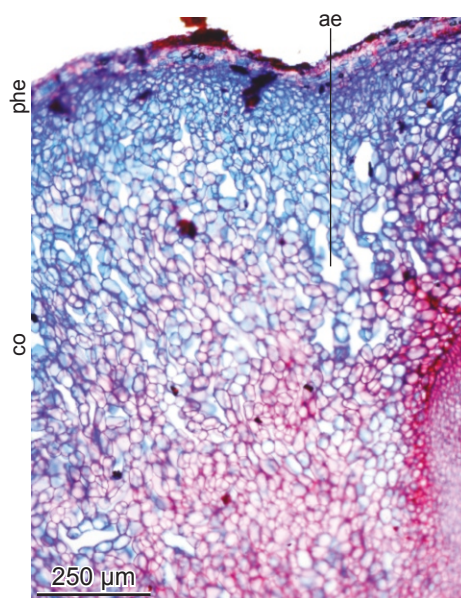
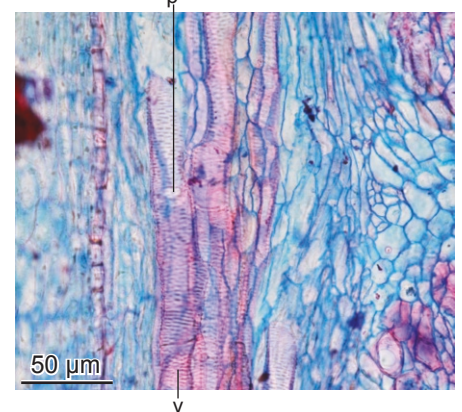
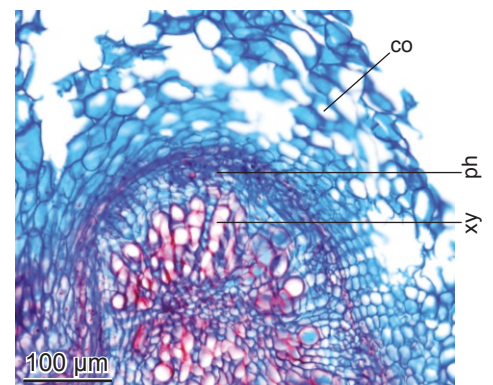
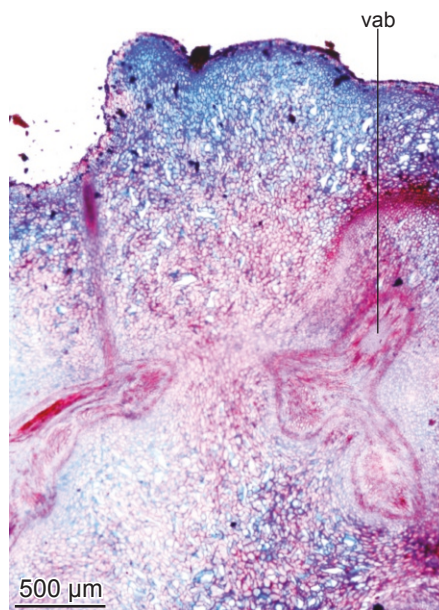
Perforation plates simple. Intervessel pits round. Vessel length 60–80 μm. Crystals absent.

## Bark

Phloem uniform. Cortex composed of round parenchyma cells and large intercellulars (aerenchyma). Phellem cells rectangular; radially arranged. Crystals absent.

## Pith

Round.



Features according to IAWA and Crivellaro and Schweingruber 2015

Xylem 2 - 9 - 13 - 20 - 40.2 - 50.1 - 52.2 - 60.1 - 79.1 - 117

*Soldanella pusilla* Baumg.  
Primulaceae

**Description:** Perennial herbs, 3–6 cm tall, leaves all basal, reniform, leathery, flowers purple, 8–12 mm long, bell-shaped, nodding, single, on erect scapes.

**Distribution:** S & SE Europe (Alps, N Apennines, S Carpathians, Pirin Mts.).

**Habitat:** Rocky slopes, screes, snowbeds.



Petr Koucky

Rhizome with a diameter of 1–1.5 mm. Xylem to bark ratio 1:6. Rings indistinct. Analyzed: 2 individuals.

**Xylem**

*Transverse section*

Vessel diameter 10–12 μm. Vessels poorly lignified, thick-walled, solitary and in short radial rows. Vessel outline angular. Fibers absent. Parenchyma pervasive, unligified. Crystals absent.

*Tangential section*

Rays absent.

