Allocation of secondary metabolites, photosynthetic capacity, and antioxidant activity of Kacip Fatimah (Labisia pumila Benth) in response to CO2 and light intensity

ABSTRACT

A split plot 3 by 4 experiment was designed to investigate and distinguish the relationships among production of secondary metabolites, soluble sugar, phenylalanine ammonia lyase (PAL; EC 4.3.1.5) activity, leaf gas exchange, chlorophyll content, antioxidant activity (DPPH), and lipid peroxidation under three levels of CO2 (400, 800, and 1200 μmol/mol) and four levels of light intensity (225, 500, 625, and 900 μmol/m2/s) over 15 weeks in Labisia pumila. The production of plant secondary metabolites, sugar, chlorophyll content, antioxidant activity, and malondialdehyde content was influenced by the interactions between CO2 and irradiance. The highest accumulation of secondary metabolites, sugar, maliondialdehyde, and DPPH activity was observed under CO2 at 1200 μmol/mol + light intensity at 225 μmol/m2/s. Meanwhile, at 400 μmol/mol CO2 + 900 μmol/m2/s light intensity the production of chlorophyll and maliondialdehyde content was the highest. As CO2 levels increased from 400 to 1200 μmol/mol the photosynthesis, stomatal conductance, fv/fm (maximum efficiency of photosystem II), and PAL activity were enhanced. The production of secondary metabolites displayed a significant negative relationship with maliondialdehyde indicating lowered oxidative stress under high CO2 and low irradiance improved the production of plant secondary metabolites that simultaneously enhanced the antioxidant activity (DPPH), thus improving the medicinal value of Labisia pumila under this condition.

Keyword: CO2; Secondary metabolites; Antioxidant activity; Labisia pumila