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Seasonal variations of electrical signals of Pinus halepensis Mill. in Mediterranean forests in dependence on climatic conditions

[1]Zapata,Rodolfo, [1]Oliver-Villanueva, Jose-Vicente, [1]Lemus- Zúñiga, Lenin-Guillermo, [1]Fuente, David, [1]Mateo Pla, Miguel A., [1]Luzuriaga, Jorge E. and [2]Moreno Esteve, Juan Carlos

[1]*ITACA - Institute of Information and Communication Technologies, Universitat Politècnica de València, València (Spain).*
[2]*Applied Physics Department, Universitat Politècnica de València, València (Spain).*

Abstract

Electric potential differences in living plants are explained by theories based on sap flow (Fromm et al., 2007) and it could be associated with changes in water tension or ion concentrations (Oyarce et al., 2010). In order to acquire more advanced knowledge about these electric potential measures in trees, this research aims to analyse electrical signals in a population of Aleppo pines (*Pinus halepensis* Mill.) in a representative Mediterranean forest ecosystem. Carried out during a long-term campaign experiments lasting over a year, while trials with a high frequency of measurements were also performed during several days. After a statistical evaluation of the obtained results, the main conclusions of our researches are: -Tree maturity influences directly on electric potential (Zapata et al., 2020). -The distribution patterns of both voltage and short-circuit current depending on electrode placement are uniform (Zapata et al., 2020). -Day-night oscillations of the electrical magnitudes were observed. Additionally, punctual meteorological events such as rainfall and electrical storms affect the electrical signal as well (Zapata et al., 2021) . -The measured electrical intensity grows exponentially with the voltage. In fact, no electrical intensity that exceeds the threshold of 0.01 µA is gathered when voltage values are lower than 0.6 V. In general, higher electrical signals were gathered during the rainy seasons with moderate temperatures; while very low signals, including few measures of zero intensity, were obtained during the most stressful periods over the year, mainly by mid-summer (Zapata et al., 2021). These observations of the electrical signal in *Pinus halepensis*, together with sustained intensity values during the reproductive period in spring, suggests that this electrical magnitude is an indicator of the physiological state of the tree and thus be used for in situ and minimally invasive forest monitoring. Therefore, the measurement of both components of the electrical signal of trees seem to be potential estimators of the health, biological activity and moisture content of the tree and consequently bushfire risk.

Keywords: bushfire risk, plant electrophysiology, Pinus halepensis, Mediterranean forests, seasonal variation, climatic conditions

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