

研究论文

C3、C4植物叶片叶绿素荧光猝灭日变化和对光氧化作用的响应

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摘要 C3植物花生和C4植物甘蔗的光合色素含量、 ΔA_{505nm} 、叶绿素荧光参数Fv/Fm, $\Phi PS II$, qN和qp呈日变化进程。中午前后, 甘蔗的qN, qp, Fv/Fm和 $\Phi PS II$ 的变幅比花生小, ΔA_{505nm} 的增值比花生大, 叶绿素和类胡萝卜素仍维持较高水平, 而此时花生的qN和qp皆下降。花生和苋菜(C4植物)经甲基紫精(MV)的光氧化处理后, 叶片的MDA和蛋白质的游离拨基含量及Fo增高, qp下降。qN在花生和苋菜之间的变化不同, 花生的qN上升而苋菜的qN下降。结果表明C3和C4植物对自然强光或光氧化作用响应的敏感性存在一定的差别。

关键词 [叶绿素荧光猝灭](#) [光氧化作用](#) [日变化](#) [甲基紫精](#) [C3, C4植物](#)

分类号

Diurnal Changes of Chlorophyll Fluorescence Quenching and the Response to Photooxidation in Leaves of C3 and C4 Plants

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Abstract Diurnal changes of chlorophyll fluorescence parameters, contents of photosynthetic pigments, the leaf absorption at 505nm, and the response to strong light with methyl viologen-photooxidation treatment were compared between C3 plant peanut (*Arachis hypogaea*) and C4 plants sugarcane (*Saccharum sinense*) and amaranth (*Amaranthus tricolor*). In the midday, an increment at ΔA_{505nm} and the decrease of $\Phi PS II$ primarily chemical efficiency (Fv/Fm), quantum yield of $\Phi PS II$ linear electron transport ($\Phi PS II$), as well as the decrease in photochemical quenching of chlorophyll (qp) were found in leaves of both peanut and sugarcane. The obvious increment of ΔA_{505nm} and the less changes of chlorophyll and carotenoid contents, Fv/Fm, $\Phi PS II$, qp were observed in sugarcane when compared with peanut at midday strong sunlight. Moreover nonphotochemical quenching of chlorophyll fluorescence (qN) increased slightly in sugarcane but decreased about 12% in peanut in the same case. Photooxidative treatment induced protein oxidative degradation, lipid peroxidation and inactivation of $\Phi PS II$ in peanut and another C4 plant amaranth. Under photooxidation by spraying methyl viologen (MV) solution to attached leaves and exposing to midday sunlight for 1h, the contents of malondialdehyde and protein free carbonyl increased significantly. In peanut leaves Fv/Fm and $\Phi PS II$ reduced to 74% and 54% of untreated control in the dark, respectively, the decrease of qp was accompanied with a marked increase of qN. On the contrary, qN of amaranth declined to 78% of control when qp decreased. The results showed that there are certain differences of sensibility in response to natural strong light or photooxidation between C3 and C4 plants.

Key words [Chlorophyll fluorescence quenching](#) [Photooxidation](#) [Diurnal change](#) [Methyl viologen](#) [C3, C4 plants](#)

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