New Forests
DOI 10.1007/s11056-017-9595-3

Chronic cork oak decline and water status: new insights

Constança S. P. Camilo-Alves[1,2] · Margarida Vaz[1] · M. Ivone Esteves Da Clara[1] · Nuno Manuel De Almeida Ribeiro[1]

Received: 30 August 2016 / Accepted: 17 June 2017
© Springer Science+Business Media B.V. 2017

Abstract Chronic decline and Sudden death are two syndromes of cork oak (*Quercus suber*) dieback. Mortality is associated with water stress, but underlying physiological mechanisms are poorly understood. Here, we investigated the physiological performance of declining trees during the summer drought. Leaf water potential, gas-exchange, fluorescence of photosystem II and leaf and root starch concentration were compared in healthy (asymptomatic) and declining trees. Low annual cork increment in declining trees indicated tree decline for several years. All trees showed similar water status in spring. In summer, declining trees showed lower predawn leaf water potential (−2.0 vs. −0.8 MPa), but unexpectedly higher midday leaf water potential than healthy trees (−2.8 vs. −3.3 MPa). The higher midday water potential was linked to by means of strongly reduced stomatal conductance and, consequently, transpiration. This study is pioneer showing that declining trees had high midday water potential. A tendency for lower sap flow driving force (the difference between predawn and midday water potential) in declining trees was also associated with reduced photosynthesis, suggesting that chronic dieback may be associated with low carbon uptake. However, starch in roots and leaves was very low and not correlated to the health status of trees. Declining trees showed lower water-use efficiency and non-photochemical quenching in summer, indicating less resistance to drought. Contrarily to chronic decline, one tree that underwent sudden death presented predawn leaf water potential below the cavitation threshold.

Keywords *Quercus suber* · Mortality · Dieback · Sap flow driving force · Sudden death

✉ Constança S. P. Camilo-Alves
calves@uevora.pt

[1] Institute of Mediterranean Agricultural and Environmental Science (ICAAM), Universidade de Évora, Évora, Portugal

[2] Dep. Fitotecnia da Universidade de Évora, Polo da Mitra Ap. 94, 7002-554 Évora, Portugal

Published online: 21 June 2017