*Radial section*

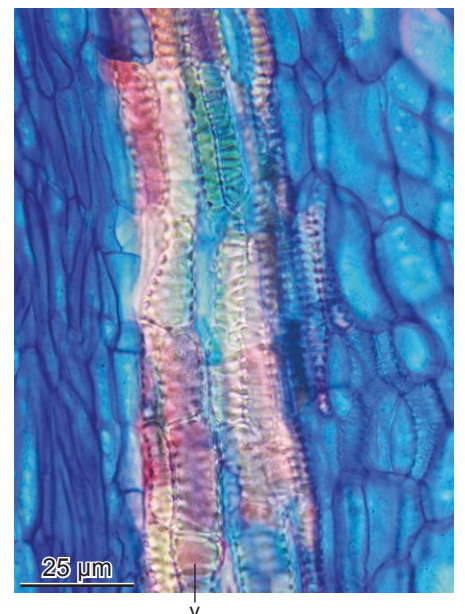
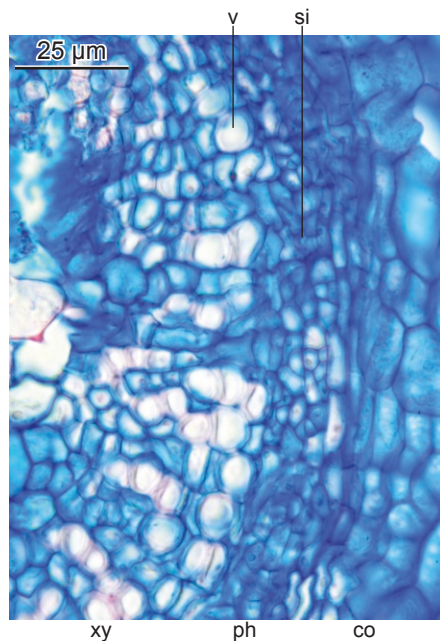
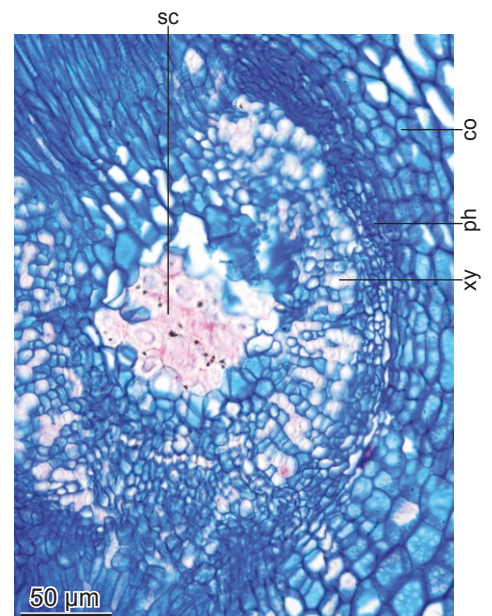
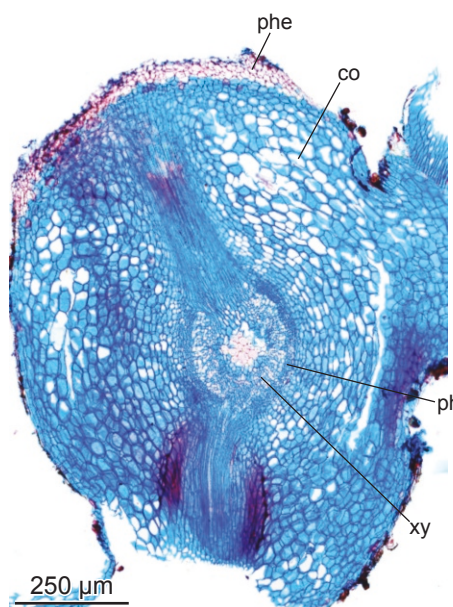
Perforation plates simple. Intervessel pits scalariform. Vessel length 30–50 μm.

**Bark**

Phloem principally uniform. Sclerenchyma and crystals absent. Phloem and cortex separated by an endodermis-like layer of unligified, tangentially enlarged cells. Phloem consisting of few rows of rectangular cells.

**Pith**

Center of pith consisting of a group of thick-walled sclereids, characteristic for genera *Soldanella* and *Primula*.



Features according to IAWA and Crivellaro and Schweingruber 2015

Xylem 2 - 9 - 12 - 13 - 22 - 40.1 - 50.2 - 52.1 - 52.1 - 60.1 - 79.1 - 117

# *Vitaliana primuliflora* Bertol.

Primulaceae

**Syn.:** *Androsace vitaliana* (L.) Lapeyr., *A. lutea* Lam., *A. rugosa* Clairv., *Douglasia vitaliana* (L.) Hook.f. ex B.D.Jacks., *Gregoria vitaliana* (L.) Duby, *Primula vitaliana* L.

**Description:** Perennial herbs, 1–5 cm tall, caespitose, subglabrous to hairy, leaves in basal rosettes, narrowly lanceolate, flowers bright yellow, 8–11 mm long, in 1–5-flowered subsessile umbels.

