

Publication

Life at 0 °C: the biology of the alpine snowbed plant *Soldanella pusilla***JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)****ID** 4523347**Author(s)** Körner, Christian; Riedl, Susanna; Keplinger, Tobias; Richter, Andreas; Wiesenbauer, Julia; Schweingruber, Fritz; Hiltbrunner, Erika**Author(s) at UniBasel** [Körner, Christian](#) ; [Hiltbrunner, Erika](#) ; [Riedl, Susanna](#) ;**Year** 2019**Title** Life at 0 °C: the biology of the alpine snowbed plant *Soldanella pusilla***Journal** Alpine Botany**Volume** 129**Pages / Article-Number** 63-80

All plant species reach a low temperature range limit when either low temperature extremes exceed their freezing tolerance or when their metabolism becomes too restricted. In this study, we explore the ultimate thermal limit of plant tissue formation exemplified by a plant species that seemingly grows through snow. By a combination of studies in alpine snowbeds and under controlled environmental conditions, we demonstrate and quantify that the clonal herb *Soldanella pusilla* (Primulaceae) does indeed grow its entire flowering shoot at 0 °C. We show that plants resume growth under 2–3 m of snow in mid-winter, following an internal clock, with the remaining period under snow until snow melt (mostly in July) sufficient to produce a flowering shoot that is ready for pollination. When snow pack gets thin, the flowering shoot intercepts and re-radiates long-wave solar radiation, so that snow and ice gently melt around the fragile shoot and the flowers emerge without any mechanical interaction. We evidence bud preformation in the previous season and enormous non-structural carbohydrate reserves in tissues (mainly below ground) in the form of soluble sugars (largely stachyose) that would support basic metabolism for more than 2 entire years under snow. However, cell-wall formation at 0 °C appears to lack unknown strengthening factors, including lignification (assessed by confocal Raman spectroscopy imaging) that require between a few hours or a day of warmth after snow melt to complete tissue strengthening. Complemented with a suite of anatomical data, the work opens a window towards understanding low temperature limits of plant growth in general, with potential relevance for winter crops and trees at the natural climatic treeline.

Publisher Springer**ISSN/ISBN** 1664-2201 ; 1664-221X**edoc-URL** <https://edoc.unibas.ch/73712/>**Full Text on edoc** No;**Digital Object Identifier DOI** 10.1007/s00035-019-00220-8