View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by University of Kentucky

University of Kentucky

UKnowledge

International Grassland Congress Proceedings

21st International Grassland Congress / 8th International Rangeland Congress

Profile of Water Uptake in Winterfat during Seed Germination

Ruojing Wang
Canadian Food Inspection Agency, Canada

Yuguang Bai
University of Saskatchewan, Canada

Edward J. Kendall
University of Saskatchewan, Canada

Karen Tanino
University of Saskatchewan, Canada

Follow this and additional works at: https://uknowledge.uky.edu/igc

 Part of the Plant Sciences Commons, and the Soil Science Commons

This document is available at https://uknowledge.uky.edu/igc/21/1-4/17

The 21st International Grassland Congress / 8th International Rangeland Congress took place in Hohhot, China from June 29 through July 5, 2008.

Proceedings edited by Organizing Committee of 2008 IGC/IRC Conference

Published by Guangdong People's Publishing House

This Event is brought to you for free and open access by the Plant and Soil Sciences at UKnowledge. It has been accepted for inclusion in International Grassland Congress Proceedings by an authorized administrator of UKnowledge. For more information, please contact UKnowledge@lsv.uky.edu.

Profile of water uptake in winterfat during seed germination

Ruojing Wang[1] ,*Yuguang Bai*[2] ,*Edward J . Kendall*[3] *and Karen Tanino*[2]
[1] *Canadian Food Inspection Agency* , 301-421 *Downey Road* , *Saskatoon* , *SK S7N 4L8* [2] *Dept of Plant Sciences* , *Univ . of Saskatchewan* , 51 *Campus Drive* , *Saskatoon* , *SK S7N 5A8* ,*Canada*[3] *Dept of Biochemistry* , *Univ . of Saskatchewan* , 107 *Wiggens Rd .*, *Saskatoon SK S7N 5E5* ,*Canada*

Key words : aquaporin inhibition , Chenopodiaceae , germination , $HgCl_2$, NMR spectroscopy , Saskatchewan , water relations , winterfat (*Krascheninnikovia lanata*)

Introduction Aquaporins are enriched in zones of fast cell growth , expansion and vacuolization (Ludevid et al ., 1992 ; Schäffner , 1998) . These observations suggest that aquaporins are involved in cell elongation and growth , osmotic regulation and resistance to drought and salinity stress (reviewed in Schäffner , 1998 ; Johansson et al ., 2000) . We examined : (1) the role of aquaporins in seed water relations during seed imbibition and early seedling growth of winterfat at low temperatures ; and (2) water distribution and biophysical status within a germinating seed .

Materials and methods Five replicates of twenty seeds (total 100 seeds) were imbibed at 5℃ in darkness . 2 .5 mL of 0 , 30 , 35 , 40 , 50 and 100 (M $HgCl_2$ (aquaporin inhibitor , Sigma , USA) was used . NMR spectroscopy : Bruker Advance DRX 360 WB system (Bruker BioSpin Ltd ., Milton , ON , Canada) , at 360 .13 MHz . ^1H microimaging was performed at 20℃ on a single seed mounted in a shortened pipette tip inserted into a plexiglass foot and then placed in a 10 mm NMR tube . Spin-lattice relaxation rates , R_1 ($1/T_1$) , and spin-spin relaxation rate , R_2 ($1/T_2$) , were also measured at each interval .

Results Water migrated first to the embryo then to the perisperm (Figure 1) . Exposure to $HgCl_2$ significantly restricted water flux to the perisperm ,which was also associated with reduced germination rate (Figure 1) . Both embryo and whole seed water uptake was reduced in the presence of 30 M $HgCl_2$, a dose lower than the LD_{50} . The impact of restricted water uptake was expressed preferentially in the root during early seedling growth , which was 24 times shorter in the presence of mercury , indicating more dry matter allocation to the cotyledons . Results suggest that aquaporins mediate seed water relations from initial seed imbibition to early seedling growth .

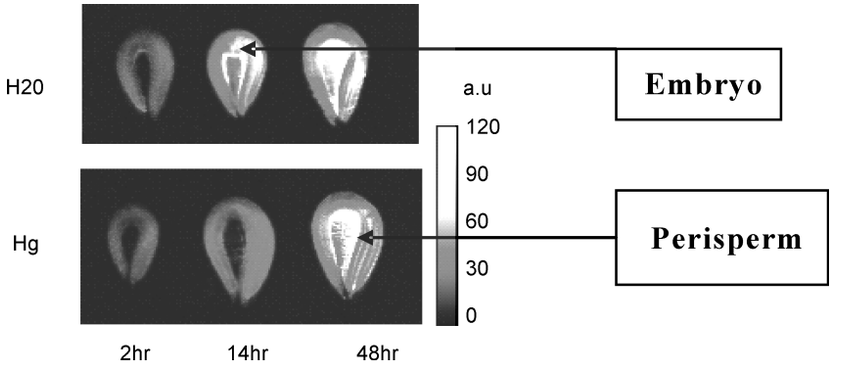

Figure 1 *NMR microimaging of winterfat seeds during imbibition at 20℃ with and without 30 M $HgCl_2$. Scale indicates range from no measurable free water (0 , black) to maximum limit of measurable free water (120 , light yellow) .*

Conclusions In winterfat , aquaporins were determined to play a critical role in germinative and early-growth water dynamics . Water entered the embryo in early water uptake and then diffused mainly through cell to cell pathways to the perisperm , reaching the maximum content near embryo protrusion in winterfat .

References

Johansson , I . , M . Karlsson , U . Johansson , C . Larsson , And P . Kjellbom (2000) . The role of aquaporins in cellular and whole plant water balance . *Biochimica et Biophysica Acta* 1465 : 324-342 .

Ludevid , D . , H . Höfte , E . Himelblau , and M . J . Chrispeels (1992) . The expression pattern of the tonoplast intrinsic protein γ-TIP in *Arabidopsis thaliana* is correlated with cell enlargement . *Plant Physiology* 100 : 1633-1639 .

Schäffner , A . R . (1998) . Aquaporin function , structure , and expression : are there more surprises to surface in water relations ? *Planta* 204 : 131-139 .