**Distribution:** Europe (Pyrenees, Alps).

**Habitat:** Rocks, rock crevices, screes.



Fritz Schweingruber

Root collar with a diameter of 0.05–0.2 mm. Xylem to bark ratio 1:3. Rings distinct. Maximal 10 rings. Analyzed: 3 individuals.

## Xylem

### Transverse section

Diffuse-porous. Ring boundaries, marked by slightly tangentially arranged earlywood vessels with a diameter of 15–20 µm. Vessels lignified, thick-walled, solitary. Vessel outline angular. Fibers absent. Parenchyma pervasive, unligified. Vascular bundles remaining. Crystals absent.

### Tangential section

Rays 4–8-seriate, confluent with the axial tissue.

### Radial section

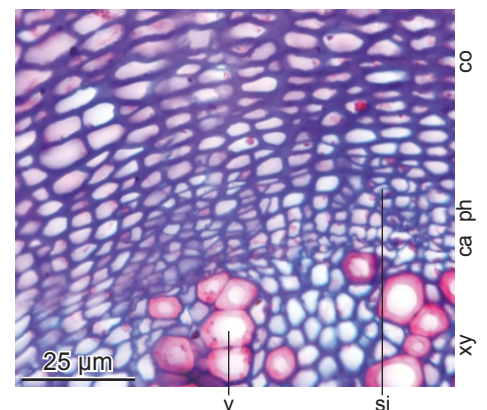
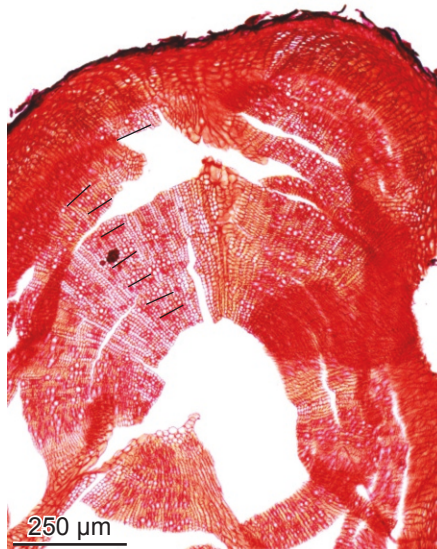
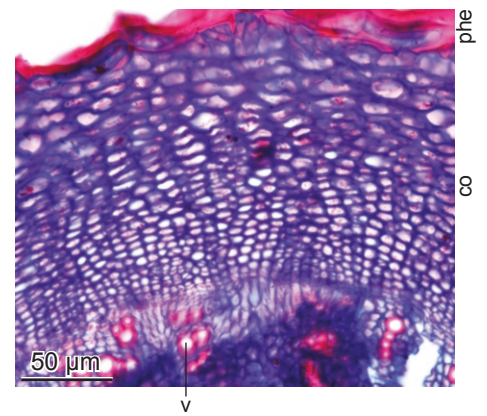
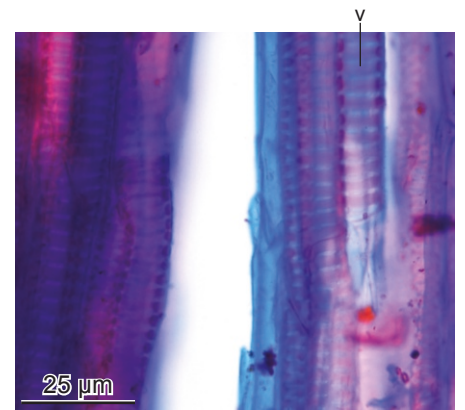
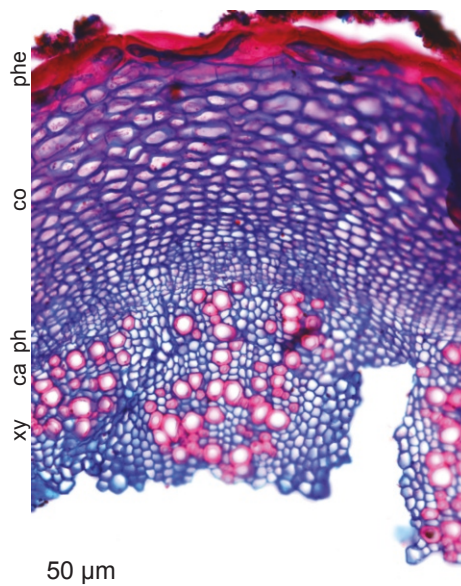
Perforation plates simple. Intervessel pits scalariform. Vessel length 60–80 µm. Ray cells upright.

## Bark

Phloem uniform. Sclerenchyma and crystals absent. Phellem consisting of few rows of irregularly formed cells.

## Pith

No slide available.



Features according to IAWA and Crivellaro and Schweingruber 2015

Xylem 1 - 5 - 9 - 12 - 13 - 20.1 - 40.1 - 50.2 - 52.1 - 52.2 - 60.1 - 79.1 - 99 - 100.1 - 100.2