Microscopic analysis of root cellular architecture in different coffee species: a preliminary comparison of the main phenotypical traits in controlled conditions

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Rationale:
In the last years, due to the climate change, much attention has been paid to coffee plant resilience and to agronomic solutions related to different stress tolerance in the field. In this perspective, the recently activated EU-funded BOLERO project will develop phenotyping tools, apply them to evaluate coffee root system architecture traits and root plasticity. Few descriptions of coffee root have been reported so far [1], especially in non-commercial species. This preliminary study aims to describe the main phenotypical root traits in different coffee plants kept under controlled conditions to deepen the knowledge and to possibly reveal interspecific differences.

Methods:
Lateral roots with radicles of 6 *Coffea* sp. young plants kept under greenhouse optimal conditions (*C. arabica*, *C. anthonyi*, *C. canephora*, *C. eugenioides*, *C. stenophylla*, *C. congensis*) were sampled, put in ethanol 50% and immediately delivered to illycaffé (Trieste, Italy). Fresh sections in agarose blocks were cut by hand and observed by optical and electronic microscopy. Specific histochemical techniques were used to highlight starch grains and suberin distribution.

Results:
The root primary cell architecture is quite the same for all the investigated species and it is composed by a raw of epidermal cells with hairs, an exodermis with suberin, 4-5 layers of cortical cells, a suberized endodermis and a central stele, from tetrarch to exarch. However, special cells traits characterized each species: peculiar 'window' cells are observed in *C. canephora* and *C. arabica* root exodermis, highly suberized. *C. arabica* xylem vessel are the greatest compared to the other species. *C. eugenioides* is characterized by large exodermis and cortical cells whereas *C. stenophylla* presents quite opposite characteristics. *C. congensis* is particularly rich in epidermal hairs and starch grains in the cortex cells.

Conclusions & Perspectives:
Coffee roots in primary structure are similar but the above-mentioned phenotypical traits could be differently affected under stress conditions. In facts, the 'window' cells presence in the exodermis increases the transport of nutrients and the suberin presence together with large cortical cells are associated to tolerance to drought. In view of these preliminary results, it will be interesting to discover the strategies adopted by various coffee spp. root cells in response to abiotic or biotic stresses [2, 3].

References:
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