



Perennial submerged plant, stems short and corm-like, hollow roots at base, erect rosette of subulate stiff leaves 6–15 cm long with minute ligule on upperside near base. Heterosporous sporangia embedded in leaf-base below the ligule in older leaves. Leaves contain 4 air cavities connected with a distinct central air cavity in roots.

Distribution and ecology

Euro-Siberian boreo-montane distribution and native also in N. America. Very rarely in AT, CH, CZ, DE and PL. Oligotrophic mountainous lakes (>1000 m a.s.l.), mostly stony substrates, down to 6 m depth. Psychrophilous, germination of megaspores lasts for two seasons, sensitive to overgrowing of the substrate by filamentous algae. CAM and diffusive CO₂ uptake by roots facilitate photosynthetic CO₂ fixation.

Anatomy of the basal part of a leaf

The leaf has a diameter of 1 mm (1). The leaf is composed of a closed concentric vascular bundle, a large cortex and an epidermis (1). Xylem and phloem are difficult to distinguish on cross-sections (2). Radial sections show that vessel-walls have annual thickenings (3). The center of the stele contains a large intercellular. Intercellulars of the cortex are laterally separated by radial strips of parenchyma cells (1). Aerenchymatic chambers in the cortex are horizontally separated by a thick-walled stellate cellular tissue with extraordinary filaments around pits (4). The leaf is externally surrounded by an epidermis and a hypodermis (1).

