



Impact of the Aridity Gradient on the Physico-chemical Parameters of the Needles of *Pinus halepensis* Mill. in the Western Algeria

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Abstract: In Algeria, pinewoods are mainly concentrated in arid and semi-arid areas where climatic and edaphic conditions have an effect on the phenology, physiognomy and growth of trees. The objective of this study is to see whether the aridity gradient has an effect on the needles of Aleppo pine. For realized this work, some characteristics of 50 samples of Aleppo pine needles collected from five stations in two areas of western Algeria (semi arid and arid) were studied. Analysis of the results showed a significant difference in the specific characteristics of needles in each zone, namely morphology, water content, chlorophyll rate and yield, which are more important in the semi-arid zone. On the other hand organic and mineral content, the pH and conductivity remain homogeneous between the two zones. The principal component analysis (PCA) confirmed the significant differences between the parameters measured in the two study areas, highlighting the imprint of the bioclimatic stage on the *Pinus halepensis* Mill in each zone.

Keywords: *Pinus halepensis* Mill., Needles, Drought, Physico-chemical parameters

In the mediterranean region, currently the main climatic constraint on ecosystems is the summer drought characterized by high temperatures associated with low rainfall in summer (Le Houérou 2005). High-intensity drought can cause water stress to trees and results in decrease in productivity and survival, thus can have significant deleterious consequences for ecosystem services. Water stress may alter the functioning of plantations over the long term by decreasing production and leaf area, resulting in a decrease in photosynthesis and therefore growth (Breda et al 2006). Trees, with very long life cycles, appear to be particularly vulnerable, whether for survival or for the services they provide, to the effects of climate change that can be rapid. This vulnerability may, among other things, affect the goods and services that humans derive from it wood production, carbon storage, water cycle operation (Lindner et al 2010). On the other hand, associated with these climate changes, other factors such as land use changes or the use of biomass as renewable energy can affect the forest ecosystem. They can act independently or in combination with climate change (Hendrik 2016). Mediterranean forests are a fragile natural environment already deeply disturbed by multiple uses, the origins of which date back to the early neolithic period. The

aggressions they underwent, however, varied considerably in frequency and intensity over the ages as a function of human demography, which determined phases of regression or progression of their surface (Marien and Billand 2009, Guénon 2010). Aleppo pine is the most common resinous essence in the Mediterranean basin and especially in Algeria, as it is the most rustic and able to adapt to several types of soil and the most varied climates, there are almost 881 000 ha of Aleppo pine in Algeria from a reforestation or in the natural state (DGF 2007). Aleppo pine is characterized by leaves in the form of very fine needles (less than 1 mm), soft 5 to 10 cm long. The aim of present study is to understand some physico-chemical characteristics of needles of the *Pinus halepensis* species between the semi-arid and arid bioclimatic stage represented by the mountain of Sid Ahmed Zaggai (Saida) and Antar (Naâma) forestands to assess the impact of the main regional climatic conditions on the adaptation of the needles of Aleppo pine in the face of extreme conditions.

MATERIAL AND METHODS

Semi-arid area: The semi-arid area is represented by the forest of Sid Ahmed Zaggai (34° 50' 12.7" N, 00° 05' 14.2" E, Altitude: 1126 m), 4.5 km west of wilaya of Saida upstream of