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Physiological Adaptations in Response to Drought Stress in Four Wild Populations of *Coffea arabica*

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Abstract

The ecophysiological basis of drought tolerance was examined in four wild populations of *Coffea arabica* from an ecocline in Southern Ethiopia, which runs from the drier Bale Mountains with an annual precipitation of 790 mm to the wetter area in the Southwest with 2200 mm per yr. It was hypothesised that this gradient in water availability would promote regional differentiation in ecophysiological traits that allow the identification of drought tolerant coffee populations.

In order to eliminate possible confounding effects, seedling from the four provenances of wild coffee were used for an ex-situ experiment under controlled environmental conditions. A completely randomised split-split plot design was established, based on the 12 subpopulations within the 4 main populations. Two irrigation levels as well as two light regimes were imposed over a 16-days period. Throughout the experiment seedling survival and physiology were monitored every four days by measuring leaf water potential, diurnal gas exchange as well as leaf carbon isotope discrimination on randomly selected individuals.

The selected coffee populations, occupying a broad range of stands with different habitat conditions, show considerable variability in their physiological behaviour. At the end of a 16 days treatment, predawn water potential of the plants in the well watered plot remained above -3,0 bar whereas the values of the stressed plot declined to -36,2 bar. Particularly plants from Berhane-Kontir allowed leaf water potential to be maintained for a longer period of time and delayed the appearance of stress symptoms in comparison with the other populations. These results suggest that this provenance is relatively tolerant of desiccation compared to the coffee populations from the other habitats. This may give this population a competitive advantage during drought events.

Keywords: *Coffea arabica*, drought response, ecophysiology, environmental heterogeneity

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