Geophysical Research Abstracts
Vol. 15, EGU2013-13686, 2013
EGU General Assembly 2013

Effect of Severe Winter Cold on the Photosynthetic Potentials of Three Co-occurring Evergreen Woody Species in a Mediterranean Forest, Catalonia (Spain)

Dominik Sperlich (1,2), Carlos Gracia (1,2), Josep Peñuelas (3), Santi Sabaté (1,2)

(1) Centre for Ecological Research and Forestry Applications (CREAF), Universitat Autonoma de Barcelona, 08193 Bellaterra, Barcelona, Spain, (2) Departament d'Ecologia, Facultat de Biologia, Universitat de Barcelona, Diagonal 645, 08028 Barcelona, Spain, (3) Global Ecology Unit CSIC-CEAB-CREAF, CREAF, Facultat de Ciencies, Universitat Autònoma de Barcelona. 08913 Bellaterra. Spain

Evergreen tree species in the Mediterranean region have to cope with a wide range of environmental stress conditions from summer drought to winter cold. The winter period can lead to photoinhibition due to a combination of high solar irradiances and chilling temperatures which can reduce the light saturation point. However, Mediterranean winter mildness can lead periodically to favourable environmental conditions above the threshold for positive carbon balance benefitting evergreen woody species in contrast to winter deciduous species. The advantage of being able to photosynthesis all year round with a significant fraction in the winter month is compensating for the lower photosynthetic potentials during spring and summer in comparison to deciduous species. In this work, we investigated the physiological behaviour of three evergreen tree species (Quercus ilex, Pinus halepensis, Arbutus undeo) co-occurring in a natural and mature Mediterranean forest after a period of mild winter conditions and their response to a sudden period of intense cold weather. Therefore, we examined in each period the photosynthetic potentials by estimating the maximum carboxylation rate (Vcmax) and the maximum electron transport rate (Jmax) through gas exchange measurements. The results indicate that all species exhibited extraordinary high photosynthetic potentials during the first period of measurement as a response to the mild conditions. However, the sudden cold period affected negatively the photosynthetic potentials of Quercus ilex and A. unedo with reduction ranging between 37 to 45 %, whereas they were observed to be only insignificantly reduced in Pinus halepensis. Our results can be explained by previous classifications into photoinhibition-avoiding (P. halpensis) and photoinhibition-tolerant (Q. ilex, A. undeo) species on the basis of their susceptibility to dynamic photoinhibition (Martinez Ferri 2000). Photoinhibition tolerant species are characterised with a more dynamic photoinhibition which is associated with fast reversible mechanisms. In contrast, photoinhibition-avoiding species are able to maintain a sustained PS II photochemical efficiency. In conclusion, our results provide new information on the photosynthetic responses of co-occurring Mediterranean evergreen tree species in a natural environment to contrasting winter conditions.