Rubber-Redox

Biochemical, near-infra red spectroscopy and gene expression analyses of reactive oxygen species-scavenging systems in latex of Hevea brasiliensis.

ABSTRACT

Natural rubber production and industry have an important environmental and socio-economic role in South East Asian countries. Hevea brasiliensis is the main source of the renewable natural rubber (NR). This latter is synthesized in latex cells. Climate change is expected to dramatically affect NR production by enhancing the occurrence of a physiological syndrome, called Tapping Panel Dryness (TPD), affecting latex production. Mechanisms of TPD have been intensively studied at the biochemical, physiological and molecular levels. Environmental and harvesting stresses can trigger an oxidative stress in latex cells and consequently induce TPD. A biochemical latex diagnosis is used for two decades to monitor the physiological status of rubber trees in commercial plantations, and adjust harvesting systems to prevent TPD occurrence. Given the increasing environmental constraints and limited application of latex diagnosis in smallholdings, the improvement and simplification of latex diagnosis are needed for further development in breeding programme and application in all types of plantations.
The antioxidant component of latex diagnosis is evaluated through the quantification of the global thiols content in latex. Although glutathione be a major part of thiols, ascorbate, another major antioxidants of latex, is not include in the analysis. In addition, recent studies revealed that the ratio between oxidised and reduced forms of antioxidants is more relevant to understand plant stress physiology, especially by reflecting the capacity of plants to regenerate the active reduced form of antioxidants. Besides, predictive methodologies based on near-infra red spectroscopy (NIRS) are commonly used to evaluate various types of products. Finally, a genome-wide analysis of redox-related genes led to predict the regulation of these genes in latex of TPD-affected trees. All this information can be today gathered to improve latex diagnosis and its applications.

Based on this statement, the PhD thesis has three objectives :
• First, to study the evolution of the reduced and oxidised antioxidants in latex of a TPD-susceptible clone in response to various harvesting stress and then to evaluate the genetic variability of these parameters using a panel of accessions.
• Second, to check if NIRS might be suitable to develop a simple and rapid methodology for phenotyping segregating populations at the IRRI breeding programme and for application in smallholding plantations.
• Third, to better understand the transcriptional regulation of redox-related genes in a panel of rubber clones in order to identify gene expression signature useful for further genetics studies.
This academic study conducted in partnership with UGM is part of a large research and development programme on agronomy, physiology, genetics and breeding led for more than 10 years by the Indonesian Rubber Research Institute and CIRAD, facilitating further development of adapted rubber clones and agronomic applications.

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