From Forest Nursery Notes, Winter 2012

217. © Biomass allocation and foliage heteroblasty in hard pine species respond differentially to reduction in rooting volume. Climent, J., Chambel, M. R., Pardos, M., and Lario, F. European Journal of Forest Research 130:841-850. 2011.

Eur J Forest Res (2011) 130:841–850
DOI 10.1007/s10342-010-0476-y

ORIGINAL PAPER

Biomass allocation and foliage heteroblasty in hard pine species respond differentially to reduction in rooting volume

José Climent · Maria Regina Chambel · Marta Pardos · Francisco Lario · Pedro Villar-Salvador

Received: 6 May 2010 / Revised: 25 November 2010 / Accepted: 17 December 2010 / Published online: 8 January 2011

Abstract Rooting space is considered as a resource in plants, but comparative studies on the biomass allocation plasticity in response to rooting volume (RV) are rare. We compared responses in growth, biomass allocation and ontogenetic heteroblasty in nine hard pine species of contrasted ecology. Seedlings were cultivated in containers of 0.2, 0.5, 1.0, 2.8 and 7 L for two growing seasons (425 days). Reduction in RV caused a reduction in plant absolute and relative growth rate and biomass allocated to stems but it increased biomass allocated to roots. RV affected to a lesser extent and in a less consistent direction allocation to leaves. Species that grew faster (higher relative growth rate) had a steeper decrease in growth with the reduction in RV. Ontogenetic heteroblasty, evaluated as the proportion of secondary needles in the needle biomass, showed highly different plasticity patterns in response to RV. Decrease in RV caused negligible or no change either in the most ontogenetically delayed Mediterranean pines or in the most ontogenetically advanced pines, the mesic *Pinus sylvestris* and *P. uncinata*. By contrast, ontogenetically intermediate species showed steep reaction norms in response to reduction in RV. While *P. pinaster* and *P. brutia* showed marked rejuvenation, *P. nigra* accelerated the development of adult foliage.

Keywords Container · Developmental plasticity · Growth · *Pinus* · Root restriction · Rooting volume

Abbreviations

RV	Rooting volume
RR	Root restriction
TM	Total plant biomass
AGR	Absolute height growth rate
RGR	Relative height growth rate
RMF	Root mass fraction
SMF	Stem mass fraction
LMF	Leaf mass fraction
SNMF	Secondary needles mass fraction

Communicated by R. Matyssek.

J. Climent · M. R. Chambel · M. Pardos
CIFOR. Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA), Apto. 8111, 28080 Madrid, Spain

F. Lario
Departamento de Mejora Agroforestal, TRAGSA, Ctra. de Maceda-Valdrey km 2, 32700 Maceda (Ourense), Spain

P. Villar-Salvador
Departamento de Ecología, Universidad de Alcalá, Carretera Madrid-Barcelona Km 33.6, 28871 Alcalá de Henares (Madrid), Spain

J. Climent · M. R. Chambel
Sustainable Forest Management Research Institute (UVA-INIA), Palencia, Spain

J. Climent (✉)
CIFOR-INIA, Ctra. A Coruña km 7.5, 28040 Madrid, Spain
e-mail: climent@inia.es

Introduction

Differences in allometry driven by environmental factors are considered key manifestations of developmental plasticity in plants (Chambel et al. 2007; Poorter and Nagel 2000; Sanchez-Gomez et al. 2006). In forest tree seedlings, allometry has long been investigated from different points of view. On the one hand, seedling allometry has been used as a plant quality selection criterion in forestation projects