Diurnal Cycle and Photoinhibition of Photosynthesis in Palm *Trachycarpus fortunei* H. Wendl. under Winter and Summer Conditions

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A study was conducted to analyze the contribution of high irradiance and resulting photoinhibition to the decline in net photosynthesis in the leaves of palm *Trachycarpus fortunei* during summer and winter as well as at normal growth and low temperatures in field and laboratory conditions, respectively. Fluorescence induction measurements indicated that there was a 10% decrease in the F_v/F_m ratio in field conditions at midday during both summer and winter, due to the relatively low intensity of incident light resulting from the partial leaf segment folding. Fluorescence parameters completely recovered by the evening hours. In summer the midday decay was due to the decrease of F_m which probably represents a rapidly reversible component of photoinhibition by the protective down-regulation of PSII mediated by the xanthophyll cycle. In winter, however, the initial F_v/F_m ratio was 40% less than as measured in summer and its midday decline was associated with the decrease of F_v indicating the partial inactivation of PS II. The net CO_2 assimilation rate followed the pattern of the F_v/F_m ratio but it could not recover due to the stomatal closure after midday. Comparing the fluorescence and gas exchange measurements we have concluded that the photoinhibition of *T. fortunei* represented by the F_v/F_m ratio changes is a regulatory adjustment of PS II efficiency to limiting carbon utilization and to limiting carbon availability imposed by stomatal closure. Leaves photoinhibited under laboratory conditions at growth temperature showed a substantial decrease of 50% in the F_v/F_m ratio due to the perpendicular exposure, but no apparent changes in D_1 protein content could be detected. Phytotron grown plants exposed to cold stress (6 °C) and low irradiance (250 μmol m^{-2} s^{-1}) under laboratory conditions showed a time related but much slower continuous decrease in F_v/F_m ratio. After high irradiance the recovery kinetics in the dark at normal growth temperature (28 °C) strongly depended on the extent of the photoinhibition, while after low irradiance complete recovery occurred in 12 hours irrespective of the initial F_v/F_m value, independently from the time of cold treatment, indicating that at low light and cold treatments only reversible inactive PS IIs were formed.