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Plant stem electrical properties associated with stress conditions in plants

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Abstract

Statement of the Problem: The analysis of the electrophysiological activity of plants permits a real-time information of the plant status (e.g. light availability and water stress). However, even though it is clear that the role of the electrical signals in plant is crucial, especially in processes involving the propagation of rapid signals, a systematic approach for the interpretation of the electrical patterns is still missing.

Methodology & Theoretical Orientation: this presentation aims to elucidate long term electrical analysis related to plant stress. For example, the analysis of the physiological status of each plant has been used to correlate different water stress intensities with specific electrical patterns. Here we present a methodology based on a continuous monitoring of several plants in vivo, in a non-destructive way, for a long period through a new set-up that consists of a multi-electrodes system able to detect the electrical signals on several plants (or in different zones of the same plant).

Findings: the electrical properties measurement has been utilized to monitor several parameters (i.e. water stress) of each plant and to evaluate if it was possible to establish when the plant was facing the stress, the timing of the recovery and eventually to differentiate the intensity of the stress (i.e. mild, high or no stress). The comparison between the physiological parameters of the plants and the electrical measurements has highlighted the possibility to use such electrical signal to obtain information on the plant status.

Conclusion & Significance: multi-electrodes approach can be easily applied for monitoring a few plants as "biosensor" to estimate the status of a more numerous group of plants subjected to similar conditions. The set-up could provide a useful tool for monitoring water conditions in plants and has several potential applications for sensor and automatic system in greenhouse or field.

Biography:

Diego Comparini got his PhD in Agro-biotecnology for tropical production in Florence studying the mechanisms involved in the early stages of the chemical and electrical response to gravity in root tips. It also involved the investigation of biomaterials inspired by plant (biomimetic) and their potential application for soil exploration. I did my post-doc in Japan at the University of Kitakyushu focusing on the effect of light through the use of LEDs technologies for plant researches. He is currently doing a Marie Sklodowska-Curie individual fellowships project in collaboration with the University of Wageningen (The Netherland). The project aim is to develop automated hydroponic systems that use high frequency pulsing-light and intermittent/alternate nutrient supply to optimize resources and plant acclimation.

Speaker Publications:

1. Taiti, C., Costa, C., Migliori, C. A., Comparini, D., Figorilli, S., & Mancuso, S. (2019). Correlation Between Volatile Compounds and Spiciness in Domesticated and Wild Fresh Chili Peppers. Food and Bioprocess Technology, 1-15.
2. Caparrotta, S., Comparini, D., Marone, E., Kimmenfield, R., Luzzietti, L., Taiti, C., & Mancuso, S. (2019). Correlation between VOC fingerprinting and antimicrobial activity of several essential oils extracted by plant resins against A. tumefaciens and P. savastanoi. Flavour and Fragrance Journal, 34(5), 377-387.
3. Taiti, C., Costa, C., Figorilli, S., Billi, M., Caparrotta, S., Comparini, D., & Mancuso, S. (2018). Volatome analysis approach for the taxonomic classification of tree exudate collection using Proton Transfer Reaction Time of Flight Mass Spectrometry. Flavour and fragrance journal, 33(3), 245-262.
4. Comparini, D., Nguyen, H. T., Ueda, K., Moritaka, K., Kihara, T., & Kawano, T. (2018). Effect of different light spectra on the pigmentation of stored elephant garlic. Journal of the Science of Food and Agriculture, 98(7), 2598-2606.

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