

Abstract

A study to determine the physiological and biochemical responses of eight tea [*Camellia sinensis* (L.) O. Kuntze] cultivars to water-deficit stress was conducted in a 'rain-out shelter' using potted plants. Three levels of soil moisture content [34, 26, or 18% (v/v) water] were applied to three plants of each cultivar in a complete randomised design, and the whole experiment was replicated three-times. The treatments were applied for 12 weeks, during which time plant water status, shoot extension rates, changes in gas exchange parameters, and leaf proline and glycinebetaine concentrations were determined. The imposition of severe water-deficit conditions [18% (v/v) soil water content] caused a significant ($P \leq 0.05$) decline in the relative water content of leaves, shoot water potentials, and shoot extension rates from mean values of 84.8% to 50.6%, -0.80 to -1.15 MPa, and 1.87 to 0.29 mm d⁻¹, respectively, compared to plants grown in a well-watered soil [34% (v/v) soil water content]. The three gas exchange parameters measured (stomatal conductance, evapotranspiration rate, and rate of net photosynthesis) also declined significantly ($P \leq 0.05$) with decreasing soil moisture content. In contrast, water-deficit stress increased the accumulation of leaf proline and glycinebetaine from mean values of 0.104 to 0.244 $\mu\text{mol g}^{-1}$ FW, and from 1.567 to 2.025 $\mu\text{mol g}^{-1}$ DW, respectively. The eight tea cultivars differed significantly ($P \leq 0.05$) in their responses to water-deficit stress. Proline accumulation was significantly ($P \leq 0.05$) higher in the drought-tolerant cultivars, 'TRFK 306', 'TRFCA SFS150', and 'EPK TN14/3', suggesting that proline concentration could be used as a marker for drought-tolerance in tea.